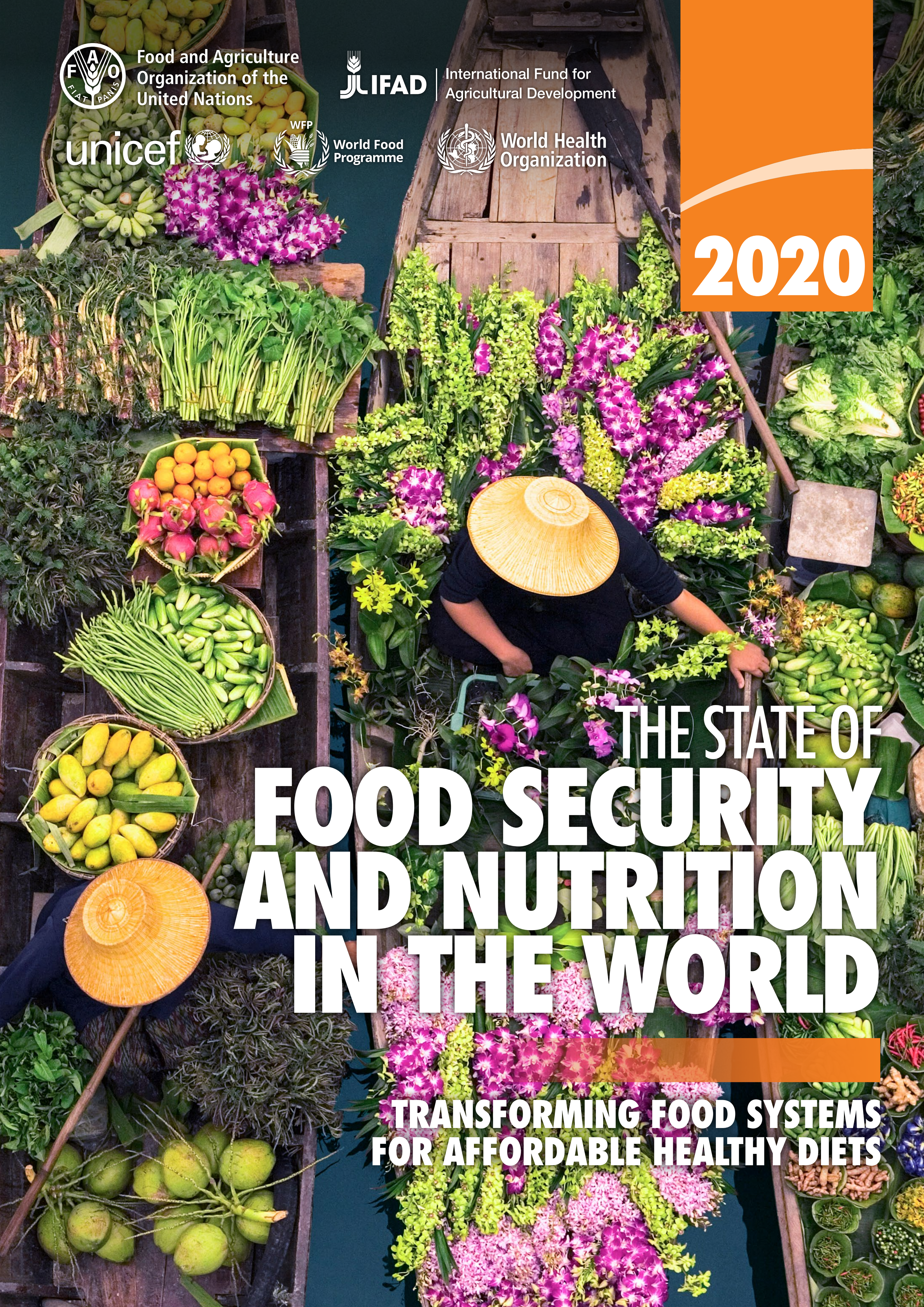

Food and Agriculture Organization of the United Nations

IFAD International Fund for Agricultural Development

unicef

WFP World Food Programme

World Health Organization

2020

THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD

TRANSFORMING FOOD SYSTEMS FOR AFFORDABLE HEALTHY DIETS

This flagship publication is part of **THE STATE OF THE WORLD** series of the Food and Agriculture Organization of the United Nations.

Required citation:
FAO, IFAD, UNICEF, WFP and WHO. 2020. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets.* Rome, FAO.
https://doi.org/10.4060/ca9692en

ISSN 2663-8061 (PRINT)
ISSN 2663-807X (ONLINE)
ISBN 978-92-5-132901-6

COVER PHOTOGRAPH ©Mint Images

THAILAND. Floating market on a canal in Bangkok, where local boats are laden with fresh food.

ISSN 2663-8061

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TRANSFORMING FOOD SYSTEMS FOR AFFORDABLE HEALTHY DIETS

Food and Agriculture Organization of the United Nations
Rome, 2020

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FOREWORD

Five years after the world committed to end hunger, food insecurity and all forms of malnutrition, we are still off track to achieve this objective by 2030. Data tell us that the world is progressing neither towards SDG target 2.1, of ensuring access to safe, nutritious and sufficient food for all people all year round, nor towards target 2.2, of eradicating all forms of malnutrition.

There are many threats to progress. The 2017 and 2018 editions of this report showed that conflict and climate variability and extremes undermine efforts to end hunger, food insecurity and malnutrition. In 2019, the report showed that economic slowdowns and downturns also undercut these efforts. In 2020, the COVID-19 pandemic, as well as unprecedented Desert Locust outbreaks in Eastern Africa, are obscuring economic prospects in ways no one could have anticipated, and the situation may only get worse if we do not act urgently and take unprecedented action.

The most recent estimate for 2019 shows that prior to the COVID-19 pandemic, almost 690 million people, or 8.9 percent of the global population, were undernourished. This estimate is based on new data on population, food supply and more importantly, new household survey data that enabled the revision of the inequality of food consumption for 13 countries, including China. Revising the undernourishment estimate for China going back to the year 2000 resulted in a significantly lower number of undernourished people worldwide. This is because China has one-fifth of the global population. Despite this, the trend reported in past editions of this report still stands: since 2014, the number of hungry people worldwide has been slowly rising. The new estimate for 2019 has revealed that an additional 60 million people have become affected by hunger since 2014. If this trend continues, the number of undernourished people will exceed 840 million by 2030. Hence, the world is not on track to achieve Zero Hunger, even without the negative effects that COVID-19 will likely have on hunger. Preliminary projections based on the latest available global economic outlooks, also presented in this report, suggest that the COVID-19 pandemic may add an additional 83 to 132 million people to the ranks of the undernourished in 2020.

Beyond hunger, a growing number of people have had to reduce the quantity and quality of the food they consume. Two billion people, or 25.9 percent of the global population, experienced hunger or did not have regular access to nutritious and sufficient food in 2019. This situation could deteriorate if we do not act immediately and boldly.

These trends in food insecurity contribute to increasing the risk of child malnutrition, as food insecurity affects diet quality, including the quality of children's and women's diets, and people's health in different ways. Hence, as painful as it is to accept, it is unsurprising that the burden of child malnutrition remains a threat around the world: in 2019, 21.3 percent (144.0 million) of children under 5 years of age were estimated to be stunted, 6.9 percent (47.0 million) wasted and 5.6 percent (38.3 million) overweight, while at least 340 million children suffered from micronutrient deficiencies. The good news is that between 2000 and 2019, the global prevalence of child stunting declined by one-third. However, the world is not on track to achieve the global nutrition targets, including those on child stunting, wasting and overweight by 2030. Furthermore, adult obesity is on the rise in all regions. Projections for 2030, even without considering a potential global recession, serve as an added warning that the current level of effort is not anywhere near enough to end malnutrition in the next decade.

We can still succeed, but only by ensuring all people's access not only to food, but to nutritious foods that make up a healthy diet. With this report, all five agencies are sending a strong message: A key reason why millions of people around the world suffer from hunger, food insecurity and malnutrition is because they cannot afford the cost of healthy diets. Costly and unaffordable healthy diets are associated with increasing food insecurity and all forms of malnutrition, including stunting, wasting, overweight and obesity. Food supply disruptions and the lack of income due to the loss of livelihoods and remittances as a result of COVID-19 means that households across the globe are facing increased difficulties to access nutritious foods and are only making it even more difficult for the poorer and vulnerable populations to have access to healthy diets.

It is unacceptable that, in a world that produces enough food to feed its entire population, more than 1.5 billion people cannot afford a diet that meets the required levels of essential nutrients and over 3 billion people cannot even afford the cheapest healthy diet. People without access to healthy diets live in all regions of the world; thus, we are facing a global problem that affects us all.

Current food consumption patterns also generate what this year's report calls "hidden costs" related to health costs (SDG 3) and climate-change costs (SDG 13). If current food consumption patterns continue, diet-related health costs linked to mortality and diet-related non-communicable diseases are projected to exceed USD 1.3 trillion per year by 2030. The diet-related social cost of greenhouse gas emissions associated with current dietary patterns is estimated to reach more than USD 1.7 trillion per year by 2030. Both of these hidden costs are a significant underestimation. The environmental costs do not account for other negative environmental impacts and the health costs do not account for the negative impacts of undernutrition due to data constraints. In light of this evidence, it is clear that the adoption of healthy diets that include sustainability considerations can significantly reduce these hidden costs, generating important synergies with other SDGs.

We must look throughout the food system to address the factors that are driving up the cost of nutritious foods. This means supporting food producers – especially small-scale producers – to get nutritious foods to markets at low cost, making sure people have access to these food markets, and making food supply chains work for vulnerable people – from small-scale producers to the billions of consumers whose income is simply insufficient to afford healthy diets.

Clearly, then, we face the challenge of transforming food systems to ensure that no one is constrained by the high prices of nutritious foods or the lack of income to afford a healthy diet, while we ensure that food production and consumption contribute to environmental sustainability. However, there is no one-size-fits-all solution for countries, and policymakers will need to assess the context-specific barriers, manage trade-offs and maximize synergies – such as potential environment gains – to achieve the required transformations.

We trust that the recommendations in this report, once tailored to each country context, will help governments to reduce the cost of nutritious foods, make healthy diets affordable for everyone and enable vulnerable people working in food systems to earn decent incomes that enhance their own food security. This will set in motion a transformation of existing food systems that makes them resilient and sustainable. Areas of policy emphasis should include rebalancing of agricultural policies and incentives towards more nutrition-sensitive investment; and policy actions all along food supply chains, with a focus on nutritious foods for healthy diets, to reduce food losses, create opportunities for vulnerable small-scale producers and others working in food systems, and enhance efficiencies. Nutrition-sensitive social protection policies will also be central to increase the purchasing power and affordability of healthy diets by the most vulnerable populations. An enabling environment should also be promoted by policies that, more generally, improve the nutritional quality of the food produced and available on the market, support the marketing of diverse and nutritious food, and provide education and information for fostering individual and social behaviour change towards healthy diets.

These policy recommendations are in line with key recommendations under the United Nations Decade of Action on Nutrition, 2016–2025. We believe that the analysis conducted and policy recommendations provided in this report will also help set the agenda for the first UN Food Systems Summit, which will take place in 2021 with the overarching goal of helping stakeholders better understand and manage complex choices that affect the future of food systems and their needed transformation to significantly accelerate progress towards achieving the SDGs by 2030.

Our agencies stand firmly committed to support a shift that makes healthy diets affordable to all and contributes to the eradication of hunger, food insecurity and all forms of malnutrition in children and adults. Our efforts shall ensure that this shift unfolds in a sustainable way, for people and the planet, and creates synergies to spur progress on other SDGs.

Qu Dongyu
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David Beasley
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METHODOLOGY

The State of Food Security and Nutrition in the World 2020 has been prepared by the FAO Agricultural Development Economics Division in collaboration with the Statistics Division of the Economic and Social Development Department and a team of technical experts from FAO, IFAD, UNICEF, WFP and WHO.

A senior advisory team consisting of designated senior managers of the five UN publishing partners guided the production of the report. Led by FAO, this team decided on the outline of the report and defined its thematic focus. It further gave oversight to the technical writing team composed of experts from each of the five co-publishing agencies. Background technical papers were prepared to support the research and data analysis undertaken by the members of the writing team.

The writing team produced a number of interim outputs, including an annotated outline, first draft and final draft of the report. These were reviewed, validated and cleared by the senior advisory team at each stage in the preparation process. The final report underwent a rigorous technical review by senior management and technical experts from different divisions and departments within each of the five UN agencies, both at headquarters and decentralized offices. Finally, the report underwent executive review and clearance by the heads of agency of the five co-publishing partners.

ACKNOWLEDGEMENTS

The State of Food Security and Nutrition in the World 2020 was jointly prepared by the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP) and the World Health Organization (WHO).

Under the overall guidance of Maximo Torero Cullen, the direction of the publication was carried out by Marco V. Sánchez Cantillo and José Rosero Moncayo, with the overall coordination of Cindy Holleman, the Editor of the publication, all of whom are from the FAO Economic and Social Development Department (ES). The development of the report was guided by a Steering Committee consisting of agency representatives from the five co-publishing partners: Marco V. Sánchez Cantillo (Chair), Sara Savastano (IFAD), Victor Aguayo (UNICEF), Arif Husain (WFP) and Francesco Branca (WHO). Alessandra Garbero and Tisorn Songsermsawas (IFAD), Chika Hayashi and Roland Kupka (UNICEF), Yvonne Forsén (WFP) and Marzella Wüstefeld (WHO) contributed to the coordination and provided technical support. Valuable comments and final approval of the report were provided by the executive heads and senior staff of the five co-authoring agencies.

Part 1 of the report was coordinated by Anne Kepple (FAO). Section 1.1 was prepared by Carlo Cafiero with inputs from Piero Conforti, Juan Feng, Adeeba Ishaq, Anne Kepple and Sara Viviani (FAO). Section 1.2 was prepared by Elaine Borghi with Elisa Dominguez (WHO), Chika Hayashi, Julia Krasevec, Richard Kumapley, Roland Kupka and Vrinda Mehra (UNICEF), with inputs from Katrina Lundberg, Lisa Rogers, Zita Weise Prinzo and Marzella Wüstefeld (WHO). Section 1.3 was prepared by Anne Kepple, with Cristina Álvarez-Sánchez, Marinella Cirillo, Ana Moltedo, Ramani Wijesinha-Bettoni, Trudy Wijnhoven and Isabela Sattamini (FAO), and Chika Hayashi and Vrinda Mehra (UNICEF), with inputs from Nancy Aburto and Lidan Du (FAO), Katrina Lundberg, Karen McColl and Marzella Wüstefeld (WHO) and inputs from Terri Ballard and Anna Herforth. José Rosero Moncayo provided editorial support and input to Part 1.

This year's report contains important updates, especially the revision of the prevalence of undernourishment (PoU) for China. This revision is significant, given that China has one-fifth of the global population, and hence we sought independent assessment on the integrity of our approach and methodology from four leading experts: Joachim von Braun, Professor for the Department of Economic and Technological Change and Director of Center for Development Research (ZEF) at Bonn University, and Chair of the Scientific Committee of the 2021 Food Systems Summit; Christopher Barrett, Professor of Applied Economics and Management, international professor of agriculture at the Charles H. Dyson School of Applied Economics and Management at Cornell University; David Laborde, Senior Research Fellow and Theme Leader on Macroeconomics and Trade at the International Food Policy Research Institute; and Maria Ana Lugo, Senior Economist with the Poverty and Equity Global Practice at the World Bank.

Reviewers concluded that the approach adopted by FAO to update estimates of the coefficient of variation for food consumption at the national level for China, which is based on the combined analysis of data from two different household surveys, is valid, and that the methodology is sound. They attested to the increased consistency of our revised results with existing evidence on nutrition in China, as well as with a set of economic development indicators in the country, including extreme poverty, prevalence of stunting, food expenditure distribution and shared prosperity. The peer reviewers also confirmed that our results were aligned with the findings of their own analyses based on different econometric modelling exercises. FAO is deeply indebted to the peer reviewers for generously sharing their time and expertise.

Part 2 of the report was coordinated by Cindy Holleman (FAO). Sections 2.1 and 2.2 were prepared by Cindy Holleman with input from Giovanni Carrasco Azzini, Valentina Conti and Lidan Du (FAO); Caterina Ruggeri Laderchi and Tisorn Songsermsawas (IFAD); Saskia de Pee, Simone Gie and Nora Hobbs (WFP); and Joyce Haddad, Katrina Lundberg, Karen McColl and Marzella Wüstefeld (WHO). Additional input came from a background paper prepared by Anna Herforth, Yan Bai, Aishwarya Venkat, Alissa Ebel and William A. Masters (Tufts University) and Kristi Mahrt (IFPRI); a background paper prepared by Marco Springmann (Oxford University); and from special advisor to research Harold Alderman. Section 2.3 was prepared by Yvonne Forsen (WFP) with Mark Smulders (FAO), with input from Giovanni Carrasco Azzini, Valentina Conti, Christian Derlagen, Emiliano Magrini and Valentina Pernechele (FAO); Caterina Ruggeri Laderchi and Tisorn Songsermsawas (IFAD); Saskia de Pee, Simone Gie, Nora Hobbs and Jeandamour Nkundimana (WFP); and Elaine Borghi, Karen McColl and Marzella Wüstefeld (WHO). Section 2.4 was prepared by Mark Smulders, with input from Giovanni Carrasco Azzini, Christian Derlagen and Emiliano Magrini (FAO); Richard Abila, Romina Cavatassi, Antonella Cordone, Isabel de la Peña, Ron Hartman, Athur Mabiso, Joyce Njoro, Caterina Ruggeri Laderchi and Tisorn Songsermsawas (IFAD); Roland Kupka (UNICEF); Karen McColl and Marzella Wüstefeld (WHO); and Selina Chan, Saskia de Pee, Simone Gie, Nora Hobbs and Kelly Stablein (WFP). Marco V. Sánchez Cantillo provided editorial support and technical input to Part 2.

Numerous colleagues from different technical units and departments across the five co-publishing agencies provided valuable technical comments and input to the report. An agency-wide technical clearance process facilitated a comprehensive technical review by many technical experts. Listing each of the contributions would be challenging and furthermore increase the risk of important omissions.

Juan Feng and Sara Viviani were responsible for preparing undernourishment and food security data with input from Verónica Boero, Marinella Cirillo, Filippo Gheri, Adeeba Ishaq, Talent Manyani, Ana Moltedo, María Rodríguez, Abdul Sattar, Firas Yassin and under the supervision of Carlo Cafiero in Section 1.1. Supporting data were provided by the Food Balance Sheets team, led by Salar Tayyib of the FAO Statistics Division (ESS). Richard Kumapley (UNICEF) was responsible for consolidating the nutrition data, with input from Elaine Borghi, Elisa Dominguez and Leanne Riley (WHO); and Chika Hayashi, Julia Krasevec and Vrinda Mehra (UNICEF) in Section 1.2. Tomasz Filipczuk, Filippo Gheri and Salar Tayyib (FAO) contributed to the food availability analysis and Talent Manyani, Nathalie Troubat and Firas Yassin (FAO) contributed to the food consumption and food security analysis in Section 1.3. Anna Herforth, Yan Bai, Aishwarya Venkat, Alissa Ebel and William A. Masters (Tufts University), Kristi Mahrt (IFPRI), Marco Springmann (Oxford University) and Valentina Conti (FAO) were responsible for preparing the data analysis for Part 2 and Annexes 3 to 8.

Support for report production came from Giovanni Carrasco Azzini, Andrew Park (consulting editor) and Daniela Verona in the FAO Economic and Social Development Department.

The FAO Meeting Programming and Documentation Service provided printing services and carried out the translations, in addition to the contributors mentioned above.

The Publishing Group (OCCP) of the FAO Office for Corporate Communications provided editorial support, design and layout, as well as production coordination, for editions in all six official languages. Elaine Borghi (WHO) and Julia Krasevec (UNICEF) prepared the graphics, and Nona Reuter (UNICEF) designed the maps for Section 1.2.

ACRONYMS AND ABBREVIATIONS

AARI	Average Annual Rate of Increase
AARR	Average Annual Rate of Reduction
ADER	Average dietary energy requirement
AMDR	Acceptable Macronutrient Distribution Range
BMI	Body mass index
BMK	Benchmark diet (scenario)
CHFS	China Household Finance Survey
CHNS	China Health and Nutrition Survey
CV	Coefficient of variation
CV|r	CV due to energy requirements
CV|y	CV due to income
DEC	Dietary energy consumption
DES	Dietary energy supply
DHS	Demographic and health survey
DICE	Dynamic Integrated model of Climate and the Economy
DQ-Q	Diet Quality Questionnaire
EBF	Exclusive breastfeeding
FAO	Food and Agriculture Organization of the United Nations
FBDGs	Food-based dietary guidelines
FBS	Food Balance Sheet
FGDS	Food Group Diversity Score
FIES	Food Insecurity Experience Scale
$FI_{mod+sev}$	Prevalence of moderate or severe food insecurity
FI_{sev}	Prevalence of severe food insecurity
FLX	Flexitarian diet
FNG	Fill the Nutrient Gap
GDP	Gross domestic product
GHG	Greenhouse gas
GIFT	FAO/WHO Global Individual Food consumption data Tool
GWP	Gallup© World Poll
HCES	Household Consumption and Expenditure Survey
HEI	Healthy Eating Index
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
IMF	International Monetary Fund
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
IYCDDS	Infant and Young Child Dietary Diversity Score
LIFDCs	Low-income food-deficit countries
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity for Women
MDER	Minimum dietary energy requirement
MICs	Middle-income countries
NCD	Non-communicable disease
NRP	Nominal rate of protection
NTM	Non-tariff measure

PAHO	Pan American Health Organization
PAL	Physical activity level
PoU	Prevalence of undernourishment
PPP	Purchasing power parity
PSC	Pescatarian diet
SCC	Social cost of carbon
SD	Standard deviation
SDGs	Sustainable Development Goals
SPS	Sanitary and phytosanitary measures
SSB	Sugar-sweetened beverage
SUA	Supply and Utilization Accounts
TBT	Technical barriers to trade
UNICEF	United Nations Children's Fund
USD	United States dollar
VEG	Vegetarian diet
VGN	Vegan diet
WEO	World Economic Outlook
WFP	World Food Programme
WHA	World Health Assembly
WHO	World Health Organization
WTO	World Trade Organization

KEY MESSAGES

➔ Updates for many countries have made it possible to estimate hunger in the world with greater accuracy this year. In particular, newly accessible data enabled the revision of the entire series of annual undernourishment estimates for China back to 2000, resulting in a substantial downward shift of the series of the number of undernourished in the world. Nevertheless, the revision confirms the trend reported in past editions: the number of people affected by hunger globally has been slowly on the rise since 2014.

➔ Current estimates are that nearly 690 million people are hungry, or 8.9 percent of the world population – up by 10 million people in one year and by nearly 60 million in five years. The number of people affected by severe food insecurity, which is another measure that approximates hunger, shows a similar upward trend. In 2019, close to 750 million – or nearly one in ten people in the world – were exposed to severe levels of food insecurity.

➔ Considering the total affected by moderate or severe food insecurity, an estimated 2 billion people in the world did not have regular access to safe, nutritious and sufficient food in 2019.

➔ The world is not on track to achieve Zero Hunger by 2030. If recent trends continue, the number of people affected by hunger would surpass 840 million by 2030.

➔ A preliminary assessment suggests that the COVID-19 pandemic may add between 83 and 132 million people to the total number of undernourished in the world in 2020 depending on the economic growth scenario.

➔ Globally, the burden of malnutrition in all its forms remains a challenge. According to current estimates, in 2019, 21.3 percent (144.0 million) of children under 5 years of age were stunted, 6.9 percent (47.0 million) wasted and 5.6 percent (38.3 million) overweight.

➔ The world is making progress but is not on track to achieve the 2025 and 2030 targets for child stunting and low birthweight, and for exclusive breastfeeding, is on track only for the 2025 target. The prevalence of wasting is notably above the targets. Most regions are not on track to achieve the targets for child overweight. Adult obesity is on the rise in all regions. Urgent action is needed to reverse these upward trends.

➔ The nutritional status of the most vulnerable population groups is likely to deteriorate further due to the health and socio-economic impacts of COVID-19.

➔ Food insecurity can worsen diet quality and consequently increase the risk of various forms of malnutrition, potentially leading to undernutrition as well as overweight and obesity.

➔ Low-income countries rely more on staple foods and less on fruits and vegetables and animal source foods than high-income countries. Only in Asia, and globally in upper-middle-income countries, are there enough fruits and vegetables available for human consumption to be able to meet the FAO/WHO recommendation of consuming a minimum of 400 g/person/day.

➔ While we still face significant challenges in just accessing food, challenges are even more important in terms of accessing healthy diets.

➔ Healthy diets are unaffordable to many people, especially the poor, in every region of the world. The most conservative estimate shows they are unaffordable for more than 3 billion people in the world. Healthy diets are estimated to be, on average, five times more expensive than diets that meet only dietary energy needs through a starchy staple.

➔ The cost of a healthy diet exceeds the international poverty line (established at USD 1.90 purchasing power parity (PPP) per person per day), making it unaffordable for the poor. The cost also exceeds average food expenditures in most countries in the Global South: around 57 percent or more of the population cannot afford a healthy diet throughout sub-Saharan Africa and Southern Asia.

➔ All diets have hidden costs, which must be understood to identify trade-offs and synergies in relation to other SDGs. Two hidden costs that are most critical relate to the health (SDG 3) and climate-related (SDG 13) consequences of our dietary choices and the food systems that support these.

➔ Under current food consumption patterns, diet-related health costs linked to mortality and non-communicable diseases are projected to exceed USD 1.3 trillion per year by 2030. On the other hand, the diet-related social cost of greenhouse gas emissions associated with current dietary patterns is estimated to be more than USD 1.7 trillion per year by 2030.

➔ Shifting to healthy diets can contribute to reducing health and climate-change costs by 2030, because the hidden costs of these healthy diets are lower compared to those of current consumption patterns. The adoption of healthy diets is projected to lead to a reduction of up to 97 percent in direct and indirect health costs and 41–74 percent in the social cost of GHG emissions in 2030.

➔ However, not all healthy diets are sustainable and not all diets designed for sustainability are always healthy. This important nuance is not well understood and is missing from ongoing discussions and debates on the potential contribution of healthy diets to environmental sustainability.

➔ To increase the affordability of healthy diets, the cost of nutritious foods must come down. The cost drivers of these diets are seen throughout the food supply chain, within the food environment, and in the political economy that shapes trade, public expenditure and investment policies. Tackling these cost drivers will require large transformations in food systems with no one-size-fits-all solution and different trade-offs and synergies for countries.

➔ Countries will need a rebalancing of agricultural policies and incentives towards more nutrition-sensitive investment and policy actions all along the food supply chain to reduce food losses and enhance efficiencies at all stages. Nutrition-sensitive social protection policies will also be central for them to increase the purchasing power and affordability of healthy diets of the most vulnerable populations. Policies that more generally foster behavioural change towards healthy diets will also be needed.

EXECUTIVE SUMMARY

FOOD SECURITY AND NUTRITION AROUND THE WORLD IN 2020

Five years into the 2030 Agenda, it is time to assess progress and to question whether continuing efforts implemented thus far will allow countries to reach SDG 2 targets. For this reason, this year's report complements the usual assessment of the state of food security and nutrition in the world with projections of what the world may look like in 2030 if trends of the last decade continue. Importantly, as the COVID-19 pandemic continues to evolve, this report attempts to foresee some of the impacts of this global pandemic on food security and nutrition. However, given that the full extent of the devastation that COVID-19 will cause is still largely unknown, it is important to recognize that any assessment at this stage is subject to a high degree of uncertainty and should be interpreted with caution.

Progress towards hunger and food insecurity targets

The three most recent editions of this report already presented evidence that the decades-long decline in hunger in the world, as measured using the prevalence of undernourishment (PoU), had unfortunately ended. Additional evidence and several important data updates, including a revision of the entire PoU series for China back to 2000, show that almost 690 million people in the world (8.9 percent of the world population) are estimated to have been undernourished in 2019. Revision in light of the new data, which results in a parallel downward shift of the entire global PoU series, confirms the conclusion of past editions of this report: the number of people affected by hunger in the world continues to increase slowly. This trend started in 2014 and extends to 2019. There are nearly 60 million more undernourished people now than in 2014, when the prevalence was 8.6 percent – up by 10 million people between 2018 and 2019.

The reasons for the observed increase of the last few years are multiple. Much of the recent increase in food insecurity can be attributed to the greater number of conflicts, often exacerbated by climate-related shocks. Even in some peaceful settings, food security has deteriorated as a result of economic slowdowns threatening access to food for the poor.

The evidence also reveals that the world is not on track to achieve the SDG 2.1 Zero Hunger target by 2030. Combined projections of recent trends in the size and composition of the population, in the total food availability, and in the degree of inequality in food access point to an increase of the PoU by almost 1 percentage point. As a result, the global *number* of undernourished people in 2030 would exceed 840 million.

The PoU in Africa was 19.1 percent of the population in 2019, or more than 250 million undernourished people, up from 17.6 percent in 2014. This prevalence is more than twice the world average (8.9 percent) and is the highest among all regions.

Asia is home to more than half of the total undernourished people in the world – an estimated 381 million people in 2019. Yet, the PoU in the population for the region is 8.3 percent, below the world average (8.9 percent), and less than half of that of Africa. Asia has shown progress in reducing the number of hungry people in recent years, down by 8 million since 2015.

In Latin America and the Caribbean, the PoU was 7.4 percent in 2019, below the world prevalence of 8.9 percent, which still translates into almost 48 million undernourished people. The region has seen a rise in hunger in the past few years, with the number of undernourished people increasing by 9 million between 2015 and 2019.

In terms of the outlook for 2030, Africa is significantly off track to achieve the Zero Hunger target in 2030. If recent rates of increase persist, its PoU will rise from 19.1 to 25.7 percent. Latin America and the Caribbean is also off track, although to a much lower degree. Mostly due to deterioration in recent years, its PoU is expected to increase from 7.4 percent in 2019 to 9.5 in 2030. Asia, while making progress, will also not achieve the 2030 target based on recent trends.

Overall, and without considering the effects of COVID-19, projected trends in undernourishment would change the geographic distribution of world hunger dramatically. While Asia would still be home to almost 330 million hungry people in 2030, its share of the world's hunger would shrink substantially. Africa would overtake Asia to become the region with the highest number of undernourished people (433 million), accounting for 51.5 percent of the total.

At the time of this writing, the COVID-19 pandemic was spreading across the globe, clearly posing a serious threat to food security. Preliminary assessments based on the latest available global economic outlooks suggest that the COVID-19 pandemic may add between 83 and 132 million people to the total number of undernourished in the world in 2020 depending on the economic growth scenario (losses ranging from 4.9 to 10 percentage points in global GDP growth). The expected recovery in 2021 would bring the number of undernourished down but still above what was projected in a scenario without the pandemic. Again, it is important to recognize that any assessment at this stage is subject to a high degree of uncertainty and should be interpreted with caution.

Latest estimates suggest that 9.7 percent of the world population (slightly less than 750 million people) was exposed to severe levels of food insecurity in 2019. In all regions of the world except Northern America and Europe, the prevalence of severe food insecurity has increased from 2014 to 2019. This is also broadly consistent with recent trends in the PoU in the world and across regions, with the partial exception of Asia.

While the 746 million people facing severe food insecurity are of utmost concern, an additional 16 percent of the world population, or more than 1.25 billion people, have experienced food insecurity at moderate levels. People who are moderately food insecure do not have regular access to nutritious and sufficient food, even if not necessarily suffering from hunger.

The prevalence of both moderate and severe levels of food insecurity (SDG Indicator 2.1.2) is estimated to be 25.9 percent in 2019 for the world as a whole. This translates into a total of 2 billion people. Total food insecurity (moderate or severe) has consistently increased at the global level since 2014, mostly because of the increase in moderate food insecurity.

Although Africa is where the highest levels of total food insecurity are observed, it is in Latin America and the Caribbean where food insecurity is rising the fastest: from 22.9 percent in 2014 to 31.7 percent in 2019, due to a sharp increase in South America.

In terms of the distribution of total food insecure (moderate or severe) people in the world, out of the 2 billion people suffering from food insecurity, 1.03 billion are in Asia, 675 million in Africa, 205 million in Latin America and the Caribbean, 88 million in Northern America and Europe, and 5.9 million in Oceania.

At the global level, the prevalence of food insecurity at moderate or severe level, and severe level only, is higher among women than men.

The gender gap in accessing food increased from 2018 to 2019, particularly at the moderate or severe level.

Progress towards global nutrition targets

Worldwide, the prevalence of child stunting in 2019 was 21.3 percent, or 144 million children. Although there has been some progress, rates of stunting reduction are far below what is needed to reach the World Health Assembly (WHA) target for 2025 and the SDG target for 2030. If recent trends continue, these targets will only be achieved in 2035 and 2043, respectively.

In 2019, more than nine out of ten stunted children lived in Africa or Asia, representing 40 percent and 54 percent of all stunted children in the world, respectively. Most regions have made some progress in reducing stunting between 2012 and 2019 but not at the rate needed to achieve the 2025 and 2030 targets. Globally, stunting estimates vary by wealth. Children from the poorest wealth quintile had a stunting prevalence that was more than double that of children from the richest quintile.

The global prevalence of overweight among children under 5 years of age has not improved, going from 5.3 percent in 2012 to 5.6 percent, or 38.3 million children, in 2019. Of these, 24 percent lived in Africa and 45 percent in Asia. Australia and New Zealand is the only subregion with a very high prevalence (20.7 percent). Southern Africa (12.7 percent) and Northern Africa (11.3 percent) have prevalences considered high.

Globally, 6.9 percent of children under 5 (47 million) were affected by wasting in 2019 – a figure significantly above the 2025 target (5 percent) and the 2030 target (3 percent) for this indicator.

Worldwide, 14.6 percent of infants were born with low birthweight (less than 2 500 g) in 2015. The trends for this indicator at global and regional level show that some progress has been made in recent years, but not enough to achieve the target of a 30 percent reduction in low birthweight by 2025 or even by 2030.

Globally, as of 2019, it is estimated that 44 percent of infants aged less than six months were exclusively breastfed. Currently, the world is on track to achieve the 2025 target of at least 50 percent of babies younger than six months being exclusively breastfed. If additional efforts are not made, however, the global target for 2030 of at least 70 percent will not be achieved before 2038. Most subregions are making at least some progress, except Eastern Asia and the Caribbean. If the Eastern Africa, Central Asia and Southern Asia subregions maintain their current rates of progress, they will reach the targets set for both 2025 and 2030.

Adult obesity continues to rise, from 11.8 percent in 2012 to 13.1 percent in 2016 and is not on track to reach the global target to halt the rise in adult obesity by 2025. If the prevalence continues to increase by 2.6 percent per year, adult obesity will increase by 40 percent by 2025, compared to the 2012 level. All subregions show increasing trends in the prevalence of adult obesity between 2012 and 2016.

The critical link between food security and nutrition outcomes: food consumption and diet quality

Diet quality comprises four key aspects: variety/diversity, adequacy, moderation and overall balance. According to WHO, a healthy diet protects against malnutrition in all its forms, as well as non-communicable diseases (NCDs) such as diabetes, heart disease, stroke and cancer. It contains a balanced, diverse and appropriate selection of foods eaten over a period of time.

In addition, a healthy diet ensures that a person's needs for macronutrients (proteins, fats and carbohydrates including dietary fibres) and essential micronutrients (vitamins and minerals) are met, specific to their gender, age, physical activity level and physiological state. Healthy diets include less than 30 percent of total energy intake from fats, with a shift in fat consumption away from saturated fats to unsaturated fats and the elimination of industrial trans fats; less than 10 percent of total energy intake from free sugars (preferably less than 5 percent); consumption of at least 400 g of fruits and vegetables per day; and not more than 5 g per day of salt (to be iodized). While the exact make-up of a healthy diet varies depending on individual characteristics, as well as cultural context, locally available foods and dietary customs, the basic principles of what constitutes a healthy diet are the same.

Global assessment of food consumption and diet quality poses many challenges. To date, there is no single, validated composite index to measure the multiple dimensions of diet quality across all countries.

Data on food availability at the country level show large discrepancies in the per capita availability of foods from different food groups across different country income groups. Low-income- and lower-middle-income countries rely heavily on staple foods like cereals, roots, tubers and plantains. Overall, the availability of staple foods for the world has changed little between 2000 and 2017. Availability of roots, tubers and plantains increased in lower-middle-income countries, driven by a rise in Africa, whereas it decreased in high-income countries.

In low-income countries, cereals, roots, tubers and plantains represent nearly 60 percent of all food available in 2017. This percentage decreases gradually with country income groups, down to 22 percent in high-income countries.

The world average availability of fruits and vegetables increased; however, only in Asia, and globally in upper-middle-income countries, are there enough fruits and vegetables available to meet the FAO/WHO recommendation of consuming a minimum of 400 g per day.

Availability of animal source foods overall is highest in high-income countries, but it is growing rapidly in upper-middle-income countries. Most of the global increases in animal source foods were observed in lower- and upper-middle-income countries. Asia showed the largest increase in the total amount of animal source foods available.

The contribution from animal source foods varies with the country income group. It is higher in high-income countries (29 percent) compared to upper-middle- and lower-middle-income countries (20 percent), and lowest in low-income countries (11 percent).

According to UNICEF, dietary diversity in infants and young children was low in the majority of the regions, with less than 40 percent of children meeting minimum dietary diversity in seven out of the eleven subregions. In addition, there are stark disparities in the prevalence of minimum dietary diversity by the place of residence (urban/rural) and wealth status. The prevalence of children eating foods from at least five out of eight food groups is on average 1.7 times higher among children living in urban households than in rural, and among those living in the richest households compared to the poorest.

How does food insecurity affect what people eat?

An analysis of dietary patterns according to levels of food insecurity found that diet quality worsens with increasing severity of food insecurity.

The ways in which moderately food insecure people modify their diets vary according to the income level of the country. In two lower-middle-income countries studied (Kenya and Sudan), there is a marked decrease in consumption of most food groups, and an increase in the share of staples in the diet. In two upper-middle-income countries examined (Mexico and Samoa), people who are moderately food insecure consume more foods that are typically cheaper on a per-calorie basis (cereals, roots, tubers and plantains), and consume lesser amounts of expensive foods (meat and dairy), compared with those who are food secure. Mexico in particular shows a decrease in fruit and dairy consumption as the severity of food insecurity increases.

In summary, with ten years to go until 2030, the world is off track to achieve the SDG targets for hunger and malnutrition. After decades of long decline, the number of people suffering from hunger has been slowly increasing since 2014. Beyond hunger, a growing number of people have been forced to compromise on the quality and/or quantity of the food they consume, as reflected in the increase in moderate or severe food insecurity since 2014. Projections for 2030, even without considering the potential impact of COVID-19, serve as a warning that the current level of effort is not enough to reach Zero Hunger ten years from now.

As for nutrition, progress is being made on decreasing child stunting and low birthweight and on increasing exclusive breastfeeding for the first six months of life. However, the prevalence of wasting is notably above the targets and the prevalence of both child overweight and adult obesity is increasing in almost all regions. COVID-19 is expected to exacerbate these trends, rendering vulnerable people even more vulnerable.

Increasing availability of and access to nutritious foods that comprise healthy diets must be a key component of stronger efforts to achieve the 2030 targets. The remaining years of the UN Decade of Action on Nutrition 2016–2025 present an opportunity for policymakers, civil society and the private sector to work together and accelerate efforts.

TRANSFORMING FOOD SYSTEMS TO DELIVER AFFORDABLE HEALTHY DIETS FOR ALL

As already highlighted above, diet quality is a critical link between food security and nutrition outcomes that needs to be present as part of all efforts to achieve the hunger, food security and nutrition targets of SDG 2. Meeting these targets will only be possible if we ensure that people have enough food to eat, and that what they are eating is nutritious. However, one of the biggest challenges to achieving this is the current cost and affordability of healthy diets, which is the focus of Part 2 of this report this year.

The cost and affordability of healthy diets around the world

New analysis presented in this report aims to determine whether the food system brings three levels of diet quality within reach of the poorest. The three diets chosen denote increasing levels of diet quality, starting from a basic energy sufficient diet meeting calorie needs, to a nutrient adequate diet and then a healthy diet, the latter including an estimation of recommended intake of more diversified and desirable food groups. As expected, the cost of the diet increases incrementally as the diet quality increases and this is true across all regions and country income groups. The cost of a healthy diet is 60 percent higher than the cost of the nutrient adequate diet, and almost 5 times the cost of the energy sufficient diet.

While most of the poor around the world can afford an energy sufficient diet, as defined here, they cannot afford either a nutrient adequate or a healthy diet. A healthy diet is far more expensive than the full value of the international poverty line of USD 1.90 PPP per day, let alone the portion of the poverty line that can credibly be reserved for food (63 percent), to end up with a threshold of USD 1.20 PPP per day. When comparing its cost to household food expenditure, on average a healthy diet is affordable, with the cost representing 95 percent of average food expenditures per capita per day at the global level. Most striking is that the cost of a healthy diet exceeds national average food expenditures in most countries in the Global South.

It is estimated that based on average estimated incomes more than 3 billion people in the world could not afford a healthy diet in 2017. Most of these people are found in Asia (1.9 billion) and Africa (965 million), although there are also millions that live in Latin America and the Caribbean (104.2 million), and in Northern America and Europe (18 million).

While the cost and affordability of diets varies around the world, across regions and in different development contexts, they may also vary within countries due to temporal and geographical factors, as well as variations in the nutritional needs of individuals across the life cycle. These within-country variations in cost are not captured in the above global and regional analysis – but evidence from case studies makes it clear such variations can be substantial.

The hidden health and environmental costs of what we eat

Valuing the hidden costs (or negative externalities) associated with different diets could modify significantly our assessment of what is "affordable" from a broader societal perspective and reveal how dietary choices affect other SDGs. Two hidden costs that are most critical relate to the health (SDG 3) and climate-related (SDG 13) consequences of our dietary patterns and the food systems that support these. The health and environmental consequences of unbalanced and unhealthy diets translate into actual costs for individuals and society as a whole, such as increased medical costs and the costs of climate damage, among other environmental costs.

New analysis for this report has estimated the health and climate-change costs of five different dietary patterns: one benchmark diet, representing current food consumption patterns, and four alternative healthy diet patterns that, although differing in the way they include foods from several groups and diversity within food groups, all include sustainability considerations.

The health impacts associated with poor diet quality are significant. Diets of poor quality are a principal contributor to the multiple burdens of malnutrition – stunting, wasting, micronutrient deficiencies, overweight and obesity and both undernutrition early in life and overweight and obesity are significant risk factors for NCDs. Unhealthy diets are also the leading risk factor for deaths from NCDs. In addition, increasing healthcare costs linked to increasing obesity rates are a trend across the world.

Assuming that current food consumption patterns accommodate expected changes in income and population, as per in the benchmark scenario representing current food consumption patterns, health costs are projected to reach an average of USD 1.3 trillion in 2030. More than half (57 percent) of these are direct healthcare costs as they are associated with expenses related to treating the different diet-related diseases. The other part (43 percent) accounts for indirect costs, including losses in labour productivity (11 percent) and informal care (32 percent).

If, instead, any of the four alternative diet patterns used for the analyses are adopted (FLX, PSC, VEG, VGN), diet-related health costs dramatically decrease by USD 1.2–1.3 trillion, representing an average reduction of 95 percent of the diet-related health expenditures worldwide compared to the benchmark scenario in 2030.

What people eat, and how that food is produced, not only affects their health, but also has major ramifications for the state of the environment and for climate change. The food system underpinning the world's current dietary patterns is responsible for around 21–37 percent of total greenhouse gas (GHG) emissions, which reveals it to be a major driver of climate change, even without considering other environmental effects.

Most global and cross-country valuations of environmental impacts focus on GHG emissions, because data limitations hamper global cross-country comparisons of other important environmental impacts related to land use, energy and water use. This data limitation also affects this report's own global analysis, which looks at the hidden climate-change costs by focusing exclusively on GHG emissions and their climate impacts.

The diet-related social cost of GHG emissions related to current food consumption patterns are estimated to be around USD 1.7 trillion for 2030 for an emissions-stabilization scenario. Our analysis shows that adoption of any of the four alternative healthy diet patterns that include sustainability considerations could potentially contribute to significant reductions of the social costs of GHG emissions, ranging from USD 0.7 to USD 1.3 trillion across the four diets (41–74 percent) in 2030.

Managing trade-offs and exploiting synergies in the transition towards healthy diets that include sustainability considerations

To achieve the dietary patterns for healthy diets that include sustainability considerations, large transformative changes in food systems will be needed at all levels. Given the large diversity of current food systems and wide discrepancies in food security and nutrition status across and within countries, there is no one-size-fits-all solution for countries to move from the status quo to achieving healthy diets and create synergies to reduce their environmental footprints. Assessing the context-specific barriers, managing (and sometimes enduring) short-term and long-term trade-offs and exploiting synergies is critical.

While the cost of the healthy diet is lower than current food consumption patterns when one considers health and climate-related externalities, in some contexts, there are other important indirect costs and trade-offs. For countries where the food system not only provides food, but also drives the rural economy, it will be important to consider the impact of shifting to healthy diet patterns in terms of the livelihoods of smallholder farmers and the rural poor as well. In these cases, care must be taken to mitigate the negative impact on incomes and livelihoods as food systems transform to deliver affordable healthy diets.

Many lower-income countries, where populations already suffer nutrient deficiencies, may need to increase their carbon footprint in order to first meet recommended dietary needs and nutrition targets, including those on undernutrition. On the other hand, other countries, especially upper-middle-income and high-income countries, where diet patterns exceed optimal energy requirements, and where people consume more animal source foods than required, will need to make major changes in their dietary practices and food environments as well as system-wide changes in food production and trade.

What is driving the cost of nutritious food?

To increase the affordability of healthy diets, the cost of nutritious foods must come down. Many factors determine the consumer price of nutritious food, from the point of production throughout the food supply chain, and also within the food environment when consumers engage with the food system to make decisions about acquiring, preparing and consuming foods.

Addressing low productivity in food production can be an effective way of raising the overall supply of food, including nutritious foods, by reducing food prices and rising incomes, especially for the poorer family farmers and smallholder producers in low-income and lower-middle-income countries, like farmers, pastoralists and fisherfolk. In addition to low productivity, insufficient diversification towards the production of horticultural products, legumes, small-scale fisheries, aquaculture, livestock and other nutritious food products also limits the supply of diverse and nutritious foods in markets, resulting in higher food prices.

Reducing pre-harvest and post-harvest losses in quantity and quality at the production level in the agriculture, fisheries and forestry sectors is an important starting point to reduce the cost of nutritious foods along the food supply chain, as this decreases the overall availability of these foods – while possibly contributing to environmental sustainability as well. Another important component of market infrastructure is the overall quality and efficiency of the national road and transportation network, which is critical in getting produce from the farm gate to markets at reasonable cost.

The distance to food marketplaces and the time required to prepare a healthy meal in times of rapid urbanization and increasing involvement of women in economic activities can also be seen as cost drivers because people who try to overcome them would have to accept an additional cost on top of the cost of food itself.

Food and agricultural policies also have the power, either directly or indirectly, to affect the cost of food. In particular, the priorities of the food and agriculture policy framework illustrate the difficult balancing act required when choosing between actions in agriculture versus other sectors; among different government objectives (e.g. different fiscal policies); between benefits for producers, consumers and intermediaries; and even between different agricultural subsectors.

Trade policies affect the cost and affordability of healthy diets by altering the relative prices between imported and import-competing foods. Protectionary trade measures such as import tariffs, bans and quotas – together with input subsidy programmes – have often been embedded in self-sufficiency and import substitution strategies. In low-income countries, this policy has protected and incentivized the domestic production of energy-dense foods such as rice and maize, but often at the detriment of vitamin- and micronutrient-rich products (i.e. fruits and vegetables). This can have an adverse effect on the affordability of more nutritious foods. Non-tariff measures, such as sanitary and phyto-sanitary measures (SPS) and technical barriers to trade (TBT) can also negatively affect the affordability of diets, as for example, exporters and importers may face additional costs to comply with regulatory requirements, driving up the cost of trade.

Last but not least, globalization has been accompanied by a massive growth of investments by transnational food corporations and rapidly increasing levels of food sold through supermarkets, referred to as the "supermarket revolution". These developments represent a key aspect of the political economy that drive food systems transformation and influence the cost and affordability of food.

Policies to reduce the cost of nutritious foods and ensure affordability of healthy diets

Ten years remain to achieve the ambitious SDG targets within the current economic, social and political environment – an environment increasingly vulnerable to climate and other shocks, not to mention the unprecedented health, social and economic impacts of the COVID-19 pandemic. With this short timeline, countries must identify and implement critical policy and investment changes that will transform their current food systems to ensure everybody can afford healthy diets that include sustainability considerations. Urgent action is needed, especially for the poorest in society, who face the greatest challenges.

Reducing the cost of nutritious foods and increasing the affordability of healthy diets must start with a reorientation of agricultural priorities towards more nutrition-sensitive food and agricultural production. Public expenditures will need to be stepped up to enable many of the policy decisions and investments needed to raise productivity, encourage diversification in food production and ensure that nutritious foods are made abundantly available.

Policies that penalize food and agricultural production (through direct or indirect taxation) should be avoided, as they tend to have adverse effects on the production of nutritious foods. Subsidy levels in the food and agriculture sectors should also be revisited, especially in low-income countries, to avoid taxation of nutritious foods. Policies should promote investment in irrigation infrastructure specifically targeting strengthened capacity for all-season vegetable production and other high-value commodities to increase availability of nutritious foods. Likewise, national food and agricultural strategies and programmes should step up investment in research and development (R&D) to raise productivity of nutritious foods and help reduce their cost, while enhancing access to improved technologies, especially for family farmers and smallholder producers, to maintain adequate levels of profitability.

There is a need for stronger policies towards more nutrition-sensitive value chains. Key policy actions include investments in improved storage, processing and preservation to retain the nutritional value of food products, rather than investing in highly processed foods. Improving the national road network, as well as transport and market infrastructure, can go a long way to ensuring greater affordability of healthy diets. In addition to food storage, appropriate food handling and processing facilities are central to increasing efficiencies along the value chain for nutritious foods.

Policies and investments should also focus on reducing food losses, as this can increase affordability of nutritious foods in two ways. First, by focusing on the earlier (production) stages of the food supply chain, as this tends to boost supplies and hence reduce food prices at the farm gate. This is particularly important for the reduction of losses in perishable commodities, such as fruits and vegetables, dairy, fish and meat. Second, by targeting the parts of the food supply chain where food losses are greatest, as this will more likely have a greater impact on reducing the cost of the targeted food item. The overall price effect will differ from one commodity to the next and also across countries.

Trade and marketing policies aimed at decreasing the cost of food to consumers, while avoiding disincentives to the local production of nutritious foods, are often difficult to balance. Nevertheless, the efficiency of internal trade and marketing mechanisms are possibly just as important as measures to support international trade – if not more – in determining the cost of healthy diets for both urban and rural consumers, while also ensuring that food safety standards are met.

Policies aimed at reducing poverty and income inequality, while enhancing employment and income-generating activities, are key to raising people's incomes and hence the affordability of healthy diets. While there are important synergies between policies enhancing employment and reducing income inequality for increased food security and better nutrition, including social protection, these have been addressed in depth in the 2019 edition of this report.

In this edition of the report, the importance of nutrition-sensitive social protection policies is particularly highlighted. These types of policies are most appropriate to provide better access to nutritious foods to lower-income consumers and thus increase their affordability of healthy diets. It is important to strengthen nutrition-sensitive social protection mechanisms, ensuring they can support micronutrient supplementation where needed, as well as create healthy food environments by encouraging consumers to diversify their diets to reduce dependence on starchy staples, reduce consumption of foods high in fats, sugars and/or salt, and include more diverse, nutritious foods. These mechanisms may include a number of policy tools, typically cash transfer programmes, but also in-kind transfers, school feeding programmes and subsidization of nutritious foods. These policies can be particularly important in the face of adversity, as we are seeing today during the COVID-19 pandemic.

Given different starting points and challenges in each country, as well as the potential trade-offs, a combination of complementary policy interventions towards reducing the cost of nutritious foods, while enhancing the affordability of healthy diets is likely to be more effective than any single policy measure.

To achieve the healthy dietary patterns, large transformative changes in food systems will be needed at all levels and it is important to underscore that, although there are some overlaps, these changes go beyond the policy options and investments that are explicitly designed and implemented to reduce the cost of and increase the affordability of healthy diets. That is to say, other conditions must also be met, requiring a whole range of other policies that are more explicitly tailored to raise awareness and influence consumer behaviour in favour of healthy diets, possibly with important synergies for environmental sustainability. ■

KENYA
Women harvesting French beans at one of Kenya's Njukini Corporative farms.
©FAO/Fredrik Lerneryd

PART 1
FOOD SECURITY AND NUTRITION AROUND THE WORLD IN 2020

PART 1

FOOD SECURITY AND NUTRITION AROUND THE WORLD IN 2020

In 2015, the countries of the United Nations committed to the 2030 Agenda for Sustainable Development. This agenda recognized the importance of looking beyond hunger towards the goals of ensuring access to safe, nutritious and sufficient food for all people all year round, and of eradicating all forms of malnutrition (SDG 2 Targets 2.1 and 2.2). Five years into the 2030 Agenda, it is now time to assess progress and to question whether continuing efforts implemented thus far will allow countries to reach these objectives. For this reason, this year's report complements the usual assessment of the state of food security and nutrition in the world with projections of what the world may look like in 2030 if trends of the last decade continue. Importantly, as the COVID-19 pandemic continues to evolve, this report attempts to foresee some of the impacts of this global pandemic on food security and nutrition. However, given that the devastation that COVID-19 will cause is still largely unknown, it is important to recognize that any assessment at this stage is subject to a high degree of uncertainty and should be interpreted with caution.

Food security and nutrition are closely interlinked. Food insecurity can lead to different manifestations of malnutrition. One vital element that explains this connection is the food that people eat; specifically, the quality of their diet. Food insecurity can affect diet quality in different ways, potentially leading to undernutrition as well as overweight and obesity. Ensuring access to a healthy diet is a prerequisite for achieving the SDG target of eradicating all forms of malnutrition. For this reason, this report examines several issues related to the quality of diets, including the challenges of assessment and monitoring of food consumption and diet quality at global level.

Section 1.1 presents the latest available evidence on progress towards achieving the hunger and food insecurity targets (SDG 2.1). This assessment is complemented with a first assessment of the potential for achieving these targets by 2030 at the global and regional levels based on the assumption that the trends observed in the last decade will continue.

Section 1.2 presents the latest figures on progress towards achieving global targets for seven nutrition indicators (including three SDG 2.2 indicators), with a spotlight on childhood stunting. The section also provides a glimpse of what the nutrition situation would be like in 2030 if current trends continue.

The analyses presented in Sections 1.1 and 1.2 use input data compiled up to March 2020, but with a reference period that ends in 2019. As such, they should be understood to represent the food security and nutrition situation before the outbreak of COVID-19. At this stage, it is not possible to undertake a complete and well-informed quantification of the impact of the COVID-19 pandemic. Nonetheless, this report provides an assessment of how the pandemic might affect food security and nutrition, within the limitations imposed by the information that is currently available.

Section 1.3 describes the challenges of defining and monitoring diet quality. It also presents evidence on what people are eating around the world including global trends in food availability and assessments of diet quality at the global and national levels. It ends by examining the important link between people's food insecurity (access) and diet quality. This segues into Part 2 of this report, which scrutinizes in depth the cost and affordability of healthy diets. Section 1.4 summarizes and concludes Part 1.

1.1 PROGRESS TOWARDS HUNGER AND FOOD INSECURITY TARGETS

KEY MESSAGES

➔ Updates for many countries have made it possible to estimate hunger in the world with greater accuracy this year. In particular, newly accessible data enabled the revision of the entire series of annual undernourishment estimates for China back to 2000, resulting in a substantial downward shift of the series of the number of undernourished in the world. Nevertheless, the revision confirms the trend reported in past editions of this report: the number of people affected by hunger globally has been slowly on the rise since 2014.

➔ Current estimates are that nearly 690 million people are hungry, or 8.9 percent of the world population – up by 10 million people in one year and by nearly 60 million in five years.

➔ Despite the re-assessment of the extent of hunger in China, the majority of the world's undernourished – 381 million – are still found in Asia. More than 250 million live in Africa, where the number of undernourished people is growing faster than in any other region of the world.

➔ The number of people affected by severe food insecurity, which is another measure that approximates hunger, also shows an upward trend. In 2019, close to 750 million – or nearly one in ten people in the world – were exposed to severe levels of food insecurity.

➔ Considering the total affected by moderate or severe levels of food insecurity, an estimated 2 billion people in the world did not have regular access to safe, nutritious and sufficient food in 2019.

➔ At the global level, the prevalence of food insecurity at moderate or severe level, and severe level only, is higher among women than men. The gender gap in accessing food increased from 2018 to 2019.

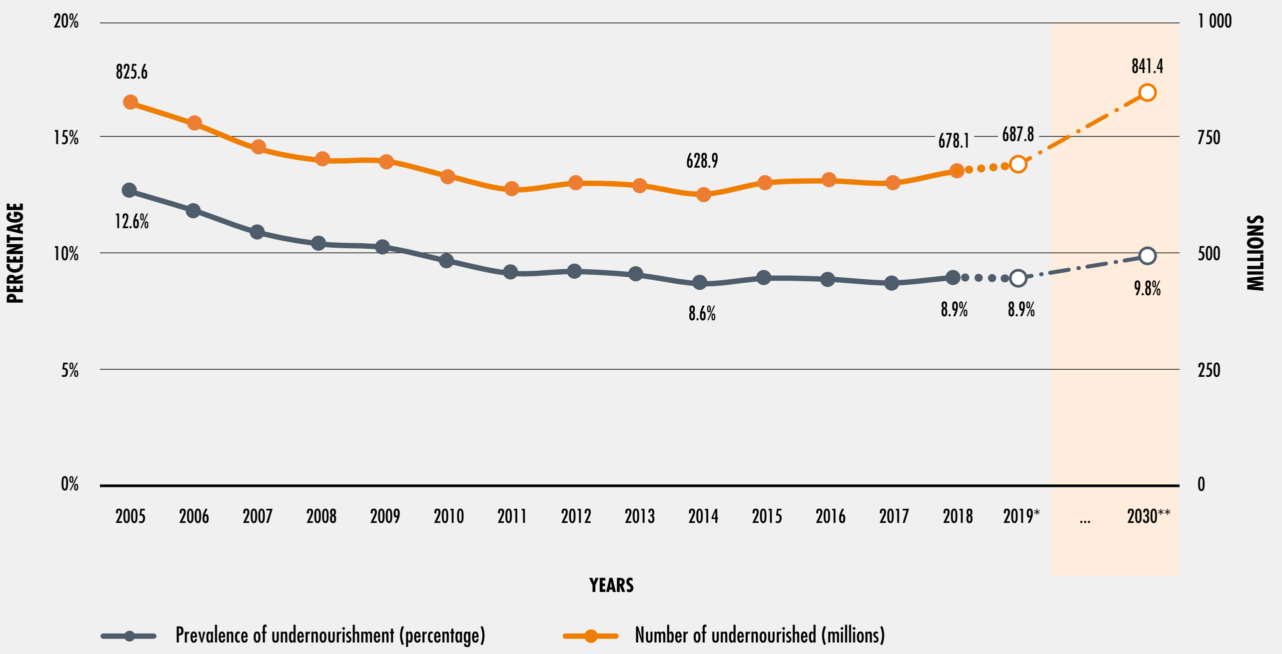
➔ The world is not on track to achieve Zero Hunger by 2030. If recent trends continue, the number of people affected by hunger will surpass 840 million by 2030, or 9.8 percent of the population. This is an alarming scenario, even without taking into account the potential impacts of the COVID-19 pandemic.

➔ COVID-19 is expected to worsen the overall prospects for food security and nutrition. Pockets of food insecurity may appear in countries and population groups that were not traditionally affected. A preliminary assessment suggests the pandemic may add between 83 and 132 million people to the total number of undernourished in the world in 2020 depending on the economic growth scenario (losses ranging from 4.9 to 10 percentage points in global GDP growth). The expected recovery in 2021 would bring the number of undernourished down, but still above what was projected in a scenario without the pandemic.

Ten years remain to eliminate hunger and ensure access to food for all

This edition of the report presents the latest available evidence on progress towards achieving the hunger and food insecurity targets. It also attempts to predict the state of food security in 2030 by assessing the current trajectory of hunger at the global and regional levels.

FIGURE 1
THE NUMBER OF UNDERNOURISHED PEOPLE IN THE WORLD CONTINUED TO INCREASE IN 2019. IF RECENT TRENDS ARE NOT REVERSED, THE SDG 2.1 ZERO HUNGER TARGET WILL NOT BE MET



NOTES: Projected values in the figure are illustrated by dotted lines and empty circles. The shaded area represents projections for the longer period from 2019 to the 2030 target year. The entire series was carefully revised to reflect new information made available since the publication of the last edition of the report; it replaces all series published previously.
* See Box 2 for a description of the projection method. ** Projections to 2030 do not consider the potential impact of the COVID-19 pandemic.
SOURCE: FAO.

The assessment benefits from important updates for several populous countries. In particular, newly accessible data for China made it possible to update estimates of inequalities in dietary energy consumption in the country. This has in turn allowed us to revise the entire prevalence of undernourishment (PoU) series for the country back to 2000, and by extension to estimate hunger in the world with greater accuracy (see Box 1).

The report presents an assessment through 2019 based on the data that was available in March 2020, just before the COVID-19 pandemic began to take hold. The challenge of eradicating hunger and ensuring access to safe and nutritious food for all now appears to be more daunting. The figures and projections reported in this section and in Section 1.2 provide a picture of how food insecurity and malnutrition in the world would have evolved had COVID-19 not appeared. In this sense, it is an important assessment to be used as a baseline against which to evaluate the impact of the pandemic on food security and nutrition.

SDG Indicator 2.1.1
Prevalence of undernourishment (PoU)

The three most recent editions of this report already presented evidence that the decades-long decline in hunger in the world, as measured using the PoU, had unfortunately ended. Additional evidence and several important data updates, including a revision of the entire PoU series for China (see Boxes 1 and 2), show that almost 690 million people in the world (8.9 percent of the world population) are estimated to have been undernourished in 2019 (Figure 1, Tables 1 and 2). Revision in light of the new data, which results in a parallel downward shift of the entire global PoU series, confirms the conclusion of past editions of this report: the number of people affected by hunger in the world continues to increase slowly. This trend started in 2014 and extends to 2019. There are nearly 60 million more undernourished people now than in 2014, when the prevalence was 8.6 percent – up by 10 million people between 2018 and 2019. »

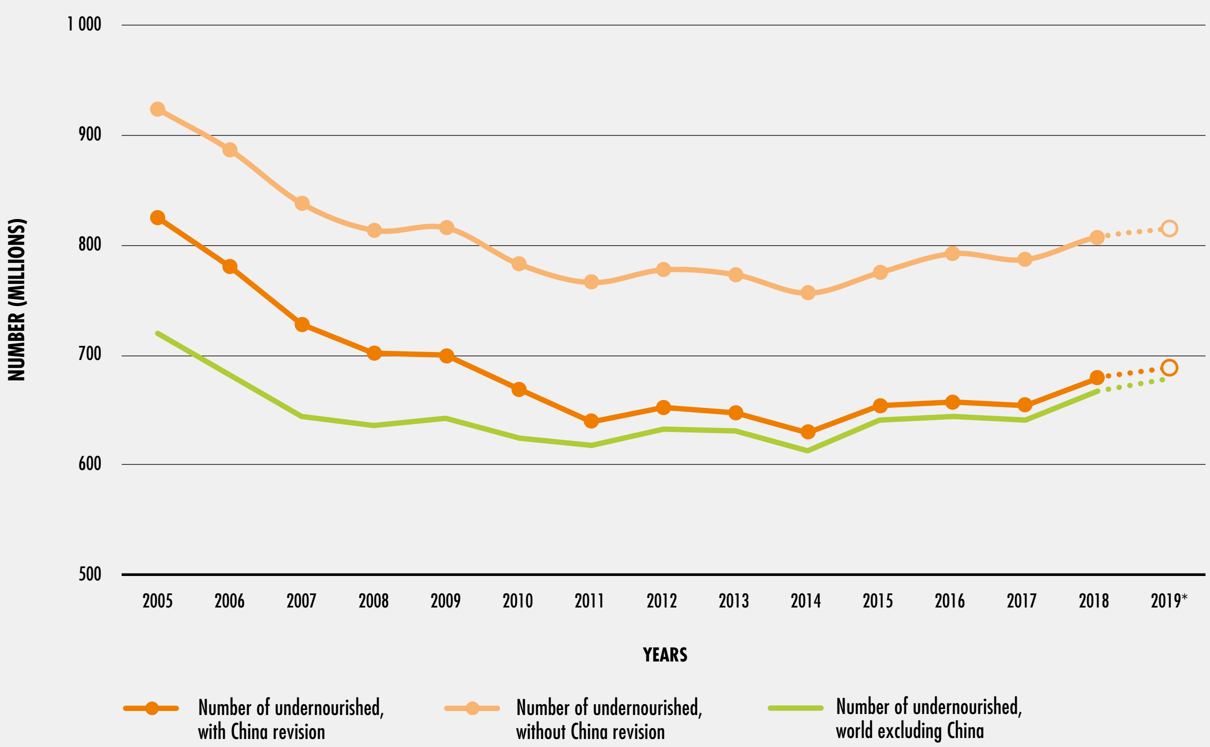
BOX 1
UPDATED INFORMATION FOR CHINA IMPROVES THE ACCURACY OF GLOBAL HUNGER ESTIMATES

Revising parameters to estimate the PoU is standard procedure, conducted annually as more data become available. This makes it impossible to compare PoU estimates across different editions of the report (see Box 2 and Annex 2). Even so, data are not available to update parameters for all countries every year. This year has been rich in updates, including revision of the crucial parameter of inequality in food consumption for 13 countries, among them some of the world's most populous. As highlighted in previous editions, particularly problematic until this year had been access to more recent data to revise the parameter of inequality in food consumption for China. Given that the country hosts one-fifth of the world's population, any update of Chinese parameters can be expected to make a significant difference to global estimates.

While still facing food security and nutrition challenges, China has made impressive economic and social development gains since the last update that were not reflected in previous assessments. Our conviction that an update of the PoU for China was needed was reinforced further by a recent assessment on the state of nutrition in China, the *Report on Chinese Residents' Chronic Diseases and Nutrition*, published by the Chinese National Health and Family Planning Commission on 30 June 2015. The report showed considerable improvement in the nutritional status of the Chinese population, including a reduction of undernutrition in adults (measured as the percentage of individuals with Body Mass Index below 18.5 kg/m^2) from 8.5 percent in 2002 to 6 percent in 2012, and of stunting in children under 6 years from 16.3 percent in 2002 to 8.1 percent in 2013.[11,12*] However, the data in the report could not be used for the update, as it does not provide information on inequality of food consumption in the population.

This year FAO obtained data from two surveys in China that could be used to update the PoU estimates. The first is the China Health and Nutrition Survey (CHNS)** conducted from 1990 to 2011, covering 12 provincial-level administrative regions of China. The second is the China Household Finance Survey (CHFS),*** which covers 28 out of 34 provincial-level

A. NUMBER OF UNDERNOURISHED IN THE WORLD, WITH AND WITHOUT THE REVISION FOR CHINA



SOURCE: FAO.

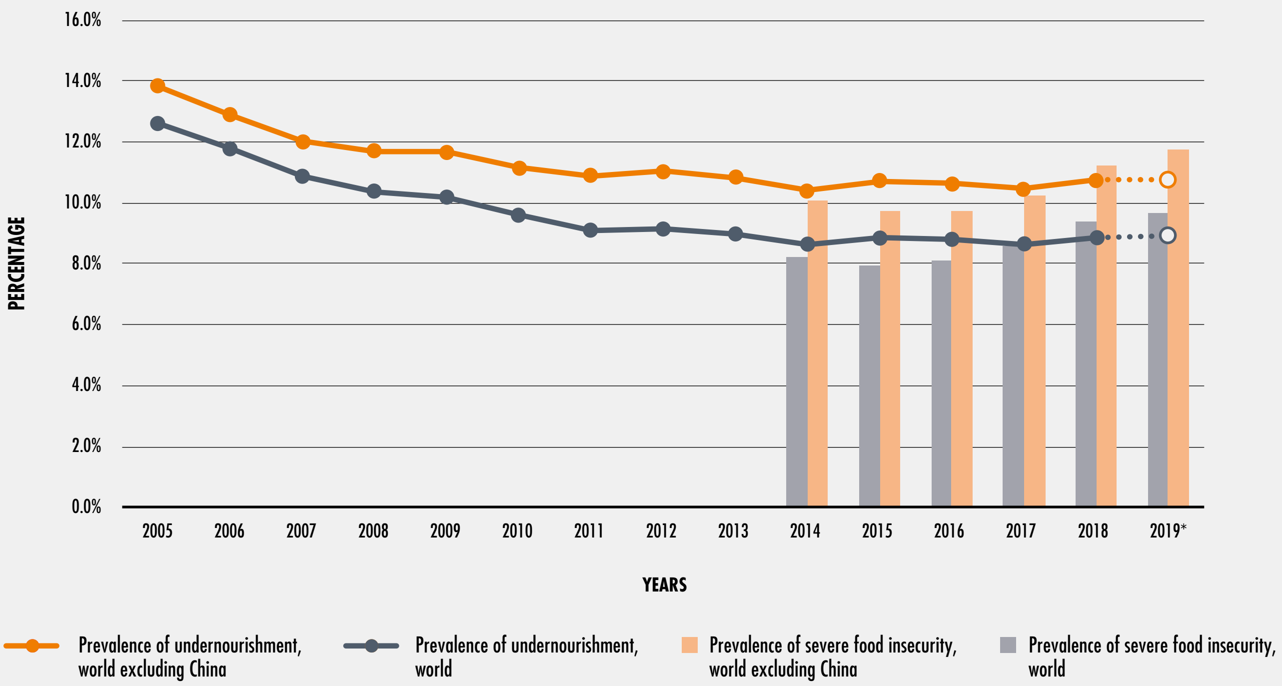
administrative regions of China, and was conducted every two years from 2011 to 2017. With these data it was possible to update the information on inequality of dietary energy consumption across the Chinese population and, consequently, the estimates of the PoU for China, and to revise the whole series back to 2000 for consistency.

Although based on different sampling frames and designs, CHNS and CHFS provide sufficiently reliable estimates of average food consumption and average food expenditure, respectively, by province and income deciles. This allowed the estimation of a statistical function that links the daily dietary energy consumption of typical households in China to their monthly food expenditure. The estimated model was then used to predict the levels of energy consumption by income decile in each of the provinces and years based on the reported food expenditure data in the CHFS. The results, properly weighted by the current population in each income decile by province, were used to compute estimates of inequality in habitual dietary energy consumption due to income (CV|y) in 2011, 2013, 2015 and 2017. These estimates were then used to update the series of PoU for China.**** With the revision, the estimated PoU for China in 2017 is below 2.5 percent of the population, which is the lowest value that can be reliably reported using the PoU methodology. Without the revision, the 2017 estimate would be close to 10 percent.

The revisions to the China series have resulted in a new series of estimates of PoU and the number of undernourished in the world which, reflecting new information, are now more accurate than in the past. The result was a substantial downward shift of the entire series of global hunger numbers, as depicted in Figure A. Despite this shift in levels, the revision confirms the trend reported in past editions of this report: the number of people affected by hunger in the world has been slowly on the rise since 2014.

In addition to the trends on improving nutrition in China from the 2015 report mentioned above, further validation for the revision comes from comparing the revised global estimates of PoU with the recent estimates of the prevalence of severe food insecurity

B. PREVALENCE OF UNDERNOURISHMENT IN THE WORLD WITH AND WITHOUT CHINA, COMPARED TO THE PREVALENCE OF SEVERE FOOD INSECURITY BASED ON THE FIES



SOURCE: FAO.

BOX 1 (CONTINUED)

based on the Food Insecurity Experience Scale (FIES). As explained in past editions of the report, the PoU and the prevalence of severe food insecurity based on the FIES are different, independent measures of the extent of serious food deprivation, based on different methods and data sources. However, they are two complementary ways to look at the extent of hunger in the world (see also the section on SDG Indicator 2.1.2 in this report).

The revised PoU estimates, both for the entire world and for the world excluding China (Figure B), display a remarkable convergence with the series of the prevalence of severe food insecurity in 2014–2019. This confirms the validity and urgency of the revision. The greater concurrence of these two indicators – for China and for the world – is a welcome step towards a unified baseline for gauging progress on the road towards the achievement of SDG 2.

* See also Table 1 in Wang, Wang & Qu (2017, p.149).[12] For the same period, the Joint Malnutrition Estimates of UNICEF, WHO and the World Bank for stunting among children under five years of age (SDG target 2.2) declined from 21.8 to 8.1 percent.

** CHNS is collected by the National Institute for Nutrition and Health (NINH), former National Institute of Nutrition and Food Safety, at the Chinese Center for Disease Control and Prevention (CCDC) and the Carolina Population Center at the University of North Carolina at Chapel Hill.

*** CHFS is collected by the Survey and Research Center for China Household Finance of the Research Institute of Economics and Management at the Southwestern University of Finance and Economics in Chengdu, Sichuan, China.

**** A more detailed description of the input data, the methods and results can be found in Cafiero, Feng & Ishaq, 2020.[13]

» There are a number of reasons why hunger has increased in the last few years. Weak, stagnant or deteriorating economic conditions are underlying causes of increasing poverty and undernourishment. Economic slowdowns and downturns, particularly since the financial crisis of 2008–2009, have had significant impacts on hunger through various channels.[1] Despite significant progress in many of the world's poorest countries, and extreme poverty rate declining in the last two decades from more than 50 percent to about 30 percent, almost 10 percent of the world population still lives on USD 1.90 per day or less, especially in sub-Saharan Africa and Southern Asia.[2] Debt has increased significantly in many poor economies during the last decade, with total debt reaching almost 170 percent of GDP in 2018,[3] thus contributing to rising global risks and weakening growth prospects in many emerging and developing economies.

A high level of commodity-export and commodity-import dependence is another factor that makes several countries and regions more vulnerable to external shocks. Large inequalities in the distribution of income, assets and resources, together with the absence of effective social protection policies, also undermine food access, particularly for the poor and vulnerable. Economic conditions, structural imbalances and the inclusiveness of the policy framework interact with natural and man-made causes to trigger persisting poverty and hunger.

The increasing frequency of extreme weather events, altered environmental conditions, and the associated spread of pests and diseases over the last 15 years are factors that contribute to vicious circles of poverty and hunger, particularly when exacerbated by fragile institutions, conflicts, violence and the widespread displacement of populations.[4,5,6,7] The number of displaced people in the world in 2018 was about 70 percent higher than in 2010, reaching some 70.8 million, mostly hosted by developing countries.[2]

Smallholder farmers and communities that rely directly on their ability to produce their own food are affected more by these phenomena. Moreover, the prevalence of hunger is higher in countries with fast population growth and poor access to healthcare and education. This establishes direct links between food security, nutrition and health conditions of the population, which in turn affect the prospects of economic growth and development.

Figure 1 reveals that the world is not on track to achieve the SDG 2.1 Zero Hunger target by

2030. Combined projections of recent trends in the size and composition of population, in the total food availability, and in the degree of inequality in food access point to an increase of the PoU by almost 1 percentage point. As a result, the global *number* of undernourished people in 2030 would exceed 840 million (see Box 2 and **Annex 2** for a description of the projection methodology).

These projections for 2030 indicate that Target 2.1 of the 2030 Agenda for Sustainable Development – "By 2030 end hunger and ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round" – will *not* be met unless relevant stakeholders at all levels, from the subnational all the way to the global level, undertake urgent and consistent actions to reverse the current trends.[a]

This is the projected situation in 2030 based on trends in recent years, *without* considering the unknown impact of the COVID-19 pandemic. The pandemic will most likely accelerate the projected increase in the number of hungry people, at least in the immediate future. This reinforces the need for urgent action to get back on track towards achieving the Zero Hunger goal. The possible impact of the COVID-19 pandemic on the food security outlook for the world in 2030 is discussed in Box 3.

According to estimates, the PoU in Africa was 19.1 percent of the population in 2019, or more than 250 million undernourished people, up from 17.6 percent in 2014.[b] This prevalence is more than twice the world average (8.9 percent) and is the highest among all regions (Tables 1 and 2).

a The last three editions of this report presented a set of responses that are relevant going forward. The 2017 edition[4] offered concrete recommendations for building and strengthening resilience to shield food security from the impact of conflicts (pp. 73–75). The 2018 edition[7] introduced policies and programmes to build resilience of livelihoods and food systems to climate shocks and stresses (pp 105–111). The 2019 edition[1] presented a set of recommendations to reduce the effects of economic vulnerability on food security and create sustained escapes from hunger and malnutrition (pp. 102–118).

b The complete historical series of the PoU at global, regional and country levels can be found in the FAOSTAT database (available at www.fao.org/faostat/en/#data/FS).

The majority of undernourished people in Africa are found in the sub-Saharan subregion, which shows an increase of about 32 million undernourished people since 2015. Hunger has been on the rise throughout sub-Saharan Africa since 2014, though the increase has been especially significant in the Eastern and the Western subregions, as well as in Middle Africa where it has reached 29.8 percent of the total population in 2019 (Figure 2, Tables 1 and 2).

Economic slowdowns and downturns help explain much of the observed increase in hunger in several parts of sub-Saharan Africa, especially in the last two to three years. For instance, in Western Africa, recent increases in undernourishment have occurred together with these adverse economic factors, as has been the case in Côte d'Ivoire, Gambia, Guinea-Bissau, Mauritania, Niger and Nigeria.[1]

Additionally, a number of conflicts have affected the subregion in recent years, including in Burundi, the Central African Republic, Côte d'Ivoire, Democratic Republic of the Congo, Libya, Mali, northeast Nigeria and South Sudan.[4,8] When such disruptions persist over long periods of time, they impair all dimensions of food security, from the ability to access food, to the availability of supplies and the livelihoods of rural communities, along with the production chains that ensure the distribution of food. Protracted instability can easily destroy the resilience of well-functioning food systems.

The recent rise in undernourishment in Middle Africa and parts of Eastern Africa results from a combination of widespread violence in countries such as Central African Republic and Somalia – where almost half of the population is undernourished – and a drop in crop yields due to climate variability. For instance, in the Great Lakes and the Horn of Africa areas, poor yields of key products, such as maize, sorghum and groundnuts, have fallen further in recent years.[7] A significant presence of displaced persons from neighbouring countries has added to the challenges already faced by countries like Democratic Republic of the Congo, Ethiopia, Kenya and Sudan.[4]

TABLE 1
PREVALENCE OF UNDERNOURISHMENT (PoU) IN THE WORLD, 2005–2019

	Prevalence of undernourishment (%)							
	2005	2010	2015	2016	2017	2018	2019*	2030**
WORLD	**12.6**	**9.6**	**8.9**	**8.8**	**8.7**	**8.9**	**8.9**	**9.8**
AFRICA	**21.0**	**18.9**	**18.3**	**18.5**	**18.6**	**18.6**	**19.1**	**25.7**
Northern Africa	9.8	8.8	6.2	6.3	6.6	6.3	6.5	7.4
Sub-Saharan Africa	23.9	21.3	21.2	21.4	21.4	21.4	22.0	29.4
Eastern Africa	32.2	28.9	26.9	27.1	26.8	26.7	27.2	33.6
Middle Africa	35.5	30.4	28.2	28.8	28.7	29.0	29.8	38.0
Southern Africa	4.9	5.4	7.0	8.0	7.0	7.9	8.4	14.6
Western Africa	13.8	12.1	14.3	14.2	14.6	14.3	15.2	23.0
ASIA	**14.4**	**10.1**	**8.8**	**8.5**	**8.2**	**8.4**	**8.3**	**6.6**
Central Asia	11.0	7.7	3.0	3.0	3.0	3.0	2.7	< 2.5
Eastern Asia	7.6	3.8	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
South-eastern Asia	17.3	11.7	10.5	10.0	9.8	9.8	9.8	8.7
Southern Asia	20.6	15.4	14.4	13.8	13.1	13.8	13.4	9.5
Western Asia	11.8	10.4	10.7	11.1	11.1	11.2	11.2	13.1
Western Asia and Northern Africa	*10.9*	*9.7*	*8.6*	*8.9*	*9.0*	*8.9*	*9.0*	*10.4*
LATIN AMERICA AND THE CARIBBEAN	**8.7**	**6.7**	**6.2**	**6.7**	**6.8**	**7.3**	**7.4**	**9.5**
Caribbean	21.3	17.5	17.3	17.0	16.6	17.0	16.6	14.4
Latin America	7.8	5.9	5.4	6.0	6.1	6.6	6.7	9.1
Central America	8.1	7.9	7.9	8.6	8.3	8.4	9.3	12.4
South America	7.6	5.1	4.4	4.9	5.2	5.8	5.6	7.7
OCEANIA	**5.6**	**5.4**	**5.5**	**5.9**	**6.0**	**5.7**	**5.8**	**7.0**
NORTHERN AMERICA AND EUROPE	**< 2.5**	**< 2.5**	**< 2.5**	**< 2.5**	**< 2.5**	**< 2.5**	**< 2.5**	**< 2.5**

On track   Off track – some progress   Off track – no progress or worsening

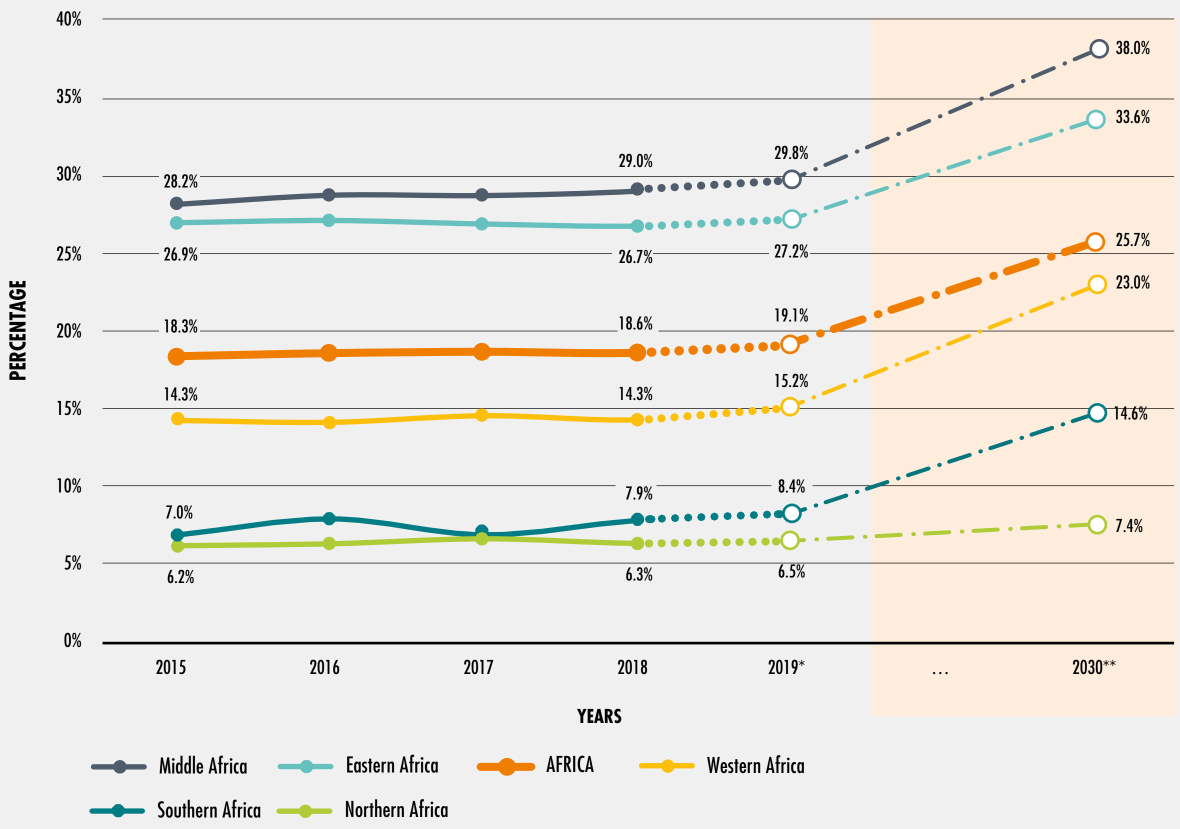
NOTES: * Projected values. ** The projections up to 2030 do not reflect the potential impact of the COVID-19 pandemic. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables inside the back cover. See Box 2, Annexes 1B and 2 for a description of how the projections are made.
SOURCE: FAO.

Furthermore, widespread droughts, generated by El Niño–Southern Oscillation (ENSO), have contributed to the increase in food insecurity seen in recent years in several countries of the Eastern and Southern Africa subregions, including Madagascar, South Africa, Zambia and Zimbabwe.[7]

At the same time, changing environmental conditions and competition for key resources such as land and water, have played a significant role in provoking violence and armed conflicts, exacerbating the vicious circle of hunger and poverty. The conflict in Darfur, for instance, is largely attributed to prolonged drought conditions. Competition between pastoralists and farmers is a source of conflicts in the Horn of Africa, where reduced mobility due to violence has affected grazing patterns and access to land and water. Similar occurrences have fueled conflict in other parts of the Sahel, for instance in the case of Mali, where desertification is reducing available croplands.[7]

In terms of outlook for 2030 (Table 1 and Figure 2), Africa is significantly off track to achieve the Zero Hunger target, even without considering the impact of COVID-19. If recent trends persist, its PoU will increase from 19.1 to 25.7 percent. Undernourishment is expected to worsen, particularly in the sub-Saharan subregion.

FIGURE 2
PoU IN AFRICA BY SUBREGION, WITH PROJECTIONS TO 2030. THE HIGHEST LEVELS OF UNDERNOURISHMENT ARE FOUND IN MIDDLE AND EASTERN AFRICA



NOTES: Projected values in the figure are illustrated by dotted lines and empty circles. The shaded area represents projections for the longer period from 2019 to the 2030 target year. * See Box 2 for a description of the projection method. ** Projections to 2030 do not consider the potential impact of the COVID-19 pandemic.
SOURCE: FAO.

By 2030, the projected rise in the PoU would bring the number of hungry people in Africa to almost 433 million, 412 million of whom would be in sub-Saharan countries (Table 2).

Asia is home to more than half of the total number of undernourished people in the world – an estimated 381 million people in 2019. Yet, the PoU in the region is 8.3 percent of the total population, below the world average (8.9 percent), and less than half of that of Africa (Tables 1 and 2). In addition, since 2005, the number of hungry people in Asia has gone down by more than 190 million. This outcome reflects progress mostly in the Eastern and Southern subregions. The situation in other subregions is stable since 2015, except for Western Asia (Tables 1, 2 and Figure 3), where it has been worsening due to widespread protracted crises.

The two subregions showing reductions in undernourishment – Eastern and Southern Asia – are dominated by the two largest economies of the continent – China and India.

TABLE 2
NUMBER OF UNDERNOURISHED PEOPLE IN THE WORLD, 2005–2019

	Number of undernourished (millions)							
	2005	2010	2015	2016	2017	2018	2019*	2030**
WORLD	**825.6**	**668.2**	**653.3**	**657.6**	**653.2**	**678.1**	**687.8**	**841.4**
AFRICA	**192.6**	**196.1**	**216.9**	**224.9**	**231.7**	**236.8**	**250.3**	**433.2**
Northern Africa	18.3	17.8	13.8	14.4	15.5	15.0	15.6	21.4
Sub-Saharan Africa	174.3	178.3	203.0	210.5	216.3	221.8	234.7	411.8
Eastern Africa	95.0	98.1	104.9	108.4	110.4	112.9	117.9	191.6
Middle Africa	39.7	40.0	43.5	45.8	47.2	49.1	51.9	90.5
Southern Africa	2.7	3.2	4.4	5.1	4.5	5.2	5.6	11.0
Western Africa	36.9	37.0	50.3	51.2	54.2	54.7	59.4	118.8
ASIA	**574.7**	**423.8**	**388.8**	**381.7**	**369.7**	**385.3**	**381.1**	**329.2**
Central Asia	6.5	4.8	2.1	2.1	2.2	2.1	2.0	n.r.
Eastern Asia	118.6	60.6	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
South-eastern Asia	97.4	70.1	66.7	63.9	63.4	64.2	64.7	63.0
Southern Asia	328.0	264.0	263.1	256.2	245.7	261.0	257.3	203.6
Western Asia	24.3	24.2	27.6	29.2	29.5	30.4	30.8	42.1
Western Asia and Northern Africa	*42.6*	*42.0*	*41.4*	*43.6*	*45.0*	*45.4*	*46.4*	*63.5*
LATIN AMERICA AND THE CARIBBEAN	**48.6**	**39.6**	**38.8**	**42.4**	**43.5**	**46.6**	**47.7**	**66.9**
Caribbean	8.4	7.2	7.4	7.3	7.1	7.3	7.2	6.6
Latin America	40.1	32.4	31.4	35.1	36.3	39.3	40.5	60.3
Central America	11.8	12.4	13.4	14.7	14.4	14.7	16.6	24.5
South America	28.4	20.0	18.0	20.4	21.9	24.6	24.0	35.7
OCEANIA	**1.9**	**2.0**	**2.2**	**2.4**	**2.4**	**2.4**	**2.4**	**3.4**
NORTHERN AMERICA AND EUROPE	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**

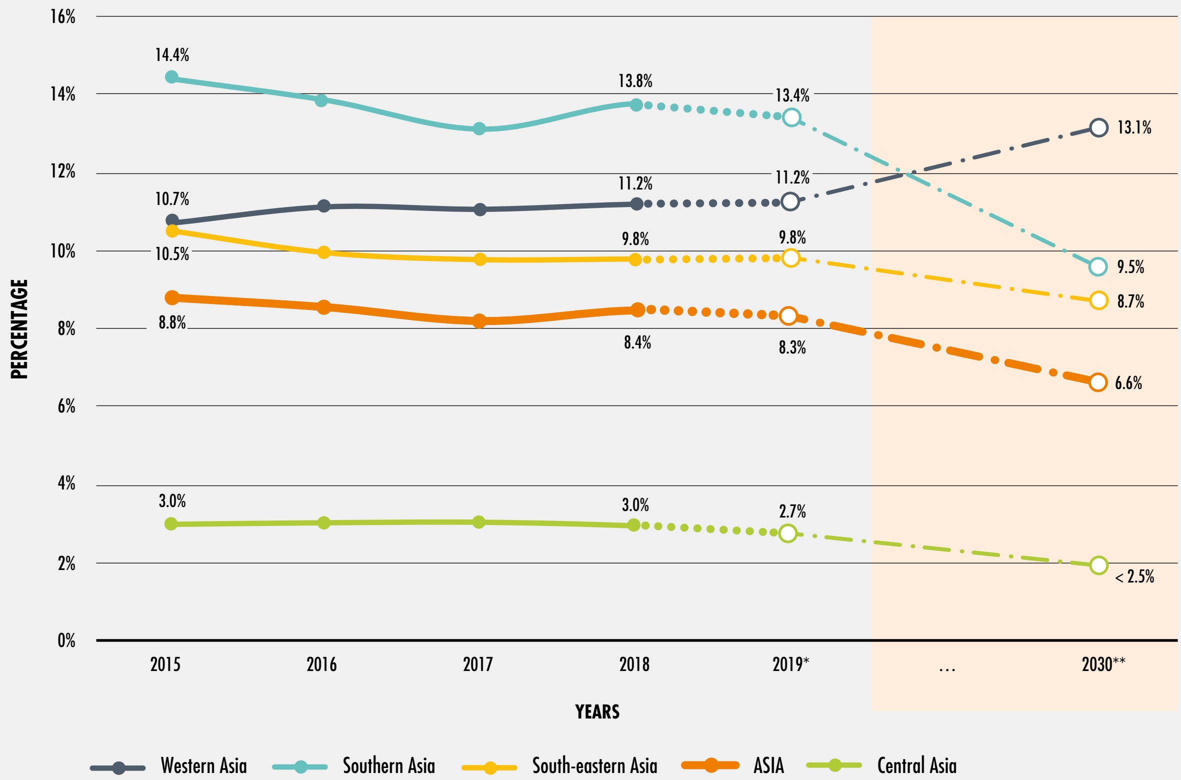
On track | Off track – some progress | Off track – no progress or worsening

NOTES: * Projected values. ** The projections up to 2030 do not reflect the potential impact of the COVID-19 pandemic. n.r. = not reported, as the prevalence is less than 2.5 percent. Regional totals may differ from the sum of subregions, due to rounding. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables inside the back cover. See Box 2, Annexes 1B and 2 for a description of how the projections are made.
SOURCE: FAO.

Despite very different conditions, histories and rates of progress, the reduction in hunger in both countries stems from long-term economic growth, reduced inequality, and improved access to basic goods and services. Average GDP growth rates were 8.6 percent and 4.5 percent in China and India, respectively, in the last 25 years.[1]
In Southern Asia, significant progress was also made in reducing hunger in the last ten years in countries like Nepal, Pakistan and Sri Lanka, owing largely to improved economic conditions.

Conflicts and instability are the primary drivers behind the rise in hunger seen in Western Asia. In particular, conflicts in Syrian Arab Republic and Yemen have increased undernourishment. In Yemen, the economic downturn following the conflict that began in 2015 has resulted in the destruction of social protection networks and basic services, contributing to critical conditions of food security and nutrition.
In Syrian Arab Republic, the civil war that started in 2011 has destroyed the economy, infrastructures, agricultural production, food systems and social institutions. All of this is exacerbated by a large presence of internally displaced populations, which is also affecting neighbouring countries.

FIGURE 3
PoU IN ASIA BY SUBREGION, WITH PROJECTIONS TO 2030. WESTERN ASIA HAS BEEN OFF TRACK IN THE RECENT PAST AND IS THE ONLY SUBREGION IN THE CONTINENT WHERE THE PREVALENCE OF UNDERNOURISHMENT IS PROJECTED TO INCREASE



NOTES: Eastern Asia is not reported as the PoU is consistently below 2.5 percent in the period shown. Projected values in the figure are illustrated by dotted lines and empty circles. The shaded area represents projections for the longer period from 2019 to the 2030 target year. * See Box 2 for a description of the projection method. ** Projections to 2030 do not consider the potential impact of the COVID-19 pandemic.
SOURCE: FAO.

The projections for Asia in 2030 (Tables 1, 2 and Figure 3) show that significant progress has been made in reducing undernourishment in all subregions, with the exception of Western Asia (see Box 2 for an explanation of how the projections are made), where undernourishment is increasing. Without considering the potential impact of the COVID-19 pandemic, Eastern and Central Asia are on track to meet SDG Target 2.1 by 2030. Southern and South-eastern Asia are making progress, but nevertheless are not on track to achieve the target by 2030. The current increasing trend in Western Asia is the opposite of what is needed to achieve the target by 2030.

In Latin America and the Caribbean, the PoU was 7.4 percent in 2019, below the world prevalence of 8.9 percent, which still translates into almost 48 million undernourished people. The region has seen a rise in hunger in the past few years, with the number of undernourished people increasing by 9 million between 2015 and »

BOX 2
REVISED SERIES OF PREVALENCE OF UNDERNOURISHMENT ESTIMATES AND PROJECTIONS UP TO 2030

The PoU series is always revised prior to the publication of each new edition of *The State of Food Security and Nutrition in the World*. This is done to take into account any new information that FAO has received since the release of the previous edition. As this process usually implies backward revisions of the entire series, **readers must avoid comparing PoU series across different editions of this report. They should always refer to the most current report, including for past values**. This is especially important this year, given the significant downward revision of the series of PoU estimates resulting from the updated PoU for China (see Box 1).

This edition extended the projections to 2030 to provide initial indications of whether the world was on track to achieve the SDG target of Zero Hunger in 2030. This was done in addition to the routine revisions due to the processing of new data and without anticipating the onset of COVID-19.

ROUTINE REVISIONS

One of the routine revisions involves the series of population data used for all countries. National population figures were obtained from the *World Population Prospects* released by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat in June 2019. It is worth noting that the new series of population estimates present different figures also for earlier years, as official statistical series are revised retrospectively each time new data become available and inconsistencies are corrected. Population figures, in terms of age and sex composition, have several implications for PoU estimates. They enter into the computation of per capita levels of Dietary Energy Supply (DES), estimates of the minimum dietary energy requirement (MDER), estimates of the coefficient of variation of food consumption that can be traced to differences in energy requirements (CV|r) and parameters that are used to calculate the number of undernourished people. The new data from the 2019 revision of the *World Population Prospects* reduced the levels of previously estimated MDER and CV|r, resulting in a reduction in PoU levels compared with assessments from previous years.

Another major revision that FAO regularly implements is the update of the Food Balance Sheet series used to estimate the average DES. Since May 2019, the Statistics Division of FAO has used improved methods for compiling Food Balance Sheets, leading to revised food supply series in all countries in the world. In December 2019, a new Food Balance Sheets domain was added to FAOSTAT with the series from 2014 to 2017. The series will be extended to 2018 for all countries by the end of 2020. Anticipating this release, the unpublished new Food Balance Sheets data for 50 countries in 2018 was used to update estimates of dietary energy consumption in the population, which informs the PoU estimates in 2018 presented in this report. The revision of the Food Balance Sheets has been substantial for a number of countries, pointing to even tighter food supplies in recent years than previously thought.

Finally, as new food consumption data from household surveys have been made available, revised estimates of the coefficient of variation (CV) of per capita levels of habitual, daily dietary energy consumption in the population were considered for a few countries and years. Since the last edition of this report, 25 new surveys from the following 13 countries have been processed to update the CV: Bangladesh, China, Colombia, Ecuador, Ethiopia, Mexico, Mongolia, Mozambique, Nigeria, Pakistan, Peru, Sudan and Thailand. When a new estimate of the CV from a survey is available for a country, the whole series is revised reconnecting the last available data point to the most recent one through linear interpolation. For most countries, however, the latest available survey dates back to 2014 or earlier.

When a reliable estimate of the prevalence of severe food insecurity based on the Food Insecurity Experience Scale (FI_{sev}) – see next section on SDG Indicator 2.1.2 – is available for countries, the component of the CV of food consumption, linked to the differences in income among households (CV|y), is further updated. The update is based on the trend in FI_{sev} from 2015 or the year of the last available food consumption survey, if the latter is more recent. The update is made to capture recent trends in food consumption inequality. In making the connection between FI_{sev} and CV, only the fraction of changes in the PoU values that could be attributed to changes in food consumption inequality were considered.

PROJECTIONS

In extending the projections of the PoU to assess the prospects for achieving the Zero Hunger target by 2030, an approach was followed based on projecting each of the three fundamental components of the PoU estimates separately for each country. The PoU and number of undernourished (NoU) values were then

BOX 2
(CONTINUED)

aggregated at the regional and global levels.

First, projected population size and composition (median variants), readily available from the *World Population Prospects*, were used. This allowed the projections of values of MDER and CV|r up to 2030.

Second, the current time series of total DES from 2005 to 2017/2018 were forecast to 2030 using a simple version of Exponential Smoothing, which treats weighted averages of past observations with the weights decaying exponentially as the observations get older. In other words, the more recent the observation, the higher the associated weight. The total DES was then divided by the projected population numbers to provide an indication of the evolution at per capita levels.

Finally, trends in the CV as estimated from 2015 or from the date of the last available survey were extended to 2030, following the same principle that guided the update of the CV up to 2019.

For further details, including on the methodology for projections to 2030, see the methodological note in Annexes 1B and 2.

» 2019, but with important differences among the subregions. The Caribbean, the subregion with the highest prevalence, showed some moderate progress in the recent past, while in Central and South America, the situation has worsened (Figure 4).

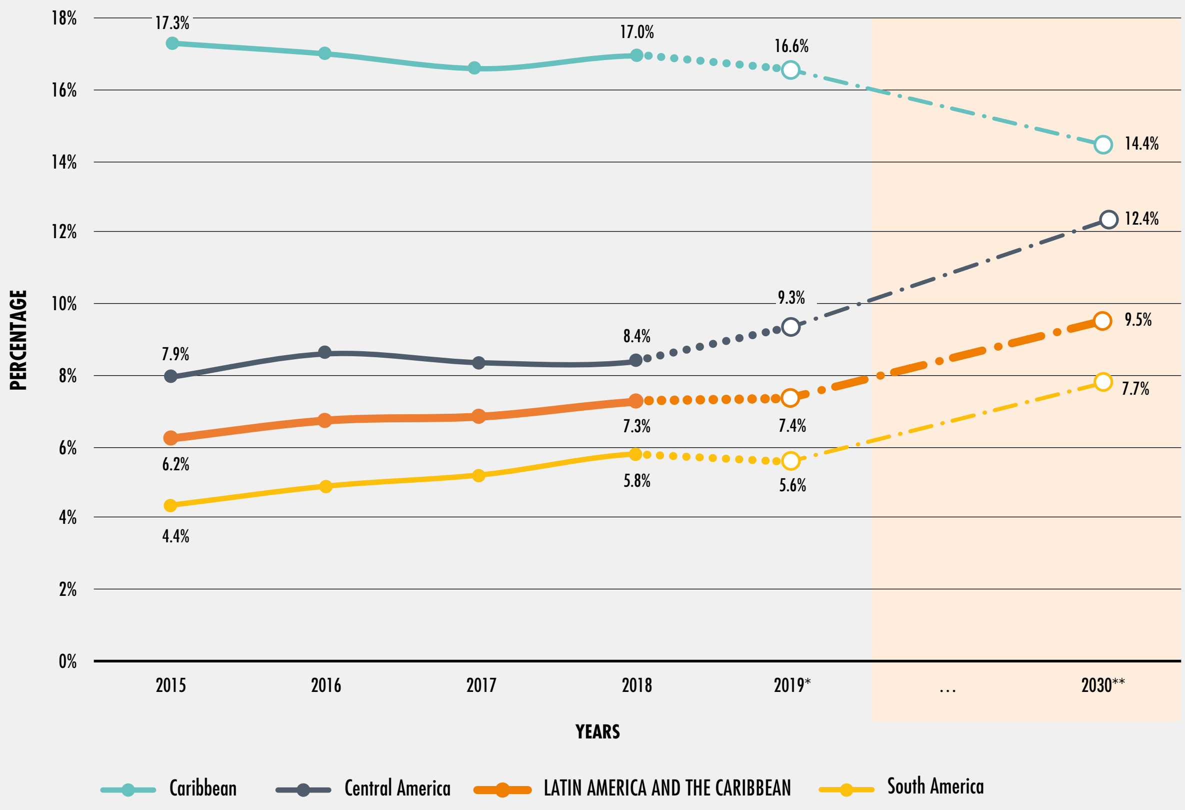
As in other regions, progress and setbacks in reducing hunger are a result of economic conditions, extreme climate events, political instability and conflicts.

In the Caribbean, the most severe conditions are found in Haiti, which has been battered by depletion of natural resources and extreme weather events like droughts, floods, heat waves and earthquakes. They have contributed to dire economic conditions, widespread poverty and high levels of undernourishment. Despite some improvements in the last decade, about half of the population is still estimated to be undernourished.

In South America, the increase in undernourishment observed in recent years is mainly driven by the situation in Venezuela (Bolivarian Republic of) where the PoU has increased from 2.5 percent in 2010–2012 to 31.4 percent in 2017–2019. The persisting political and economic crisis continues to fuel a decline in food security and nutrition levels and quality. Most of the food supply of the country is imported, and the devaluation of the Bolivar currency is making food imports increasingly expensive. As a consequence, these imports fell by 67 percent in 2016–2017, while hyperinflation curbed the purchasing power of households and their ability to access food and other basic goods. The severity of the situation in the country has driven up the number of refugees that flee to neighbouring countries, particularly Colombia and Ecuador.[9]

The Latin America and Caribbean region is not on track to achieve the SDG 2.1 Zero Hunger target by 2030 (Tables 1 and 2). The region is projected to have more than 19 million more hungry people in 2030 compared to 2019, even without considering the likely impact of the COVID-19 pandemic. A 3-percentage point increase in the PoU is projected for Central America. In South America, the PoU is projected to increase to 7.7 percent, equal to almost 36 million people, in 2030. The Caribbean subregion, while making progress, is not on track to achieve the target by 2030.

FIGURE 4
PoU IN LATIN AMERICA AND THE CARIBBEAN BY SUBREGION, WITH PROJECTIONS TO 2030. PROJECTIONS POINT TO CONVERGENCE BETWEEN CENTRAL AMERICA, WHERE UNDERNOURISHMENT IS PROJECTED TO INCREASE, AND THE CARIBBEAN, WHERE IT IS PROJECTED TO DECLINE

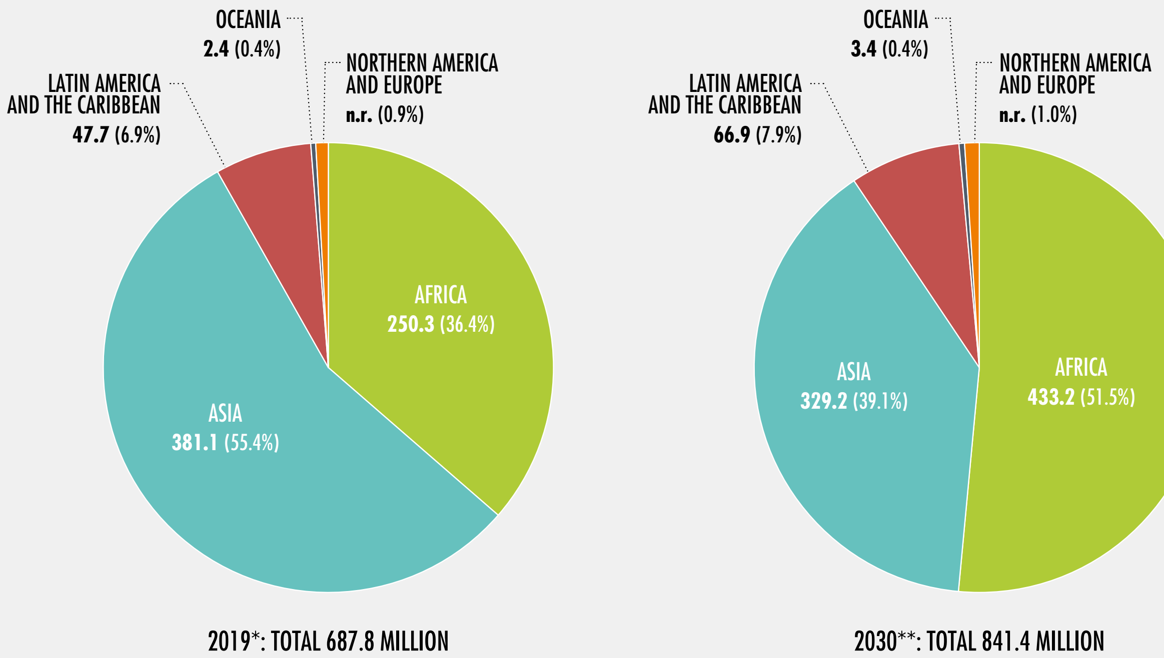


NOTES: Projected values in the figure are illustrated by dotted lines and empty circles. The shaded area represents projections for the longer period from 2019 to the 2030 target year. * See Box 2 for a description of the projection method. ** Projections to 2030 do not consider the potential impact of the COVID-19 pandemic.
SOURCE: FAO.

In summary, despite having achieved the most progress in reducing undernourishment, Asia is currently home to more than 55 percent of the undernourished people in the world. Africa has the highest PoU and the second highest number of undernourished people, accounting for 36.4 percent of the global total. A much smaller share is seen in Latin America and the Caribbean (almost 7 percent), and an even smaller share in Oceania and other regions (Figure 5, left chart).

Even without considering the effects of COVID-19, projected trends in undernourishment would change the geographic distribution of world hunger dramatically (Figure 5, right chart). While Asia would still be home to almost 330 million hungry people in 2030, its share of the world's hunger would shrink substantially, thanks to progress in highly populated countries of Eastern and Southern Asia. Africa would overtake Asia to become the region with the highest number of undernourished people,

FIGURE 5
IF RECENT TRENDS PERSIST, THE DISTRIBUTION OF HUNGER IN THE WORLD WILL CHANGE SUBSTANTIALLY, MAKING AFRICA THE REGION WITH THE HIGHEST NUMBER OF UNDERNOURISHED IN 2030



NOTES: Number of undernourished people in millions. * Projected values. ** Projections to 2030 do not consider the potential impact of the COVID-19 pandemic. n.r. = not reported, as the prevalence is less than 2.5 percent.
SOURCE: FAO.

accounting for 51.5 percent of the total. Similarly, but to a lesser degree, Latin America and the Caribbean would host a slightly larger share of people suffering from hunger in 2030 than today.

The World Bank projections on extreme poverty offer a similar pattern, with sub-Saharan Africa, and particularly the conflict-affected fragile economies of the region, becoming home to a large share of the world's poor people in 2030.[10]

The projections on undernourishment may be substantially altered by differential impacts of the COVID-19 pandemic across the regions. The full extent of the impact of the epidemic is still being assessed. More details, including a preliminary scenario analysis, are reported in Box 3.

SDG Indicator 2.1.2
Prevalence of moderate or severe food insecurity in the population, based on the FIES

Since being introduced by FAO in 2014, the Food Insecurity Experience Scale (FIES) has rapidly become a global reference for measuring food insecurity based on household and/or individual data. Many institutions responsible for food security assessments, including statistical offices and other governmental agencies, have adopted it as a standard tool for food security data collection in population surveys. As a result, many more national data sets are becoming »

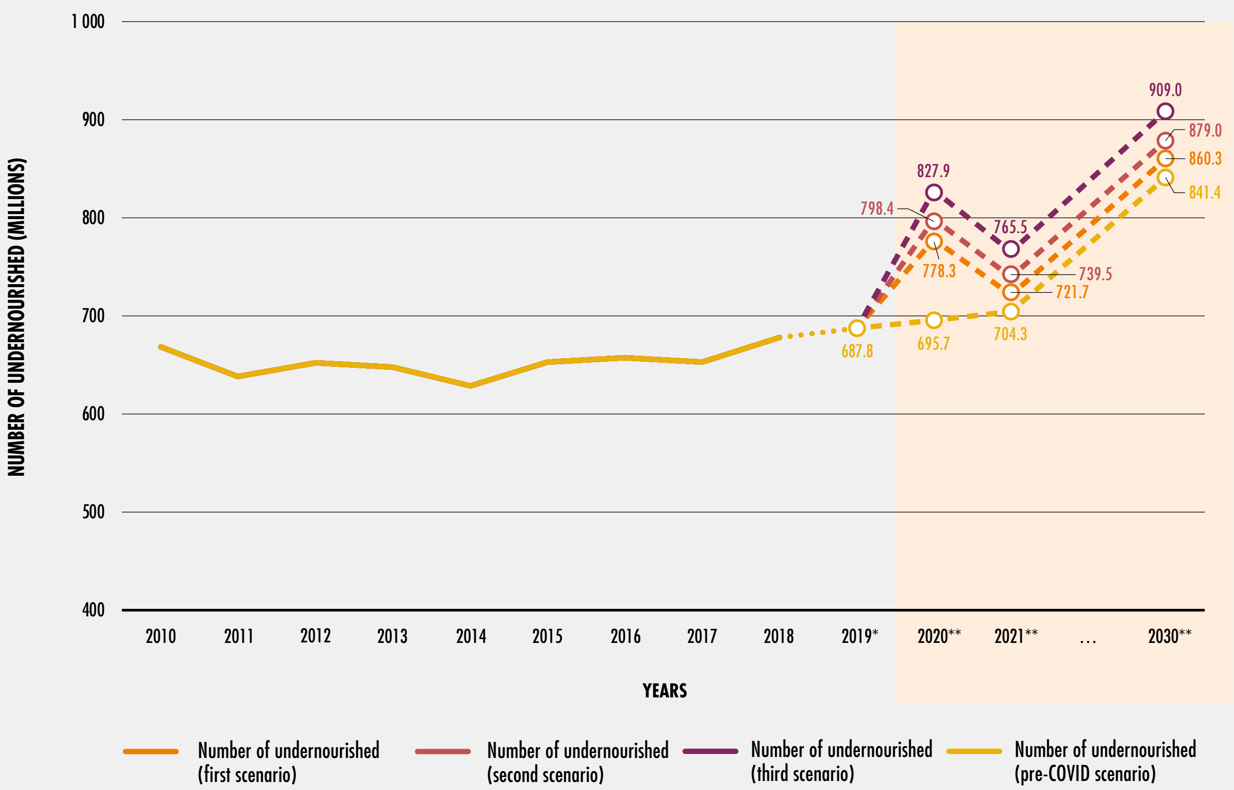
BOX 3
HOW THE COVID-19 PANDEMIC MAY AFFECT HUNGER IN THE WORLD

This report presents projections (Figure 1) of what the extent of hunger in the world may be in 2030, if trends of the last decade, observed until late last year, were to continue (see Box 2 and Annexes 1B and 2). At the time of going to press (June 2020), the COVID-19 pandemic was spreading across the globe, clearly posing a serious threat to food security. There is no doubt the pandemic will expose more people to food insecurity and accelerate the projected increase in the number of hungry people, unless immediate actions are taken. As the extent to which the COVID-19 pandemic will persist is not known, both in terms of scope and severity, the projections provided here must be seen as preliminary.

There are multiple ways in which the pandemic may affect food systems and food security.[14,15,16] It is clear that the COVID-19 pandemic is already delivering shocks to both the supply and the demand side of food systems throughout the world. On the supply side, COVID-19 itself may not necessarily create food shortages, as the production of the major food crops (wheat, rice, maize and soybean) is expected to remain above average in 2020.[17] But the pandemic has already created disruptions along the food supply chain. COVID-19 containment measures are already limiting labour mobility in areas dependent on seasonal or migrant labour and making it difficult to access markets and transport food both within and across countries. Further disruptions of logistics could disrupt the new planting seasons.

On the demand side, the massive lockdowns across the world are expected to hamper people's ability to access food and create serious economic downturns. This will make it difficult to afford food, particularly for the poor and vulnerable groups. Low- and middle-income countries will likely be the most affected, as they do not have the contingency mechanisms and funds to stimulate their economies and protect the most vulnerable. As a consequence, a pandemic-induced global economic crisis is likely to generate new pockets of food insecurity even in countries that did not require interventions previously.

HOW THE COVID-19 PANDEMIC MAY AFFECT HUNGER IN THE WORLD: THREE SCENARIOS



NOTES: The shaded area represents the projections for the longer period from 2019 to the 2030 target year.
SOURCE: FAO.

BOX 3 (CONTINUED)

Estimating COVID-19's effect on food security comes with a high degree of uncertainty due to lack of data and clarity about what the future of the world economy will look like. Potential scenarios may take different shapes, depending on the kind of policies that will be put in place and the time they will take to start showing their impact. At the time of writing, a so-called "U-shaped" recovery appeared to be more likely, which could mean a recession in 2020 followed by a recovery, whose length is uncertain, but starting in 2021. Such a recovery is conditional on second waves of infections not materializing or being easily contained.

Although it is still too early to quantify the full impact of the pandemic, this box presents the results of a quantitative analysis of the potential consequences in terms of the PoU, as driven by the global economic prospects. The analysis aims to show how the scenario described in Figure 1 might change once some of the potential effects of COVID-19 are factored in.

Because COVID-19 is triggering shocks on both the supply and the demand side of the global economy, the simplest way to gauge its potential effect on the PoU is through its impact on world economic growth. This is done by combining data from the International Monetary Fund's *World Economic Outlook* (WEO) released in April and updated in June 2020,[18] with a statistical analysis of the relationship between economic growth and food availability. It follows the methodology and country samples of an earlier exercise conducted by FAO using previously available data.[19,20]

Based on time series of total food supplies and GDP growth over 1995–2017 for most countries in the world, the statistical analysis shows that GDP growth reduction significantly affects the net food supply in net food-importing countries, and especially in low-income food-deficit countries (LIFDCs). On average, 1 percentage point of GDP growth reduction is estimated to reduce the food supply in net food-importing countries by 0.06 percent in net food-importing countries that are not low-income, and by 0.306 percent in LIFDCs.

The IMF's WEO forecasts a contraction of 4.9 percent in the world GDP in 2020, followed by a recovery of 5.4 percent in 2021. It provides country-specific estimates of GDP change in 2020 and 2021. The aforementioned elasticities estimated by FAO were applied using the GDP growth forecasts for 2020 and 2021 to all net food-importing countries (distinguishing between LIFDCs and non-LIFDCs) in order to estimate the likely shift in the series of total Dietary Energy Supply. This is used to compute the PoU, under three scenarios, illustrated by three different lines in the figure presented below. The three simulated scenarios contrast with the projections presented in Figure 1, a world without COVID-19.

The first scenario builds on the WEO, which forecasts world economic growth to be -4.9 percent in 2020 and +5.4 percent in 2021, which closely approximates an earlier forecast by IFPRI.[21] It is illustrated by the orange line in the figure. Such negative economic performance in 2020 would imply an increase of about 83 million undernourished in 2020 (from 695.7 to 778.3) attributable to the COVID-19 pandemic.

The second, less optimistic scenario (red line) foresees 2.1 percentage points lower GDP growth both in 2020 and 2021 compared with the base one (that is to say, world economic growth would be on average -7 percent and +3.3 percent in 2020 and 2021, respectively). In such case, the increase in the number of undernourished in 2020 would be of 103 million.

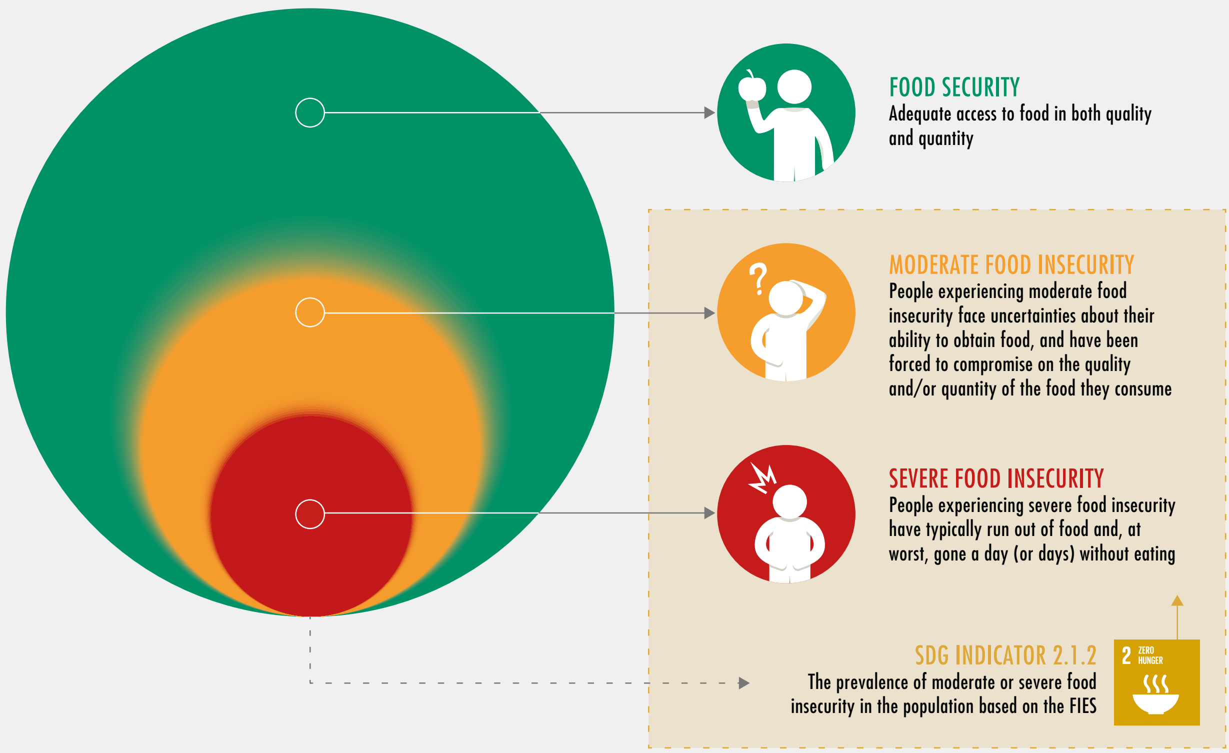
The third, more pessimistic scenario (dark red line) implies a reduction of 5.1 percentage points in the GDP growth rates compared to the first scenario, thus assuming a world economic growth of -10 percent and +0.3 percent, in 2020 and 2021 respectively. This scenario would bring the number of undernourished up to almost 828 million in 2020, out of which more than 132 million might be attributable to the impact of COVID-19. The expected recovery in 2021 would bring the number of undernourished down to 766 million, which is 62 million more than the already worrisome projection in the absence of the pandemic (indicated by the yellow line).

In all cases, the world economy would not fully recover in 2021.

The analysis is limited to the potential impact of the pandemic on net food supplies only, as the pre-COVID-19 projections for the population size and compositions and for the food consumption inequality are not altered. As a result, the analysis does not capture the full impact of the economic recession, as it does not consider possible consequences in terms of inequality in food access within countries. Therefore, it may underestimate the total potential impact of COVID-19 on food insecurity should the simulated economic growth scenarios materialize. It is also important to highlight that, as presented in the IMF's WEO, the analysis assumes that the recovery will happen in two years. Considering the high degree of uncertainty around the duration of the recovery, this represents an important limitation of this assessment.

While it cannot be considered a precise, detailed analysis, it demonstrates that, if no action is taken to prevent foreseeable disruptions in the world food systems, especially in food-deficit countries, COVID-19 will further complicate the already daunting challenge of reaching the SDG target of Zero Hunger.

FIGURE 6
EXPLANATION OF FOOD-INSECURITY SEVERITY LEVELS MEASURED BY THE FIES IN SDG INDICATOR 2.1.2



SOURCE: FAO.

» available to complement FAO data collected through the annual Gallup© World Poll (GWP) to generate estimates of the prevalence of moderate or severe food insecurity (SDG Indicator 2.1.2).

In making the global assessment, preference is given to suitable and reliable FIES data available from large national surveys, whereas FAO data collected in the GWP are used to compile the estimates for countries for which there is no other data and/or to fill gaps in terms of time series. This year, FIES or equivalent food security experience scales data collected by national institutions were used for 30 countries, covering approximately 20 percent of the world population (see **Annex 1B**). As national data are often available only for one or two years over the monitored period, FAO data are used as a complementary source of information to infer trends and complete the series of annual estimates. In all cases, results are made comparable across all countries and regions regardless of whether the main source is FAO data or official national data, by calibrating the estimated country scales against the standard FIES global reference scale.[22]

Compared to SDG Indicator 2.1.1, this indicator focuses specific attention on moderate food insecurity (Figure 6). As noted in the 2019 edition of this report, people who are moderately food insecure do not have regular access to nutritious and sufficient food, even if not necessarily suffering from hunger. This level of food insecurity can have negative effects on diet quality (see Section 1.3) and increase the risk of various forms of malnutrition and poor health. This is a crucial aspect today, when people in many parts of the world are beginning to face the consequences of the COVID-19 pandemic. While FIES data have yet to be collected in the context of the pandemic, it is expected that some people who were previously food secure may face new difficulties in accessing food due to disruptions in food distribution systems, restrictions on movement and loss of income.

SDG Indicator 2.1.2 reports on the extent of food insecurity at any level (moderate or severe) so that any reduction can be unambiguously interpreted as an improvement. As in previous editions of the report, it is nevertheless useful

TABLE 3
PREVALENCE OF FOOD INSECURITY AT SEVERE LEVEL ONLY, AND MODERATE OR SEVERE LEVEL, MEASURED WITH THE FOOD INSECURITY EXPERIENCE SCALE, 2014–2019

	Prevalence of severe food insecurity						Prevalence of moderate or severe food insecurity					
	2014	2015	2016	2017	2018	2019	2014	2015	2016	2017	2018	2019
WORLD	**8.3**	**7.9**	**8.1**	**8.6**	**9.4**	**9.7**	**22.4**	**22.4**	**23.2**	**24.8**	**25.8**	**25.9**
AFRICA	**16.7**	**16.8**	**18.2**	**18.5**	**18.3**	**19.0**	**46.3**	**46.5**	**49.4**	**51.4**	**50.6**	**51.6**
Northern Africa	10.2	9.0	10.4	11.0	9.3	8.7	29.7	26.4	30.0	36.8	31.1	28.6
Sub-Saharan Africa	18.2	18.6	20.0	20.2	20.3	21.3	50.3	51.2	53.9	54.8	55.1	56.8
Eastern Africa	23.5	23.8	25.2	24.5	23.9	24.7	58.0	57.9	61.7	61.1	60.2	61.4
Middle Africa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Southern Africa	19.4	19.5	19.7	19.9	19.7	19.8	44.1	44.4	44.6	44.8	44.8	44.7
Western Africa	11.7	12.5	13.8	14.9	15.8	17.2	42.1	44.3	46.4	48.6	50.5	53.2
ASIA	**8.0**	**7.5**	**7.1**	**7.6**	**9.1**	**9.2**	**19.4**	**18.9**	**18.9**	**20.6**	**22.6**	**22.3**
Central Asia	1.6	1.4	2.0	2.8	2.2	2.3	8.5	9.1	10.0	13.9	13.6	13.2
Eastern Asia	0.8	0.8	1.5	1.7	1.9	1.3	6.0	5.9	6.3	10.0	9.6	7.4
South-eastern Asia	4.4	3.8	4.0	5.6	5.4	4.8	16.9	15.3	17.0	19.6	19.6	18.6
Southern Asia	15.9	14.8	13.1	13.3	16.9	17.8	31.6	30.8	30.1	29.4	34.6	36.1
Western Asia	8.3	8.7	8.8	9.8	9.4	9.0	28.0	28.0	26.9	28.9	28.1	28.5
Western Asia and Northern Africa	*9.2*	*8.9*	*9.6*	*10.4*	*9.3*	*8.8*	*28.8*	*27.3*	*28.4*	*32.6*	*29.5*	*28.5*
LATIN AMERICA AND THE CARIBBEAN	**7.1**	**6.4**	**8.1**	**9.3**	**9.2**	**9.6**	**22.9**	**25.1**	**29.4**	**32.0**	**31.6**	**31.7**
Caribbean	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Latin America	6.9	6.2	7.9	9.2	9.1	9.5	22.6	24.9	29.4	32.0	31.6	31.7
Central America	10.4	10.2	10.0	11.8	13.6	14.1	31.8	32.0	31.4	34.7	38.3	39.3
South America	5.5	4.6	7.1	8.1	7.2	7.6	18.8	22.0	28.6	30.9	28.8	28.5
OCEANIA	**2.5**	**2.6**	**3.3**	**4.1**	**3.7**	**4.2**	**11.1**	**9.5**	**11.5**	**14.2**	**12.9**	**13.9**
NORTHERN AMERICA AND EUROPE	**1.4**	**1.4**	**1.3**	**1.2**	**1.0**	**1.1**	**9.4**	**9.4**	**8.8**	**8.5**	**7.6**	**7.9**

NOTES: n.a. = not available, as data are available only for countries, representing less than 50 percent of the population in the region/subregion. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables inside the back cover.
SOURCE: FAO.

to also explore the situation in terms of the prevalence of severe food insecurity only, given its expected relationship to the PoU.

Severe food insecurity

Our latest estimates suggest that 9.7 percent of the world population (slightly less than 750 million people) was exposed to **severe** levels of food insecurity in 2019 (Tables 3 and 4).

Although obtained using different data and methods, the prevalence of severe food insecurity (FI_{sev}) is conceptually comparable to the PoU. This is because people experiencing severe food insecurity, as measured by the FIES, are unlikely to be able to acquire enough food to continuously fulfil their dietary energy requirements.

Unsurprisingly, the prevalence of severe food insecurity in Africa (19 percent) is very

TABLE 4
NUMBER OF PEOPLE EXPERIENCING FOOD INSECURITY AT SEVERE LEVEL ONLY, AND MODERATE OR SEVERE LEVEL, MEASURED WITH THE FOOD INSECURITY EXPERIENCE SCALE, 2014–2019

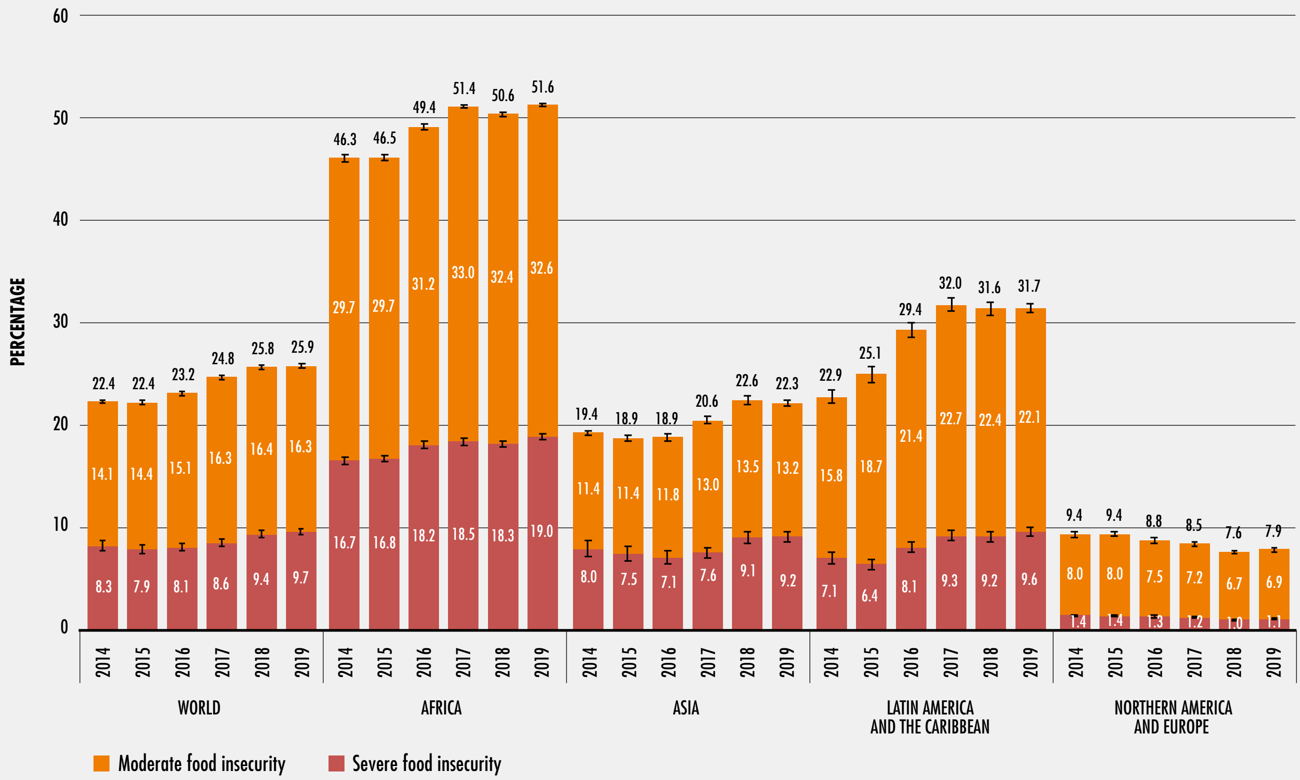
	Number of severely food insecure people (millions)						Number of moderately or severely food insecure people (millions)					
	2014	2015	2016	2017	2018	2019	2014	2015	2016	2017	2018	2019
WORLD	**602.0**	**586.0**	**605.5**	**646.4**	**717.5**	**746.0**	**1 633.5**	**1 649.5**	**1 735.2**	**1 874.5**	**1 969.6**	**2 001.1**
AFRICA	**192.0**	**198.7**	**220.5**	**230.0**	**233.1**	**248.5**	**534.1**	**549.5**	**599.6**	**640.0**	**646.2**	**674.5**
Northern Africa	22.4	20.2	23.7	25.6	22.0	21.0	65.1	59.1	68.6	85.6	73.7	69.1
Sub-Saharan Africa	169.5	178.5	196.8	204.3	211.1	227.5	469.0	490.4	531.0	554.4	572.5	605.4
Eastern Africa	89.3	92.6	101.1	100.9	101.0	107.2	219.9	225.8	247.0	251.4	254.2	266.4
Middle Africa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Southern Africa	12.0	12.3	12.6	12.9	12.9	13.2	27.4	28.0	28.5	29.1	29.4	29.8
Western Africa	39.9	43.9	49.9	55.1	60.2	67.4	144.0	155.7	167.6	180.2	192.6	208.1
ASIA	**349.8**	**330.8**	**318.2**	**342.2**	**413.0**	**421.6**	**850.9**	**836.3**	**848.2**	**931.5**	**1 030.5**	**1 027.4**
Central Asia	1.1	1.0	1.4	2.0	1.6	1.6	5.7	6.3	7.0	9.9	9.8	9.6
Eastern Asia	13.2	12.6	24.6	28.4	31.3	21.7	98.0	97.1	104.1	166.2	159.5	124.5
South-eastern Asia	27.4	24.0	25.8	36.5	35.1	31.8	105.7	97.0	108.8	127.0	128.4	122.8
Southern Asia	287.2	270.7	243.3	249.1	319.5	341.8	570.6	563.8	557.7	551.3	656.5	691.9
Western Asia	21.0	22.5	23.2	26.3	25.5	24.8	70.9	72.2	70.6	77.2	76.2	78.5
Western Asia and Northern Africa	*43.5*	*42.7*	*46.9*	*51.9*	*47.4*	*45.7*	*136.0*	*131.3*	*139.2*	*162.7*	*149.9*	*147.6*
LATIN AMERICA AND THE CARIBBEAN	**43.8**	**40.2**	**51.0**	**59.0**	**59.0**	**62.4**	**141.5**	**156.8**	**185.6**	**203.3**	**202.6**	**205.3**
Caribbean	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Latin America	39.8	36.3	46.7	54.5	54.4	57.7	129.9	144.6	172.6	189.8	189.2	191.7
Central America	17.3	17.3	17.1	20.4	23.8	25.0	53.0	54.0	53.7	60.1	67.2	69.7
South America	22.5	19.0	29.5	34.1	30.6	32.6	76.9	90.6	118.9	129.7	122.0	122.0
OCEANIA	**1.0**	**1.0**	**1.3**	**1.7**	**1.6**	**1.8**	**4.4**	**3.8**	**4.7**	**5.8**	**5.4**	**5.9**
NORTHERN AMERICA AND EUROPE	**15.4**	**15.2**	**14.4**	**13.5**	**10.8**	**11.8**	**102.6**	**103.1**	**97.2**	**93.7**	**84.9**	**88.1**

NOTES: n.a. = not available, as data are available only for a limited number of countries, representing less than 50 percent of the population in the region. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables inside the back cover.
SOURCE: FAO.

close to the PoU in the region (19.1 percent, see Table 1), and is the highest among all world regions. In Asia, the prevalence of severe food insecurity (9.2 percent) is lower than in Latin America and the Caribbean (9.6 percent), but not as low as in Northern America and Europe (1.1 percent) (Table 3).

In all regions of the world except Northern America and Europe, the prevalence of **severe food insecurity** has increased from 2014 to 2019 (Figure 7, darker bars). This is also broadly consistent with recent trends in the PoU in the world and across regions, as noted in the previous section of this report. The only partial exception is Asia, where – contrary to what we noted based on our pre-COVID-19 PoU estimates – severe food insecurity appears to be slightly on the rise in 2018 and 2019 compared to previous years.

FIGURE 7
MODERATE OR SEVERE FOOD INSECURITY AFFECTS ONE QUARTER OF THE WORLD POPULATION, AND IT HAS BEEN INCREASING OVER THE PAST SIX YEARS. OVER HALF OF THE POPULATION IN AFRICA, ALMOST ONE-THIRD IN LATIN AMERICA AND THE CARIBBEAN AND MORE THAN ONE-FIFTH IN ASIA ARE FOOD INSECURE



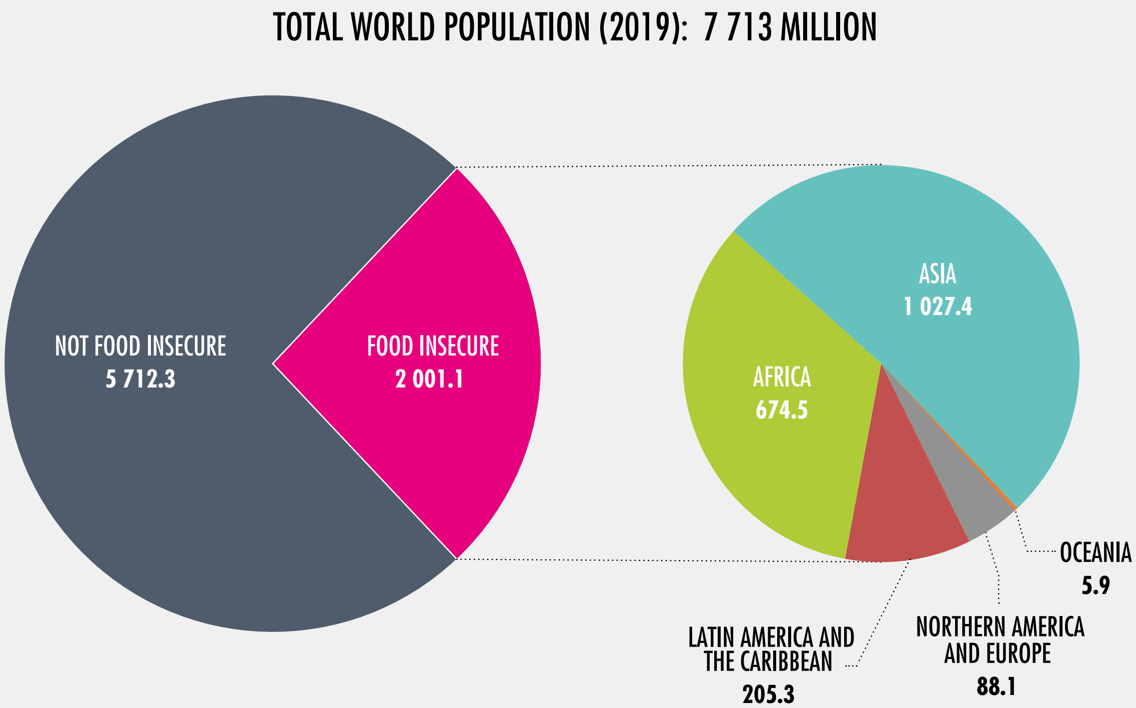
NOTES: Differences in total are due to rounding of figures to the nearest decimal point.
SOURCE: FAO.

The divergence can be explained by the different timeliness of the data used for the analyses. While FIES data are available almost in real-time, food consumption data are not collected in household surveys on a yearly basis. As PoU estimates rely on data that refers to a few, and sometimes several years back, they may fail to reflect phenomena that affect the actual extent of inequality in food consumption. When recent food consumption data are available, the two series tend to converge more closely.

Moderate or severe food insecurity

While the 746 million people facing severe food insecurity are of utmost concern, an additional 16.3 percent of the world population, or more than 1.25 billion people, have experienced food insecurity at moderate levels. The prevalence of both moderate and severe levels of food insecurity (SDG Indicator 2.1.2) is estimated to be 25.9 percent in 2019 for the world as a whole. This translates into a total of 2 billion people (Tables 3 and 4). Total food insecurity (moderate

FIGURE 8
OVER HALF OF THE PEOPLE AFFECTED BY MODERATE OR SEVERE FOOD INSECURITY IN THE WORLD LIVE IN ASIA AND MORE THAN ONE-THIRD LIVE IN AFRICA



NOTES: Number of food insecure/not food insecure people in millions.
SOURCE: FAO.

or severe) has consistently increased at the global level since 2014 (Figure 7), mostly because of the increase in moderate food insecurity.

Figure 7 shows also that the prevalence of food insecurity (moderate or severe) is still on an upward trend in **Africa**. This is explained by the increase in the sub-Saharan region. Although Africa is where the highest levels of total food insecurity are observed, it is in **Latin America and the Caribbean** where food insecurity is rising the fastest: from 22.9 percent in 2014 to 31.7 percent in 2019, due to a sharp increase in South America (Table 3). In Asia, the percentage of people exposed to moderate or severe food insecurity remained stable from 2014 to 2016, then started increasing from 2017 on. The increase is concentrated in Southern Asia where the total prevalence of food insecurity increased from less than 30 percent in 2017 to more than 36 percent in 2019.

The global crisis induced by the COVID-19 pandemic will certainly bring these figures to much higher levels, even in regions of the world like Northern America and Europe, which have traditionally been more food secure.

Figure 8 shows that today, out of the 2 billion people suffering from food insecurity, 1.03 billion are in Asia, 675 million in Africa, 205 million in Latin America and the Caribbean, 88 million in Northern America and Europe and 5.9 million in Oceania.

Gender differences in food insecurity

The FIES data collected annually by FAO in more than 140 countries at the individual (rather than household) level from 2014 to 2019 provide a unique opportunity to analyse the differences in the prevalence of food insecurity among men and women.

Figure 9 shows the prevalence of food insecurity at different levels of severity among men and women worldwide and in all regions, highlighting the evolution from 2014 to 2019. At the global level, the prevalence of moderate or severe food insecurity is higher among women than men, with significant differences found in almost all years for Africa and Latin America. For Northern America and Europe, the difference is small but statistically significant for most years. For severe food insecurity, the prevalence is also higher among women than men. The differences are statistically significant at the global level in 2019, and for Latin America in all years. At the global level, and more markedly in Africa and Latin America, the gender gap in accessing food increased from 2018 to 2019, particularly at the moderate or severe level of severity.

An in-depth analysis conducted by pooling all FIES data collected by FAO from 2014 to 2018 provides more details about the socio-economic characteristics of individuals who lack access to adequate food.[23] In addition to finding that food insecurity is more prevalent among women, regardless of the level of severity, people with higher risk of food insecurity were those in the lowest income quintile, with lower education, unemployed, with health problems, living in rural areas, belonging to the age group between 25 and 49 years old, and separated or divorced (see **Annex 2** for a description of the methodology).

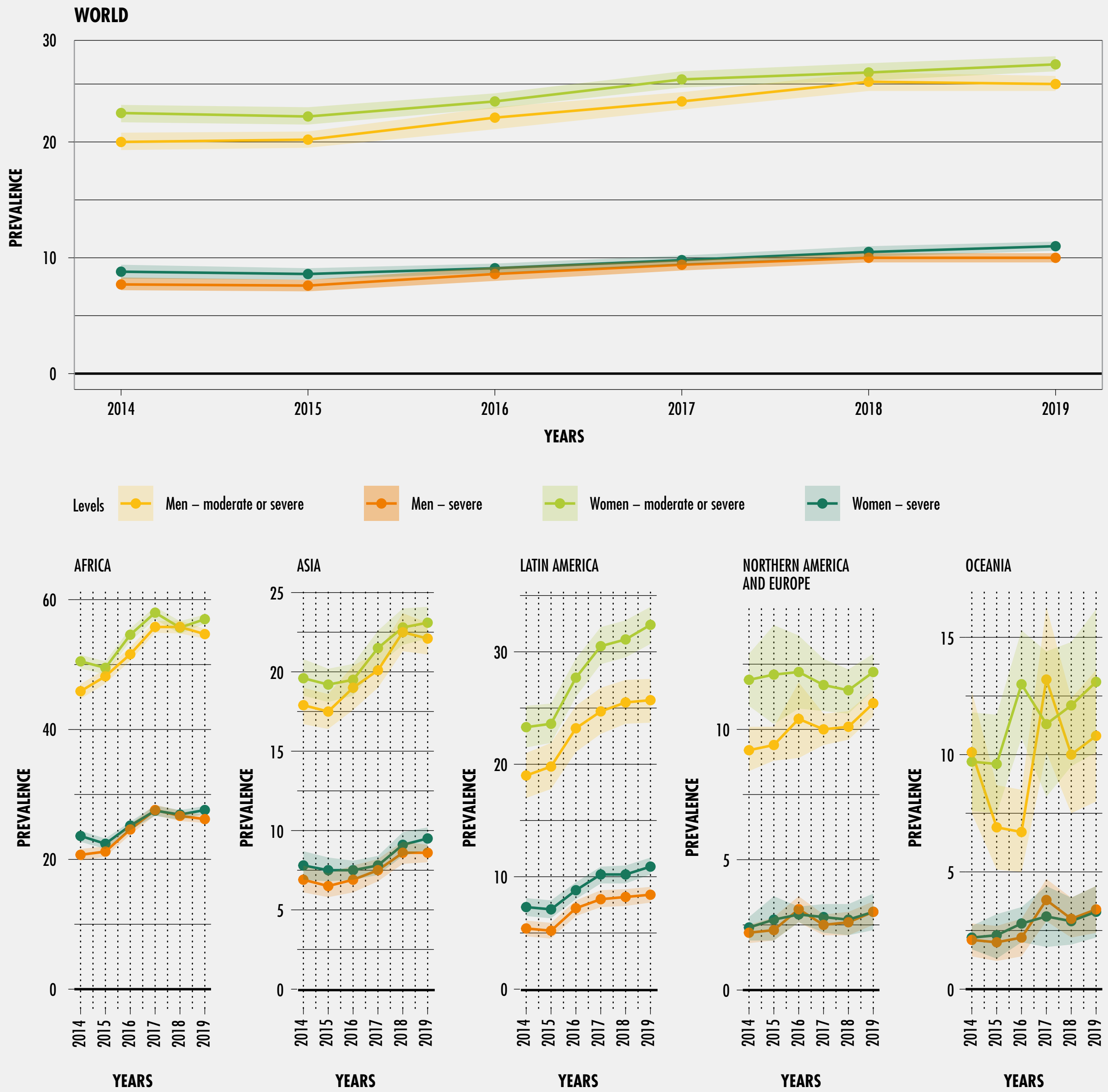
After controlling for socio-economic characteristics, women still had about a 13 percent higher chance of experiencing moderate or severe food insecurity than men, and close to 27 percent higher chance of being severely food insecure at the global level.

Globally, the gender gap in food insecurity at both moderate or severe and severe levels only decreased slightly from 2014 to 2018. The gender gap in food insecurity is larger among the poorer and less-educated strata of the population, and for individuals who are out of the workforce, with health problems and who live in suburbs of large cities compared with those who live in rural areas.

These findings point to the need for a deeper understanding of the forms of discrimination that make access to food more difficult for women, even when they have the same income and education levels and live in similar areas as men.

In summary, the continued gradual increase in the number of hungry and food insecure people in most regions of the world is alarming. It may only worsen in the face of the COVID-19 pandemic, emphasizing the need to redouble efforts to achieve the SDG targets in the ten years remaining until 2030. The food insecurity trends described in this section can have nutritional consequences, potentially leading to different manifestations of malnutrition. The next section presents the latest figures on progress towards ending all forms of malnutrition, with projections for 2030. The section includes a special focus on childhood stunting. ■

FIGURE 9
GLOBALLY AND IN EVERY REGION, THE PREVALENCE OF FOOD INSECURITY IS SLIGHTLY HIGHER IN WOMEN THAN IN MEN



NOTES: The shaded area represents the margins of error around the estimates. Latin America is presented rather than Latin America and the Caribbean due to lack of data for the Caribbean.
SOURCE: FAO.

1.2 PROGRESS TOWARDS GLOBAL NUTRITION TARGETS

KEY MESSAGES

➔ SDG 2 emphasizes not only the need to ensure access to safe, nutritious and sufficient food for all people, but also to eradicate all forms of malnutrition. Globally, the burden of malnutrition in all its forms remains a challenge. According to estimates, in 2019, 21.3 percent (144 million) of children under 5 years of age were stunted, 6.9 percent (47 million) wasted and 5.6 percent (38.3 million) overweight.

➔ The world is making progress but is not on track to achieve the 2025 and 2030 targets for child stunting and low birthweight, and for exclusive breastfeeding, is on track only for the 2025 target. Childhood overweight is not improving and adult obesity is increasing. The prevalence of wasting is notably above the 2025 and 2030 targets. Efforts must be intensified if the global targets are to be attained.

➔ Central Asia, Eastern Asia and the Caribbean have the largest rates of reduction in the prevalence of stunting and are the only subregions on track to achieve the 2025 and 2030 stunting targets.

➔ The prevalence of stunting is higher in rural populations than in urban ones. Lower household wealth is associated with higher levels of stunting.

➔ Most regions are not on track to achieve the targets for child overweight. Adult obesity is on the rise in all regions. The nutritional status of the most vulnerable population groups is likely to deteriorate further due to the health and socio-economic impacts of COVID-19. This will potentially have an effect on the projections presented in this report.

This section presents the latest assessment of the progress towards the global nutrition targets, specifically Target 2.2 of the SDGs and those endorsed by the World Health Assembly (WHA) in 2012 to be achieved by 2025.[24] To align with the 2030 SDG agenda, the WHA targets were extended to 2030 (see Table 5).[25] In addition, the WHA adopted a Global Monitoring Framework for the Prevention and Control of non-communicable diseases (NCDs) in 2013. This framework includes a target to halt the rise in adult obesity, a nutritional risk factor for NCDs, by 2025.[26]

In April 2016, the United Nations Decade of Action on Nutrition (2016–2025)[27] was proclaimed to provide all stakeholders with a unique opportunity to strengthen joint efforts to end all forms of malnutrition by 2025.

TABLE 5
THE GLOBAL NUTRITION TARGETS ENDORSED BY THE WORLD HEALTH ASSEMBLY AND THEIR EXTENSION TO 2030

	2025 Target	2030 Target
Stunting	40% reduction in the number of children under 5 who are stunted.	50% reduction in the number of children under 5 who are stunted.
Anaemia	50% reduction in anaemia in women of reproductive age.	50% reduction in anaemia in women of reproductive age.
Low birthweight	30% reduction in low birthweight.	30% reduction in low birthweight.
Childhood overweight	No increase in childhood overweight.	Reduce and maintain childhood overweight to less than 3%.
Breastfeeding	Increase the rate of exclusive breastfeeding in the first six months up to at least 50%.	Increase the rate of exclusive breastfeeding in the first six months up to at least 70%.
Wasting	Reduce and maintain childhood wasting to less than 5%.	Reduce and maintain childhood wasting to less than 3%.

NOTES: Targets were set considering the baseline year 2012.
SOURCE: WHO & UNICEF. 2017. *The extension of the 2025 Maternal, Infant and Young Child nutrition targets to 2030*. Discussion paper. Geneva, Switzerland and New York, USA. (also available at www.who.int/nutrition/global-target-2025/discussion-paper-extension-targets-2030.pdf).

The assessment examines progress made since the baseline (2012) and projected trajectories towards 2025 and 2030 targets (more details are presented in **Annex 2**), looking at subregional, regional and global levels. It is based on data available prior to the COVID-19 pandemic, which is likely to affect progress in the coming months, if not years. This edition includes a spotlight on stunting, highlighting other key factors related to the promotion of optimal growth.

Global trends

This year's report includes updated estimates for four of the seven global nutrition indicators: child stunting, wasting, overweight and exclusive breastfeeding. Globally, progress is being made towards stunting and exclusive breastfeeding targets, but the pace must be increased to achieve them by 2025 and 2030. Currently the prevalence of child wasting is above the 5 percent target for 2025, putting the lives of tens of millions of children at risk in the immediate term. The increasing trend in childhood overweight is of great concern and must be urgently addressed.

Anaemia in women of reproductive age (15–49 years) remains the most challenging nutrition target to monitor. There are various research initiatives to improve the evidence base for the indicator used to assess this target. In 2016, 32.8 percent (or 613 million) of women of reproductive age (15–49 years) globally were affected by anaemia, practically unchanged since 2012.[28] An update of the global estimates for anaemia is expected in 2021. Hence, progress for this target is not assessed in this report.

Figure 10 summarizes progress made towards the nutrition targets at the global level. Worldwide, 21.3 percent of children under 5 years of age were stunted in 2019, or 144 million.[29] Although there has been some progress, rates of stunting reduction are far below what is needed, at 2.3 percent per year in recent years (defined as the period from 2008 to 2019). A rate of 3.9 percent per year is required to reach the targets of 40 percent reduction for 2025 and 50 percent reduction for 2030, starting from the baseline year (2012).[30] If recent trends continue, these targets will only be achieved in 2035 and 2043, respectively.

The global prevalence of overweight among children under 5 years of age has not improved, increasing slightly from 5.3 percent in 2012 to 5.6 percent, or 38.3 million children, in 2019.[29] Urgent efforts are needed to reverse this trend in order to halt the rise in childhood overweight by 2025 and achieve the target of no more than 3 percent by 2030.

Wasting is an acute condition that can change frequently and rapidly over the course of a calendar year. This makes it difficult to generate reliable trends over time with the input data available. As such, only the most recent global and regional estimates are reported. Globally, 6.9 percent of children under 5 (47 million) were affected by wasting in 2019[29] – significantly above both the 2025 target (5 percent) and the 2030 target (3 percent).

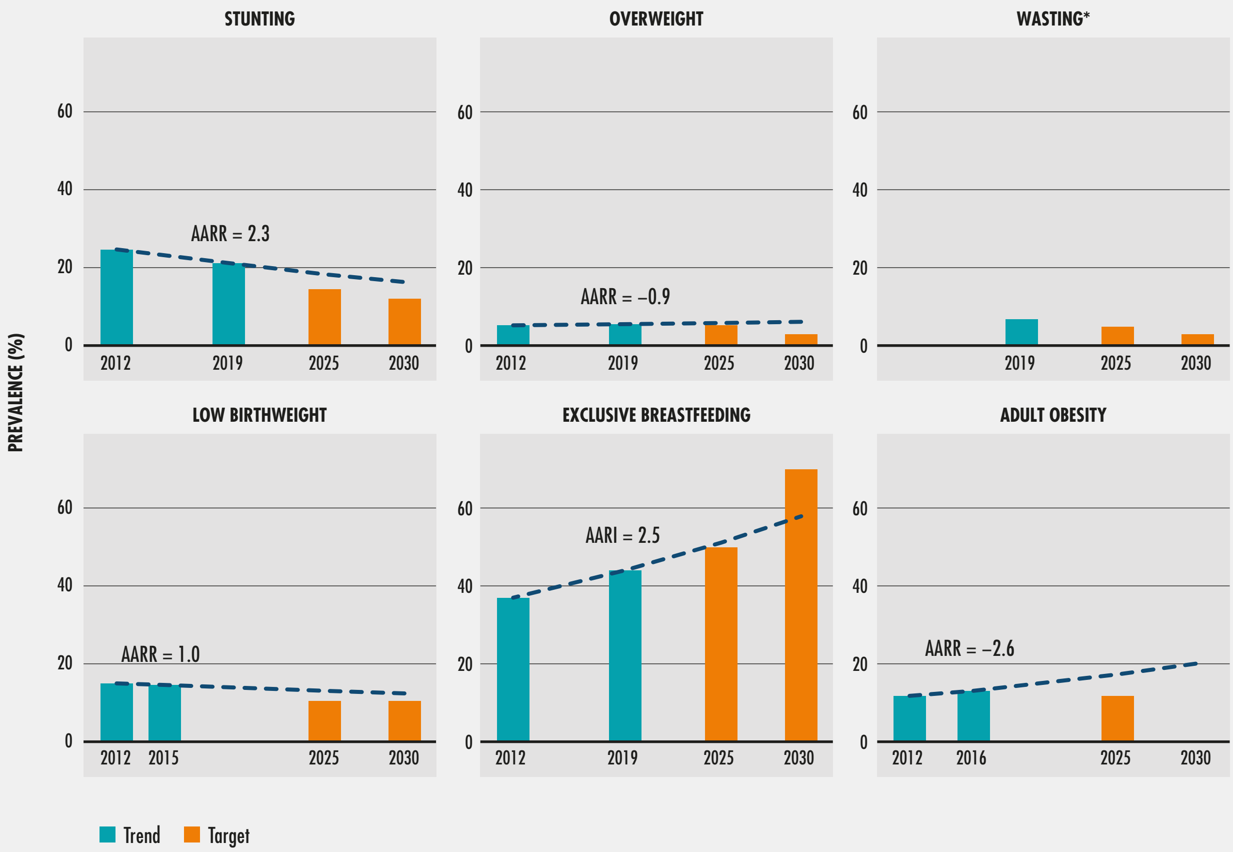
Worldwide, 14.6 percent of infants were born with low birthweight (less than 2 500 g) in 2015.[31] The Average Annual Rate of Reduction (AARR) for this indicator of 1 percent per year shows that some progress has been made in recent years, but not enough to achieve the target of a 30 percent reduction in low birthweight by 2025 (the 2030 target is the same). If progress continues at the current rate, the target will be achieved only in 2046.

As of 2019, it was estimated that 44 percent of infants aged less than six months globally were exclusively breastfed.[32] The world is currently on track to achieve the 2025 target of at least 50 percent for this indicator. If additional efforts are not made, however, the global target for 2030 of at least 70 percent will not be achieved before 2038.

Adult obesity continues to rise, from 11.8 percent in 2012 to 13.1 percent in 2016[33] and is not on track to reach the global target to halt the rise in adult obesity by 2025. If the prevalence continues to increase by 2.6 percent per year, adult obesity will increase by 40 percent by 2025, compared to the 2012 level.

The projections for 2025 and 2030 described in this section do not take into consideration the likely impact of COVID-19 on the different

FIGURE 10
DESPITE SOME PROGRESS FOR MOST INDICATORS, ONLY THE 2025 TARGET FOR EXCLUSIVE BREASTFEEDING IS ON TRACK TO BE ACHIEVED. CHILDHOOD OVERWEIGHT AND ADULT OBESITY TRENDS NEED TO BE REVERSED



NOTES: * No projection over time is generated for wasting, as it is an acute condition that can change frequently and rapidly over the course of a calendar year, not captured by input data available. Average Annual Rate of Reduction (AARR) and Average Annual Rate of Increase (AARI) are calculated using all data from 2008 onwards for stunting, overweight and low birthweight (recent trend period), and from 2012 (baseline) for the other indicators.
SOURCES: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - levels and trends in child malnutrition: key findings of the 2020 edition.* [online]. data.unicef.org/resources/jme, www.who.int/nutgrowthdb/estimates, data.worldbank.org/child-malnutrition; NCD Risk Factor Collaboration (NCD-RisC). 2017. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *The Lancet*, 390(10113): 2627–2642; UNICEF & WHO. 2019. *UNICEF-WHO Joint Low Birthweight Estimates.* [online]. [Cited 28 April 2020]. www.unicef.org/reports/UNICEF-WHO-low-birthweight-estimates-2019; www.who.int/nutrition/publications/UNICEF-WHO-lowbirthweight-estimates-2019; UNICEF. 2020. UNICEF Global Database on Infant and Young Child Feeding. In: *UNICEF* [online]. New York, USA. [Cited 28 April 2020]. data.unicef.org/topic/nutrition/infant-and-young-child-feeding

forms of malnutrition. It is still very early to know the magnitude and duration of the pandemic and to predict its impact on the projected progress to the global targets. Box 4 presents some of the ways COVID-19 might impact malnutrition.

Regional and subregional trends

Global estimates of various nutrition indicators do not reveal the wide variations that exist between regions. Table 6 summarizes the progress made since baseline (2012) and the projected trajectories towards 2025 and 2030 targets based on current trends, by region and subregion.

BOX 4

THE IMPACT OF THE COVID-19 PANDEMIC ON MALNUTRITION

Although it is too early to provide evidence on the impact of COVID-19 on the nutritional status of populations, the pandemic is expected to increase levels of malnutrition in all its forms in vulnerable households. This can occur due to:

- An increase in food insecurity due to, for example, disruptions along food supply chains that complicate the transportation of food to markets, restrictions of movement that impact the access to markets by consumers, price increases in particular in import-dependent countries, the loss of jobs and incomes resulting from the economic recession and the interruption or lack of social protection mechanisms. Higher food prices, especially for nutritious foods, and reduced affordability of healthy diets can all negatively affect nutrient intake and diet quality, and consequently, increase the risk of malnutrition.
- Overwhelming of health systems' capacities to deliver curative and preventive services, including child care and antenatal care, due to factors such as cessation of services, health worker illness and fatigue, scarcity of essential medicines, and diminished access to health services, including the loss of health insurance coverage as well as precautionary behaviour of families.[34] In children, this can hamper the management of wasting, which affects their nutritional status and health, leading to higher risk of mortality.[35] At the same time many people living with NCDs are no longer able to access the medicines that they need.
- Possible increase in infant and young child morbidity due to diminished healthcare resources to prevent and treat malaria, diarrhoea and other infectious diseases[35] and increased malnutrition.
- Discontinuation or suspension of community-level activities including community worker visits to households to provide counselling and deliver interventions, as well as cancellation of vitamin A and vaccination campaigns and growth monitoring and promotion events.
- School closures leading to missed meals and nutrition education normally provided through school food and nutrition programmes.[36]
- Deterioration of childcare practices. This could happen because of separation of mothers/ caregivers from children due to quarantine, self-isolation, illness or death. Diminished or suspended breastfeeding promotion and nutrition counselling activities, together with mothers' fears around COVID-19 infection may result in increased utilization of breastmilk substitutes. It could also spur opportunistic marketing, making the adoption and enforcement of the International Code of Breastmilk Substitutes even more important.[37]
- Altered purchasing patterns favouring products with longer shelf life and often poorer nutrition profiles,[38] which could lead to higher levels of undernutrition, as well as overweight and obesity.[39,40]

Social safety nets and efforts to provide accurate information on virus transmission are key to mitigating potential negative effects of COVID-19. The nutritional status of the population is likely to deteriorate due to the socio-economic impact of COVID-19, particularly in places where health, food and social protection programmes are fragile or cannot be scaled up as needed.

In 2019, more than nine out of ten stunted children lived in Africa or Asia, representing 40 percent and 54 percent of all stunted children in the world, respectively.
Most regions have made some progress in reducing stunting between 2012 and 2019 but not at the rate needed to achieve the 2025 and 2030 targets. The prevalence of stunting in sub-Saharan Africa is decreasing, but only at half the rate needed, and is still very high (31.1 percent in 2019). Moreover, the subregion has actually seen an increase in the number of stunted children from 51.2 million in 2012 to 52.4 million in 2019. The Central Asia, Eastern »

TABLE 6

MOST REGIONS ARE MAKING SOME PROGRESS, BUT NOT ENOUGH TO ACHIEVE GLOBAL TARGETS; NO SUBREGION IS ON TRACK FOR THE LOW BIRTHWEIGHT TARGET, AND ADULT OBESITY IS WORSENING IN ALL SUBREGIONS

	Child stunting (%)				Child overweight (%)				Low birthweight (%)				Exclusive breastfeeding[b] (%)				Adult obesity[c] (%)		
	2012	2019	2025	2030	2012	2019	2025	2030	2012	2015	2025	2030	2012	2019	2025	2030	2012	2016	2025
WORLD	**24.8**	**21.3**			**5.3**	**5.6**			**15.0**	**14.6**			**37.0**	**44.1**			**11.8**	**13.1**	
AFRICA	**32.3**	**29.1**			**4.8**	**4.7**			**14.1**	**13.7**			**35.5**	**43.7**			**11.5**	**12.8**	
Northern Africa	19.8	17.6			10.1	11.3			12.4	12.2			40.7	42.1			23.0	25.2	
Sub-Saharan Africa	34.5	31.1			3.8	3.6			14.4	14.0			34.5	44.0			8.0	9.2	
Eastern Africa	38.5	34.5			4.0	3.7			13.8	13.4			48.6	61.1			5.3	6.4	
Middle Africa	34.4	31.5			4.8	5.1			12.8	12.5			28.5	n.a.			6.7	7.9	
Southern Africa	30.4	29.0			11.7	12.7			14.3	14.2			n.a.	33.5			25.0	27.1	
Western Africa	30.6	27.7			2.3	1.9			15.6	15.2			22.1	32.2			7.4	8.9	
ASIA[d]	**27.0**	**21.8**			**4.4**	**4.8**			**17.8**	**17.3**			**39.0**	**45.3**			**6.1**	**7.3**	
Central Asia	14.9	9.9			7.3	6.2			5.6	5.4			29.2	44.8			15.6	17.7	
Eastern Asia[d]	7.9	4.5			6.4	6.3			5.1	5.1			28.5	22.0			4.9	6.0	
South-eastern Asia	29.4	24.7			5.5	7.5			12.4	12.3			33.5	47.9			5.4	6.7	
Southern Asia	38.0	31.7			2.5	2.5			27.2	26.4			47.4	57.2			4.5	5.4	
Western Asia	15.9	12.7			7.7	8.4			10.0	9.9			32.3	33.1			27.2	29.8	
Western Asia and Northern Africa	*17.8*	*15.2*			*8.9*	*9.9*			*11.2*	*11.1*			*37.4*	*38.7*			*25.3*	*27.2*	
LATIN AMERICA AND THE CARIBBEAN	**11.4**	**9.0**			**7.2**	**7.5**			**8.7**	**8.7**			**33.4**	**n.a.**			**22.2**	**24.2**	
Caribbean	10.3	8.1			6.2	7.0			10.1	9.9			29.7	25.9			22.0	24.7	
Central America	16.0	12.6			6.5	6.9			8.8	8.7			21.6	33.2			25.1	27.3	
South America	9.2	7.3[a]			7.6	7.9[a]			8.6	8.6			41.9	n.a.			21.1	23.0	
OCEANIA[e]	**37.9**	**38.4**			**7.3**	**9.4**			**10.0**	**9.9**			**56.9**	**61.3**			**21.3**	**23.6**	
Australia and New Zealand[f]	n.a.	n.a.			16.2	20.7			6.2	6.4			n.a.	n.a.			27.0	29.3	
NORTHERN AMERICA AND EUROPE	**n.a.**	**n.a.**			**n.a.**	**n.a.**			**7.0**	**7.0**			**n.a.**	**n.a.**			**25.0**	**26.9**	
Northern America[g]	2.7	2.6			8.0	8.9			7.9	7.9			25.5	34.7			32.9	35.5	

On track; Off track – some progress; Off track – no progress or worsening; No data.

NOTES: [a] Consecutive low population coverage; interpret with caution; [b] Regional averages are population weighted using the most recent estimate for each country between 2005 and 2012 (2012 column) and 2014 to 2019 (2019 column), except for China where a 2013 estimate is used for 2019 aggregates; estimates in the 2012 and 2019 columns do not have the same subset of countries; [c] There is no official target for adult obesity for 2030; [d] Stunting and overweight under 5 years of age and low birthweight regional aggregates exclude Japan; [e] Oceania excluding Australia and New Zealand; [f] Overweight estimates for Australia and New Zealand are based only on data from Australia; [g] Stunting estimates for Northern America are based only on data from the United States of America; n.a. shown where population coverage < 50 percent.

SOURCES: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - levels and trends in child malnutrition: key findings of the 2020 edition*. [online]. data.unicef.org/resources/jme; www.who.int/nutgrowthdb/estimates; data.worldbank.org/child-malnutrition; NCD Risk Factor Collaboration (NCD-RisC). 2017. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *The Lancet*, 390(10113): 2627–2642; UNICEF & WHO. 2019. *UNICEF-WHO Joint Low Birthweight Estimates*. [online]. [Cited 28 April 2020]. www.unicef.org/reports/UNICEF-WHO-low-birthweight-estimates-2019; www.who.int/nutrition/publications/UNICEF-WHO-lowbirthweight-estimates-2019; UNICEF. 2020. UNICEF Global Database on Infant and Young Child Feeding. In: *UNICEF* [online]. New York, USA. [Cited 28 April 2020]. data.unicef.org/topic/nutrition/infant-and-young-child-feeding.

» Asia and Caribbean subregions are on track to achieve the 2025 and 2030 targets (Table 6). If current progress continues, Asia and Latin America and the Caribbean regions will be very close to achieving the targets for 2025 and 2030 (missing by only one year), while Africa will need to triple its progress rate if population growth continues to increase as projected (Figure 11).

Out of the 38.3 million children who were overweight in 2019, 24 percent lived in Africa and 45 percent in Asia, despite these being the regions with the lowest prevalence of children who are overweight (4.7 percent in Africa and 4.8 percent in Asia). Australia and New Zealand is the only subregion with a very high prevalence (20.7 percent). Southern Africa (12.7 percent) and Northern Africa (11.3 percent) have prevalences considered high,[41] followed closely by Oceania (9.4 percent) and Western Asia (8.4 percent). Australia and New Zealand has also experienced the largest increase in childhood overweight, followed by Oceania (excluding Australia and New Zealand); these subregions require concerted efforts to reverse their rapidly rising upward trends. There has been little or no progress to stem the rate of overweight for most of the subregions between 2012 and 2019 (Table 6). Africa as a whole has halted the increase in childhood overweight so far, but increased efforts are needed to achieve the target of 3 percent by 2030. All other regions also require urgent action to reverse their upward trends (Figure 11).

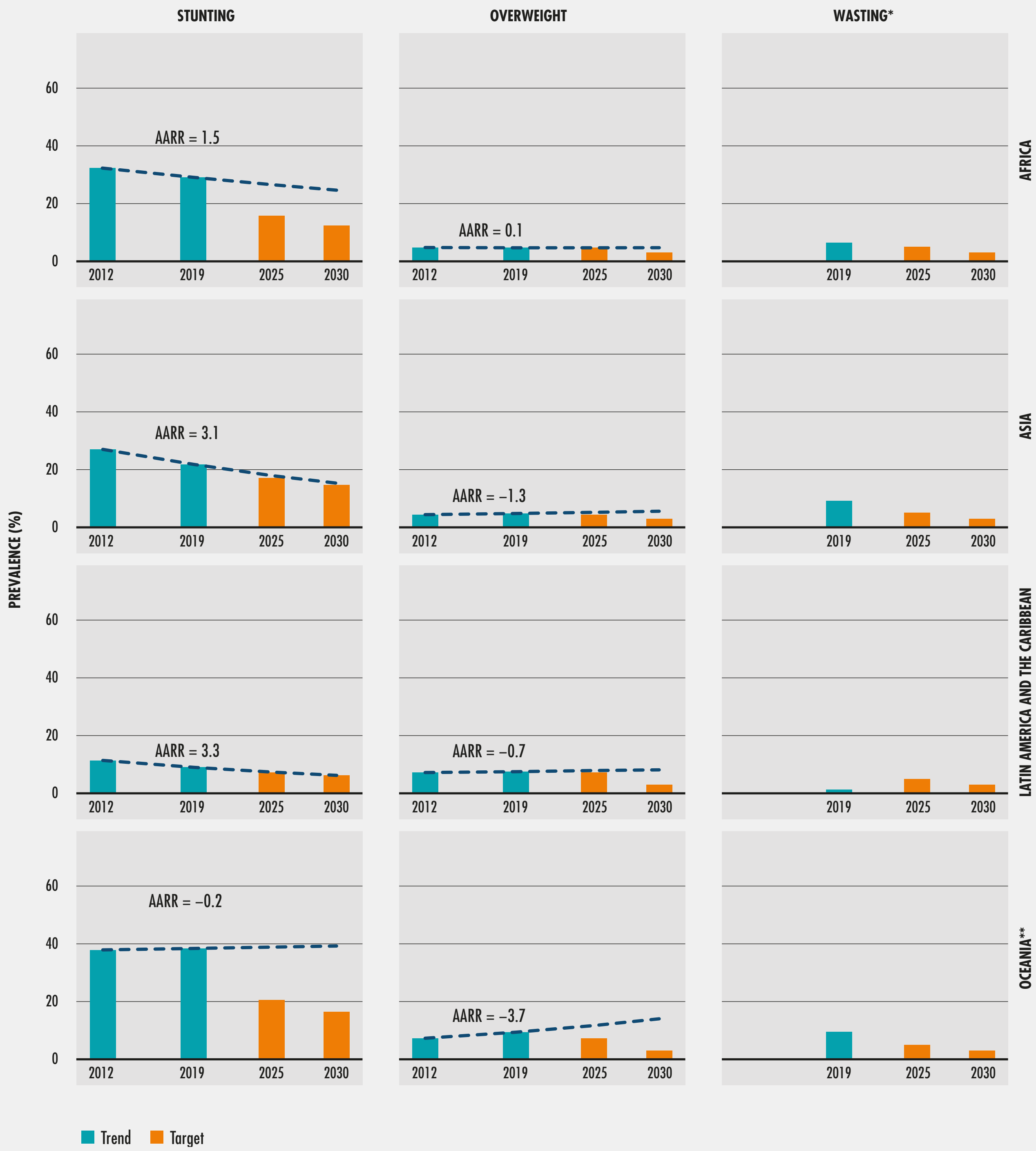
The most recent estimates (2012–2015) indicate that none of the regions are on track to achieve the target of 30 percent relative reduction in the proportion of babies born with low birthweight, even by 2030. Notably, the Southern Asia subregion had the highest prevalence estimate (26.4 percent in 2015). Rates of reduction for this indicator are very low for all subregions, with a maximum AARR of 1.2 percent per year in Southern Asia. Moreover, recent trends indicate no reduction in South America and a slight increase in Australia and New Zealand (Table 6).

Most subregions are making at least some progress towards the 2025 and 2030 targets for exclusive breastfeeding, except Eastern Asia and the Caribbean, the only subregions experiencing a decline in prevalence. Central America is nearly on track to reach both the 2025 and the 2030 targets for exclusive breastfeeding, missing both targets by only one year if current trends continue. If the Eastern Africa, Central Asia and Southern Asia subregions maintain their current rates of progress, they will reach the targets set for both 2025 and 2030. The African and Asian regions present a sustained increasing trend in exclusive breastfeeding and are on track to achieve the target of at least 50 percent by 2025, but not the 2030 target of at least 70 percent (Figure 11).

All subregions show increasing trends in the prevalence of adult obesity between 2012 and 2016. Thus, they are off track for the target of halting the rise in obesity by 2025. Northern America, Western Asia and Australia and New Zealand had the highest levels, 35.5 percent, 29.8 percent and 29.3 percent, respectively, in 2016. Latin America and the Caribbean as a whole and Oceania excluding Australia and New Zealand also had levels above 20 percent in 2016.

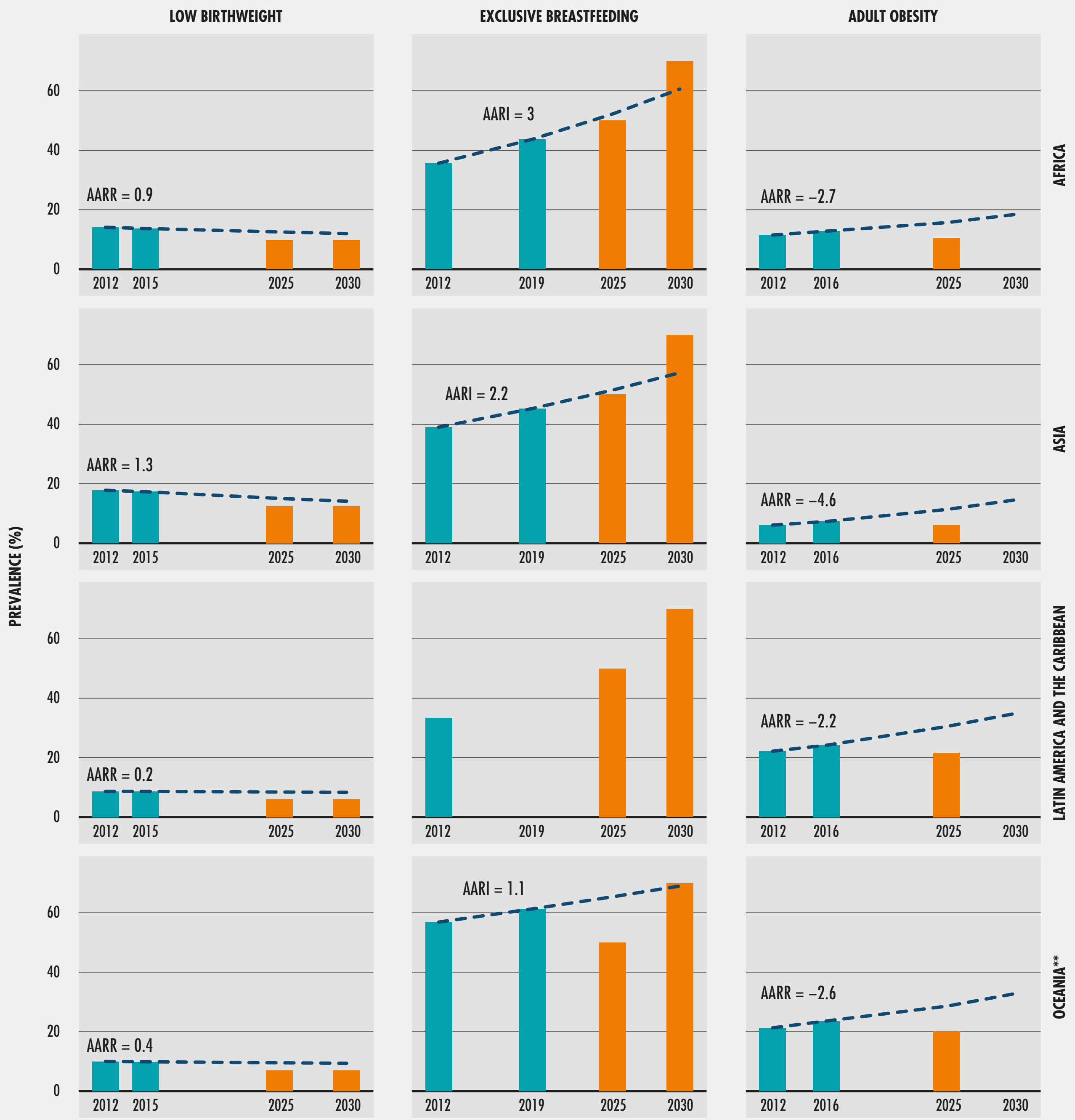
The assessment of child wasting is made based on the latest estimates (2019) through a straight comparison to the target levels of 5 percent and 3 percent for 2025 and 2030, respectively. The prevalence of wasting for the African region is 6.4 percent, with only the Southern Africa subregion having a prevalence below 5 percent. Oceania excluding Australia and New Zealand has the highest prevalence of wasting of all regions (9.5 percent), followed by Asia (9.1 percent). Southern Asia, which is home to more than half of the world's wasted children under 5 years of age, is the only subregion having a high prevalence of 14.3 percent (25 million) in 2019. By contrast, Latin America and the Caribbean is the only region with a prevalence of wasting (1.3 percent) already below the 2025 and 2030 targets (Figure 11).

FIGURE 11
MOST REGIONS ARE NOT ON TRACK TO ACHIEVE THE TARGETS FOR CHILD OVERWEIGHT, AND ADULT OBESITY IS ON THE RISE IN ALL REGIONS



NOTES: AARR and AARI refer to Average Annual Rate of Reduction and Average Annual Rate of Increase, respectively. AARI is used for exclusive breastfeeding because the target is to increase the prevalence. * No projection over time is generated for wasting, as it is an acute condition that can change frequently and rapidly over the course of a calendar year, not captured by input data available. ** Oceania excluding Australia and New Zealand; data for Northern America and Europe only available for low birthweight and adult obesity and thus not shown.

FIGURE 11
(CONTINUED)



SOURCES: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - levels and trends in child malnutrition: key findings of the 2020 edition.* [online]. https://data.unicef.org/resources/jme, www.who.int/nutgrowthdb/estimates, data.worldbank.org/child-malnutrition; NCD Risk Factor Collaboration (NCD-RisC). 2017. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *The Lancet*, 390(10113): 2627–2642; WHO. 2019. Vitamin and Mineral Nutrition Information System (VMNIS) – Micronutrients Database. In: *World Health Organization* [online]. Geneva, Switzerland. [Cited 28 April 2020]. www.who.int/vmnis/database; WHO & UNICEF. 2019. *UNICEF-WHO Joint Low Birthweight Estimates.* [online]. [Cited 28 April 2020]. www.unicef.org/reports/UNICEF-WHO-low-birthweight-estimates-2019, www.who.int/nutrition/publications/UNICEF-WHO-lowbirthweight-estimates-2019; UNICEF. 2020. UNICEF Global Database on Infant and Young Child Feeding. In: *UNICEF* [online]. New York, USA. [Cited 28 April 2020]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding.

Spotlight on stunting

Stunting, or being too short for one's age, is defined as length/height for age that is more than two standard deviations below the World Health Organization (WHO) Child Growth Standards median.[43] This indicator is a well-established risk marker of poor child development. Before the age of two years, it predicts poorer cognitive and educational outcomes later in childhood and adolescence,[44] and higher susceptibility to NCDs in adulthood.[45] Stunting is also associated with impaired education and economic development at the individual, household and community levels.[46] According to World Bank estimates, a 1 percent loss in adult height due to childhood stunting is associated with a 1.4 percent loss in economic productivity.[47] It is estimated that stunted children earn 20 percent less as adults compared to children who were not stunted.[48] Stunted and wasted children also have a higher mortality risk, which is further increased when the two conditions coexist.[49]

Stunting is caused by poor diets and frequent infections. In some settings, a high proportion of stunting has its origins in utero due to, for example, poor maternal nutrition. These determinants are in turn underpinned by other socio-economic and demographic factors.[50,51,52,c] When pregnancy occurs during adolescence, demands for ongoing maternal growth limit the nutrients available for the fetus, which can lead to childhood stunting.[46] Growth failure often continues after birth, as a reflection of suboptimal breastfeeding practices and inadequate complementary feeding and control of infection.[53] The complementary feeding period, generally corresponding to age 6–24 months, represents an important period of sensitivity to stunting with lifelong, possibly irreversible consequences.[54] Therefore, focusing on the critical 1 000-day window from conception to the child's second birthday is key.

Stunting and other forms of undernutrition early in life may predispose children to overweight and NCDs later in life. In some settings, early stunting might predispose an individual to a more central distribution of adiposity at later ages, which could translate to overweight or obesity. The extent to which maternal obesity adversely affects early growth and development of offspring might be exacerbated if the mother was undernourished in early life, reinforcing the intergenerational cycle of malnutrition in its different forms.[55]

In 2019, 144 million children under 5 were affected by stunting worldwide, a 12 percent reduction relative to the baseline reference year for the global nutrition targets in 2012 (164 million). Current progress is insufficient for the world to achieve the target of 40 percent reduction in the number of stunted children by 2025 (98.6 million) as well as the 2030 target of 50 percent reduction (82.2 million). Across subregions, progress in reducing stunting between the baseline (2012) and latest (2019) years show the disparities in terms of acceleration required to achieve the 2025 and 2030 targets (Figure 12).

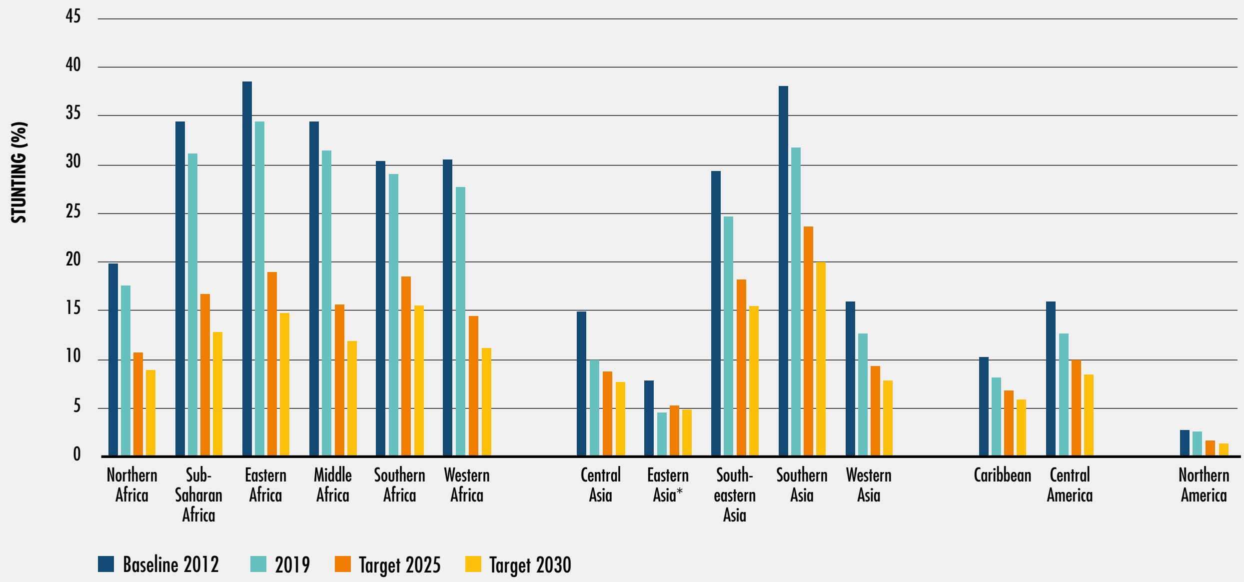
The biggest challenge remains in the sub-Saharan Africa subregion, where projected rapid under-5 population growth would offset the projected progress in terms of prevalence, hampering efforts to bring down the number of children affected. In contrast, the projected decrease in population in Asia and in Latin America and the Caribbean, together with the projected decrease in prevalence, have contributed to progress towards the target.

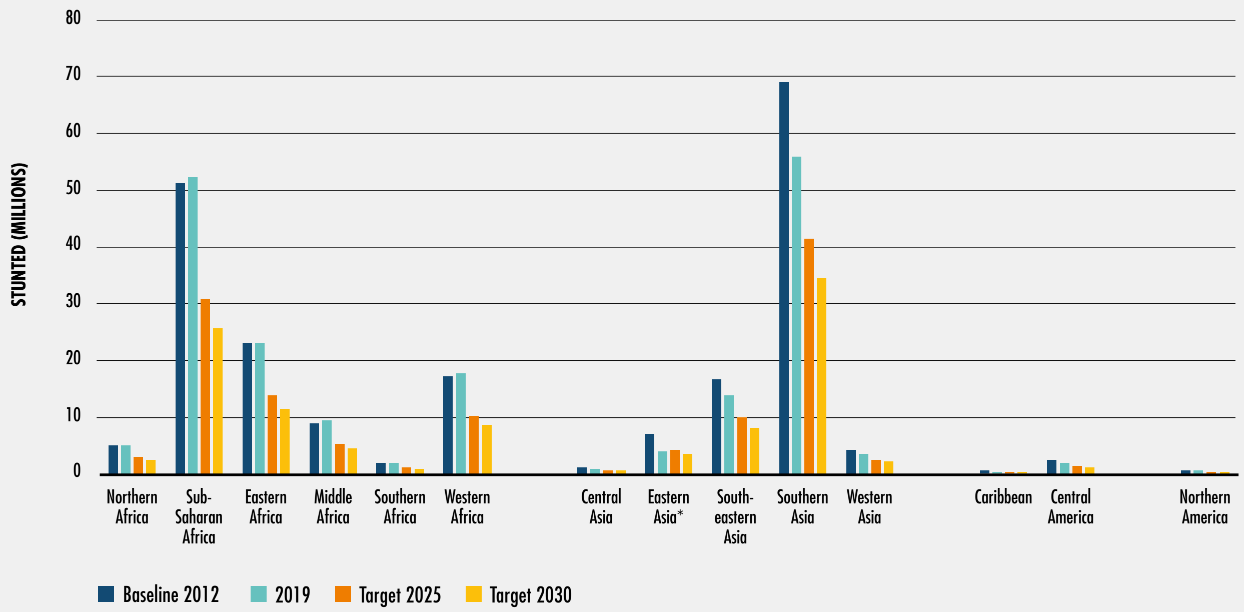
The prevalence of stunting is unequally distributed across the globe, and even within regions and subregions, with contrasting severity levels (Figure 13).

Globally, stunting estimates vary by wealth, residence, age and gender (Figure 14).[56] Among available groupings, the largest disparity in stunting prevalence is seen between the poorest and richest wealth quintiles. Children from the poorest wealth quintile had a stunting prevalence of 43 percent, more than double that of children from the richest quintile. The prevalence of stunting among children residing in rural areas was 34 percent, 1.7 times higher than children »

c Socio-economic status refers to an individual's access to social and economic resources. It is usually measured by educational level, income and occupation.

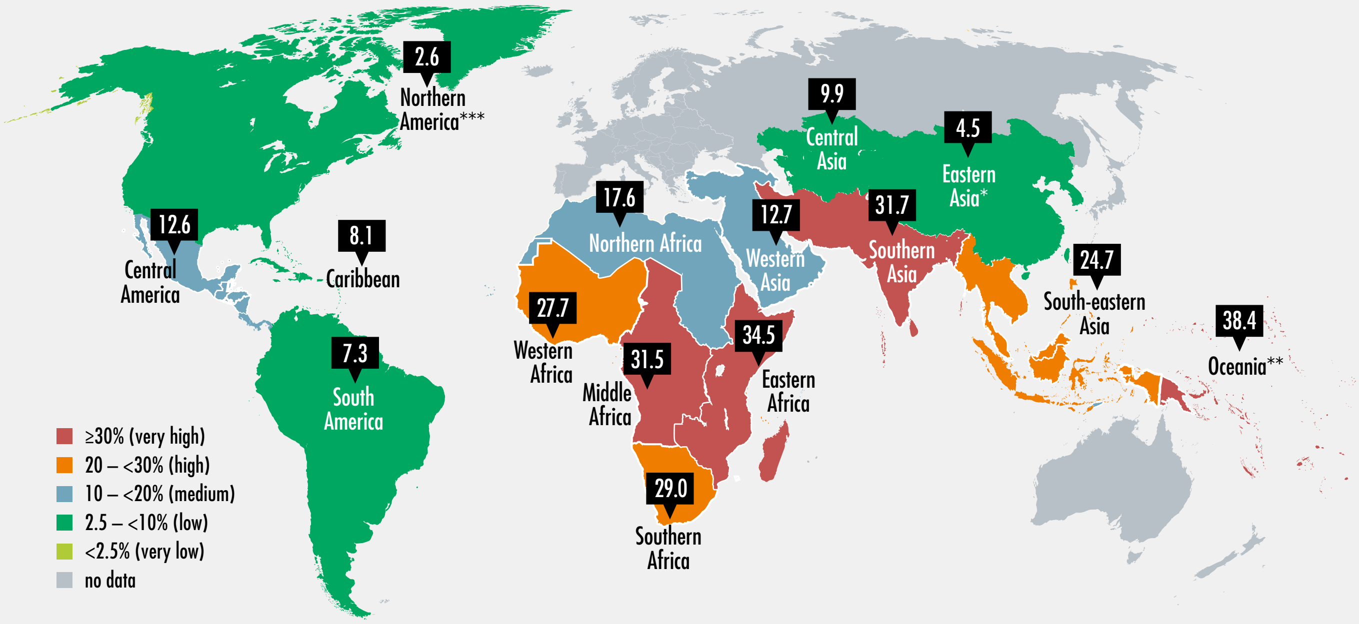
FIGURE 12
SUB-SAHARAN AFRICA IS THE ONLY SUBREGION WITH A RISING NUMBER OF STUNTED CHILDREN





NOTES: * Eastern Asia does not include Japan. No data available for South America and Europe.
SOURCE: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - levels and trends in child malnutrition: key findings of the 2020 edition.* [online]. https://data.unicef.org/resources/jme; www.who.int/nutgrowthdb/estimates; data.worldbank.org/child-malnutrition

FIGURE 13
GLOBALLY, 21.3 PERCENT OF CHILDREN UNDER 5 ARE STUNTED, AND 7 SUBREGIONS OUT OF 17 HAVE HIGH OR VERY HIGH STUNTING PREVALENCES IN 2019

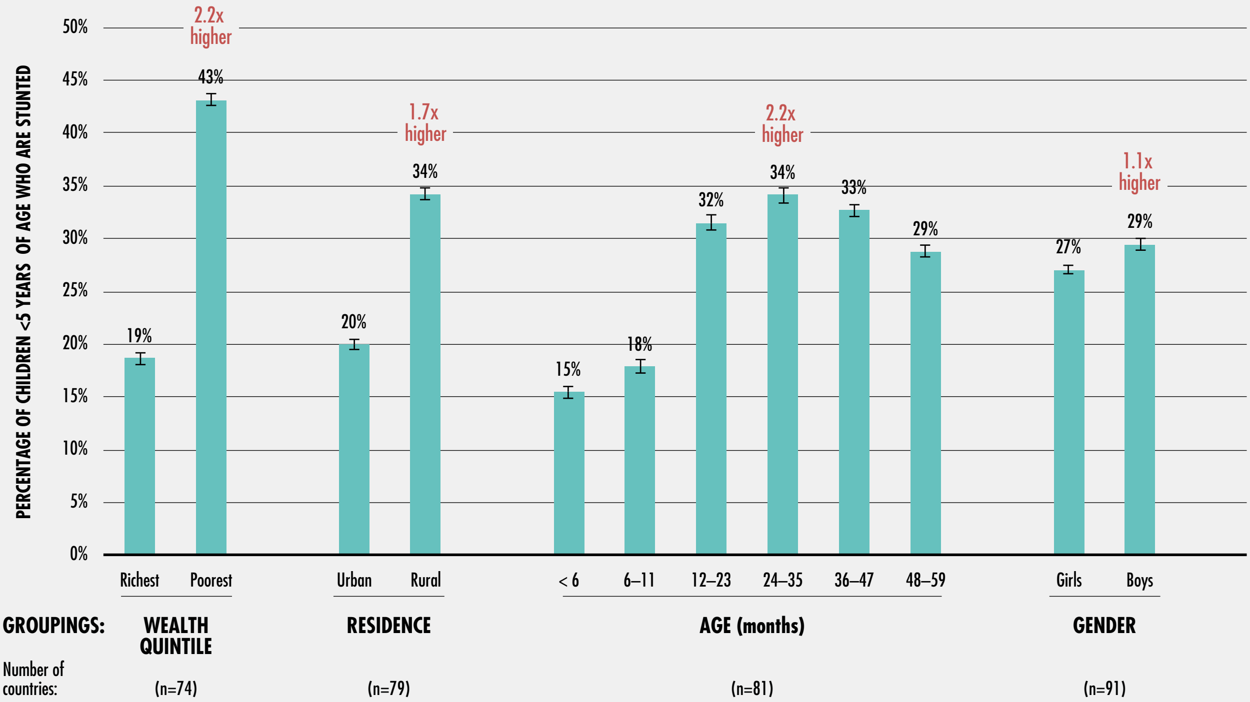


NOTES: Levels of severity as published in de Onis *et al.* (2019).[41] * Eastern Asia excluding Japan. ** Oceania excluding Australia and New Zealand. *** Northern America subregional average based on United States data. There is no estimate available for the subregions of Europe or Australia and New Zealand due to insufficient population coverage. These maps are stylized and not to scale and do not reflect a position by UNICEF, WHO or World Bank Group on the legal status of any country or territory or the delimitation of any frontiers.
SOURCE: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - levels and trends in child malnutrition: key findings of the 2020 edition.* [online]. https://data.unicef.org/resources/jme, www.who.int/nutgrowthdb/estimates, data.worldbank.org/child-malnutrition

» in urban areas. Between boys and girls, the difference in stunting prevalence is small at the global level. A large proportion of childhood stunting that makes up the under-5 stunting burden is accumulated in the first 1 000 days. These findings are aligned with previous studies[53] and reiterate the need to target stunting prevention interventions during this critical window of opportunity.

Disparities in the prevalence of child stunting between the richest and poorest households are observed in all regions and subregions with available estimates (Figure 15). The differences at the regional level in Africa and Asia mask large variances seen at the subregional level. For example, children from the poorest households in Central Asia have significantly lower stunting prevalence than those from the richest households in Southern Asia. Southern Asia is also the only subregion where more than half of the children from the poorest wealth quintile are stunted. The poorest in Northern Africa have a prevalence which is only 1.4 times higher than the richest, the smallest relative difference of all subregions in the world. Western Africa, on the other hand, is the only subregion where the gap in prevalence of stunting between the poorest and richest surpasses 30 percentage points. While the absolute difference between richest and poorest in Latin America and

FIGURE 14
THE PREVALENCE OF STUNTING IS HIGHER IN RURAL AREAS AND IN POOREST HOUSEHOLDS



NOTES: Estimates are based on the most recent national survey with disaggregated data available between 2013 and 2019 and thus only include a subset of the country data used for the global Joint Malnutrition Estimates (JME). The estimates for each grouping are based on a different subset of countries given variable data availability by background characteristics. Estimates are population weighted and require >50 percent population coverage to be displayed. The relative difference between the highest and lowest for each grouping is shown in red and was calculated using unrounded estimates.
SOURCE: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint Malnutrition Expanded country dataset, May 2020*. [online]. https://data.unicef.org/resources/jme, www.who.int/nutgrowthdb/estimates, data.worldbank.org/child-malnutrition (analysis from 118 countries).

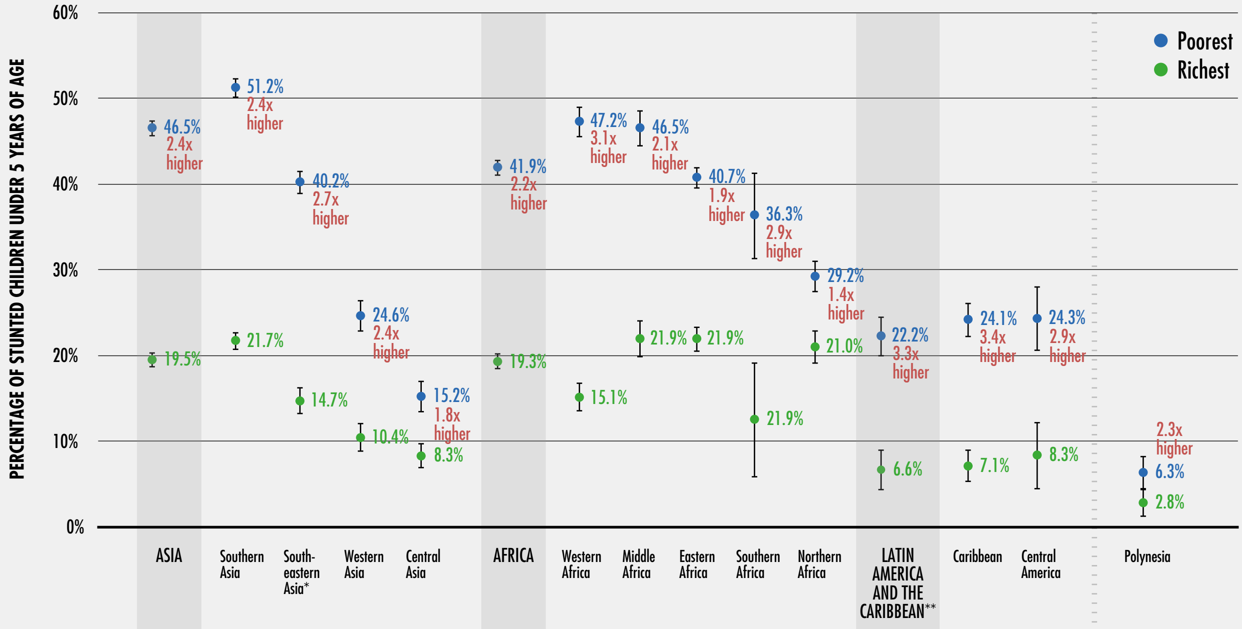
the Caribbean is the smallest of all regions, the relative difference is the largest, with children from the richest households classified as having a low stunting prevalence and those in the poorest households as having a high stunting prevalence in terms of severity level. This suggests the need for intensified efforts to address inequities even in this region where stunting reduction as a whole may no longer be considered a pressing issue.

Framework for action on stunting

Following the set of recommendations in the Framework of Action of the Second International Conference on Nutrition (ICN2), the UN Decade of Action on Nutrition and its Work Programme, countries are encouraged to address the persistent problem of childhood stunting.[25,27,57] According to the Stunting Conceptual Framework developed by WHO,[58] a range of actions is needed, targeting the individual, household, community, national and global levels.

Tackling child stunting requires the involvement of different sectors, including health, agriculture, social protection and education, and different levels of involvement, from planning and implementation to monitoring and evaluation.

FIGURE 15
IN LATIN AMERICA AND THE CARIBBEAN, STUNTING PREVALENCE OF CHILDREN LIVING IN THE POOREST HOUSEHOLDS IS ABOUT THREE TIMES HIGHER COMPARED TO THOSE LIVING IN THE RICHEST HOUSEHOLDS



NOTES: Estimates are based on the most recent national survey with disaggregated data available between 2013 and 2019 (n=74) and thus only include a subset of the country data used for the JME regional and subregional estimates. Only regions and subregions with sufficient (>50 percent) population coverage are displayed to meet adequate population coverage. * South-eastern Asia excludes Indonesia and ** Latin America and the Caribbean excludes Brazil. The relative difference between poorest and richest is shown in red and was calculated using unrounded estimates.
SOURCE: UNICEF, WHO & World Bank. 2020. *UNICEF-WHO-World Bank: Joint Malnutrition Expanded country dataset, May 2020*. [online]. https://data.unicef.org/resources/jme, www.who.int/nutgrowthdb/estimates, data.worldbank.org/child-malnutrition

Some key evidence-based actions include:

1. **Adolescent and maternal nutrition:** Consistent access to affordable foods that support healthy diets, including food sources of vitamins and minerals, are vital to ensure that adolescents and women have the ability to maintain an adequate diet throughout pregnancy and lactation. Globally, approximately 11 percent of births occur among girls between the ages of 15 and 19 years. Adequate nutrition before and during pregnancy is essential for meeting maternal and foetal growth needs, optimal birth outcomes and reducing the risk of later NCDs. When a growing adolescent becomes pregnant, there is competition for nutrients between the mother and the foetus. This can result in cessation of the prospective mother's linear growth and increase her risk of stunting, and can also lead to foetal growth restriction and low birthweight.[46] However, many adolescents and women cannot access healthy diets needed to meet the demands of pregnancy, especially in low- and middle-income countries where numerous micronutrient deficiencies coexist. Balanced energy and protein supplementation are an important intervention for the prevention of adverse perinatal outcomes in undernourished women. It increases birthweight

by 41g and reduces the risk of stillbirths by 40 percent and small-for-gestational-age births by 21 percent.[59] Thus, increasing daily energy and protein intake for pregnant women in undernourished populations is recommended to reduce the risk of low-birthweight neonates, especially in highly food-insecure areas or in populations with little access to a variety of foods. Social protection programmes also increase food security and reduce women's risk of becoming undernourished due to periods of pregnancy and lactation.[60]

2. **Optimal breastfeeding practices:** Early initiation and exclusive breastfeeding for the first six months provides protection against gastrointestinal infections, which can lead to severe nutrient depletion and therefore stunting.[61] Breastmilk is also a key source of nutrients during infection. Studies in resource-poor settings have associated non-exclusive breastfeeding with poorer growth outcomes, because breastmilk is replaced by less nutritious foods or water that often also expose infants to diarrheal infections. Similarly, continued breastfeeding in the second year contributes significantly to intake of key nutrients that are lacking in low-quality complementary diets in resource-poor settings.
3. **Child dietary diversification:** One of the most effective interventions for preventing stunting during the complementary feeding period is improving the quality of children's diets. For example, the consumption of animal source foods has been associated with improved linear growth.[62,63] Vitamins and minerals in the diet are also vital as they boost immunity and healthy development.[64] Assessments of nutrition-sensitive agriculture interventions identify dietary diversification and income generating activities through family farming as likely pathways through which agriculture and food systems could improve nutrition and reduce stunting. Recent analyses suggest that households that can afford diversified diets, including fortified complementary foods, experience improved nutrient intakes and reduced stunting.[46] However, the paradox remains that the price and accessibility of these nutritious foods which are necessary for healthy development are often much higher than their less nutritious counterparts. These price patterns are an element of the shift of dietary patterns observed in the "nutrition transition".[65] Thus, improving the availability and the affordability of nutritious foods that contribute to healthy diets can ensure healthy feeding and eating habits and reduce the risk of child stunting (see Part 2).
4. **Water, sanitation and hygiene:** Infectious diseases caused by a lack of hygienic conditions and clean water are important determinants of child stunting. Clean and sufficient drinking water, proper sanitation, drains for wastewater and proper management of solid waste are key interventions in deprived areas.
5. **Social protection/cash transfer programmes:** Social protection schemes can improve access to food products that are rich in protein, vitamins and minerals that would otherwise not be accessible to poor households. These programmes targeted to low-income households are more effective when coupled with additional interventions or conditions such as attending health and nutrition services and good sanitation practices.
6. **Monitoring health inequalities:** Monitoring stunting at national and subnational levels is needed to identify geographic areas and subpopulations where prevalence is highest. The most affected areas and population groups should be prioritized for interventions. The most disadvantaged and vulnerable groups are often adolescents, women and children living in poorest households in rural areas but also urban areas. Addressing these inequalities might help to prevent stunting.

Recognizing that both the drivers and solutions to the multiple facets of malnutrition are intricately linked, ten "double-duty actions" have been identified to address the problems of undernutrition (including stunting) and obesity simultaneously.[66,67] These actions include interventions, programmes and policies to be implemented at all levels of the population – country, city, community, household and individual. Several of the above recommendations are also considered double-duty actions to address malnutrition in all its forms. Other double-duty actions include school food programmes and policies to promote food environments able to provide healthy diets.[67]

In summary, although countries are making some progress,[68] they are encouraged under the UN Decade of Action on Nutrition to scale up and strengthen many of the above actions to prevent stunting.[69] Many of the above interventions aim to prevent stunting by implementing strategies designed to achieve SDG Target 2.2 to end all forms of malnutrition. In the section that follows, the focus will be on how healthy diets can contribute to achieve this and other targets of the SDG agenda. ■

1.3 THE CRITICAL LINK BETWEEN FOOD SECURITY AND NUTRITION OUTCOMES: FOOD CONSUMPTION AND DIET QUALITY

KEY MESSAGES

➔ Food insecurity can increase the risk of various forms of malnutrition. One vital element that helps explain this is the food that people eat: specifically, the quality of diets. Food insecurity can affect diet quality in different ways, potentially leading to undernutrition as well as overweight and obesity.

➔ The exact make-up of a healthy diet varies depending on individual characteristics, cultural context, local availability of foods and dietary customs, but the basic principles of what constitutes a healthy diet remain the same. The unfeasibility of defining specific foods and quantities that comprise a healthy diet for all countries, and the lack of cross-country comparable data on individual dietary intake, pose challenges for global assessment of food consumption and diet quality.

➔ There are large discrepancies in the per capita availability of foods from different food groups across different country income groups. Low-income countries rely more on staple foods, and less on fruits and vegetables and animal source foods than high-income countries.

➔ Only in Asia, and globally in upper-middle-income countries, are there enough fruits and vegetables available for human consumption to be able to meet the FAO/WHO recommendation of consuming a minimum of 400 g/person/day.

➔ Globally, only one in three children 6 to 23 months of age meets the recommended minimum dietary diversity, with wide variation among world regions.

➔ Analysis of individual- and household-level data shows that diet quality is negatively affected by food insecurity, even at moderate levels of severity. People who experience moderate or severe food insecurity consume less meat, and fewer dairy products and fruits and vegetables, than those who are food secure or mildly food insecure.

➔ The finding that diet quality worsens as the severity of food insecurity increases is consistent with the theoretical basis of the Food Insecurity Experience Scale: that is, people experiencing moderate food insecurity face uncertainties about their ability to obtain food and have been forced to compromise on the nutritional quality and/or quantity of the food they consume. This points to cost and affordability of nutritious foods as a key factor affecting food security and, consequently, diet quality.

Since 2017, *The State of Food Security and Nutrition in the World* has reported on progress made towards eliminating hunger and food insecurity (SDG Target 2.1), and malnutrition in all its forms (SDG Target 2.2), presenting evidence of the link between these two SDG targets. As highlighted in previous editions of this report, food insecurity can increase the risk of various forms of malnutrition.[1,7,4] One vital element that helps explain this is the food that people eat: specifically, the quality of diets. Food insecurity can affect diet quality in different ways, potentially leading to undernutrition, including micronutrient deficiencies, as well as overweight and obesity.

Healthy diets are a prerequisite to achieving many SDGs and global nutrition targets.[70] However, global monitoring of diet quality poses multiple challenges. While there are evidence-based guiding principles for healthy diets, it has been difficult to develop valid food- or diet-related metrics of diet quality for global monitoring because of the rich variety of foods consumed and dietary patterns observed worldwide. Existing metrics are relatively new and have not yet been applied widely enough to provide global data or are specific only to a single population group. The scarcity of data on what people are eating – especially data that are comparable across countries – adds to the challenge of monitoring trends in diet quality worldwide.

After describing some of these challenges in monitoring diet quality globally, this section presents evidence on global trends in availability of food for human consumption and assessments of diet quality at the global and national levels. The important link between food insecurity and diet quality is also examined.

The evolving view of diet in the food security and nutrition debate

In the mid-twentieth century, food security interventions focused on agricultural production strategies to increase food supplies and meet dietary energy needs. Production of staple foods was emphasized, typically with less attention given to the nutritional diet quality.

In the decades that followed, awareness grew that this focus was largely misguided. The real problem was that many people did not have year-round access to safe, affordable healthy diets in sufficient quantity necessary to support health and well-being.[71] The nutrient adequacy of diets became a central element of food security and nutrition programmes.

As the century drew to a close, it became increasingly evident that food insecurity was associated not only with undernutrition, but often with overweight and obesity, as well, particularly in upper middle- and high-income countries. This put a spotlight on additional aspects of diet quality in the food security and nutrition policy debate. Consequently, interventions and policies have shifted from closing the dietary energy gap to making healthy diets more widely available and affordable, while simultaneously addressing multiple forms of malnutrition through the adoption of double-duty actions (see Section 1.2).[66] Actions and policies aimed at ensuring food security must also focus on increasing access to nutritious foods that contribute to healthy diets in order to combat all forms of malnutrition.

A healthy diet is guided by basic principles that can be put into practice in multiple ways

Diet quality comprises four key aspects: variety/diversity (within and across food groups), adequacy (sufficiency of nutrients or food groups compared with requirements), moderation (foods and nutrients that should be consumed with restraint) and overall balance (composition of macronutrient intake).[72] Exposure to food safety hazards is another important quality aspect. According to WHO, a healthy diet protects against malnutrition in all its forms, as well as non-communicable diseases (NCDs) such as diabetes, heart disease, stroke and cancer.[73] It contains a balanced, diverse and appropriate selection of foods eaten over a period of time. A healthy diet ensures that a person's needs for macronutrients (proteins, fats and carbohydrates including dietary fibres) and essential micronutrients (vitamins and minerals) are met, specific to their gender, age, physical activity level and physiological state. Healthy diets include less than 30 percent of total energy intake from fats, with a shift in fat consumption away from saturated fats to unsaturated fats and the elimination of industrial trans fats; less than 10 percent of total energy intake from free sugars (preferably less than 5 percent); consumption of at least 400 g of fruits and vegetables per day; and not more than 5 g per day of salt (to be iodized).[73] While the exact make-up of a healthy diet varies depending on these individual characteristics, as well as cultural context, locally available foods and dietary customs, these basic principles of what constitutes a healthy diet are the same (Box 5).

The changes needed across food systems and beyond to promote healthy diets vary considerably depending on the context. Populations have different health and nutritional

BOX 5
GUIDING PRINCIPLES FOR HEALTHY DIETS

Healthy diets:[74]

- start early in life with early initiation of breastfeeding, exclusive breastfeeding until six months of age, and continued breastfeeding until two years and beyond, combined with appropriate complementary feeding;
- are based on a great variety of unprocessed or minimally processed foods, balanced across food groups, while restricting highly processed food and drink products;*
- include wholegrains, legumes, nuts and an abundance and variety of fruits and vegetables;**
- can include moderate amounts of eggs, dairy, poultry and fish; and small amounts of red meat;
- include safe and clean drinking water as the fluid of choice;
- are adequate (i.e. reaching but not exceeding needs) in energy and nutrients for growth and development, and to meet the needs for an active and healthy life across the life cycle;
- are consistent with WHO guidelines to reduce the risk of diet-related NCDs, and ensure health and well-being for the general population;[73]
- contain minimal levels, or none if possible, of pathogens, toxins and other agents that can cause foodborne disease.

* Food processing can be beneficial for the promotion of high-quality diets; it can make food more available as well as safer. However, some forms of processing can lead to very high densities of salt, added free sugars and saturated or trans fats and these products, when consumed in high amounts, can undermine diet quality.[75]

** Potatoes, sweet potatoes, cassava and other starchy roots are not classified as fruits or vegetables.

profiles, as well as food habits and customs, livelihoods, ecosystems and food supply chains. While science provides quantified nutrient intake requirements for different population groups, there are myriad ways in which individual foods from various food groups can be combined within diets to meet these requirements. For these reasons, while the basic principles for healthy diets in Box 5 apply to all countries, it is not feasible to define a single healthy diet for all countries to follow, in terms of specific foods and quantities. Rather, each country must translate the basic principles for healthy diets into specific guidelines for their populations to follow. Accordingly, a growing number of countries have established national food-based dietary guidelines (FBDGs), with dietary recommendations that are appropriate for their unique contexts. Some countries also address food combinations (meals), eating modalities, food safety considerations, lifestyle and sustainability aspects in their FBDGs.

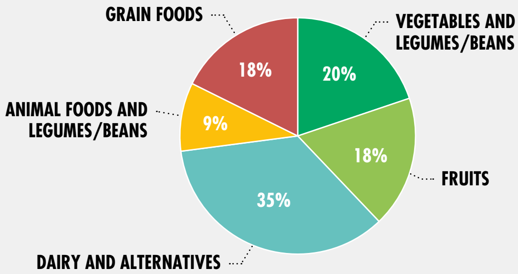
The examples of FBDGs from Australia, China and Thailand in Figure 16 illustrate how the application of the principles for healthy diets can differ from one country to another.[d] Each country's FBDGs are based on foods that are available, accessible and culturally appropriate for their population. These are used to construct recommended diet patterns that meet nutrient intake requirements, in addition to other principles for healthy diets, and address the country's main nutrition concerns. Even though all three countries are in the Asia-Pacific region, they present important differences and nuances. The graphic chosen by each country corresponds to an image that is culturally relevant for the population. When the three sets of FBDGs are compared by looking at the percentage weight contribution of each food group to the total diet based on recommendations, three differences are evident: the way the foods are grouped; the »

d See the FAO repository of national FBDGs.[130]

FIGURE 16
DIFFERENT WAYS OF APPLYING THE PRINCIPLES FOR HEALTHY DIETS: EXAMPLES FROM THREE COUNTRIES

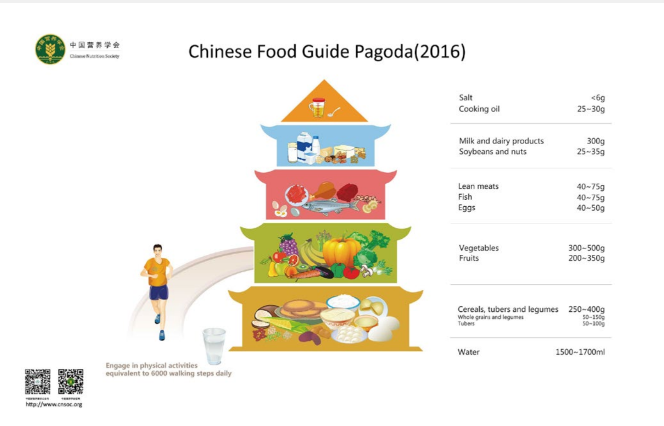
AUSTRALIA

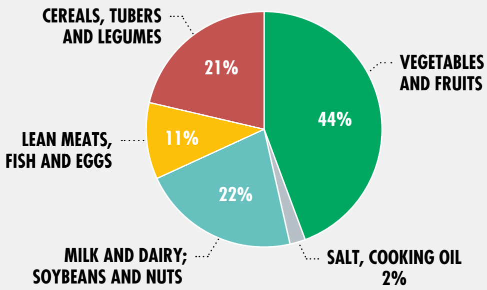
RECOMMENDATIONS AS PERCENTAGE WEIGHT OF FOOD GROUPS



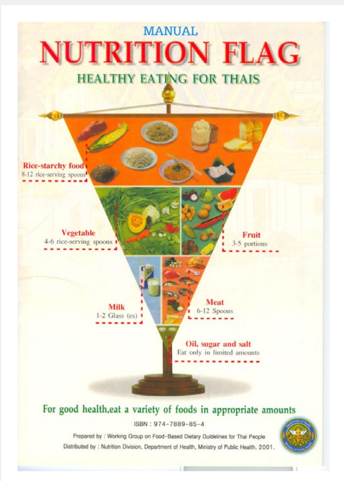
CHINA

RECOMMENDATIONS AS PERCENTAGE WEIGHT OF FOOD GROUPS

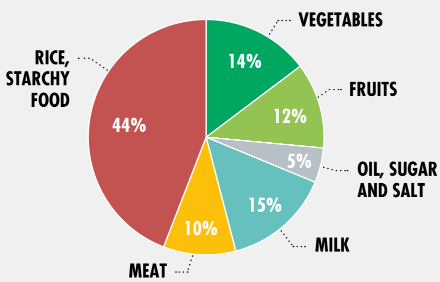




THAILAND



RECOMMENDATIONS AS PERCENTAGE WEIGHT OF FOOD GROUPS



SOURCES: Australian Government National Health and Medical Research Council 2013. *Australian Dietary Guidelines*. Summary. Canberra; Chinese Nutrition Society. 2019. Chinese Food Guide Pagoda. In: *Chinese Nutrition Society* [online]. Beijing. [Cited 28 April 2020]. en.cnsoc.org/dGuideline/611921203.html; Ministry of Public Health of Thailand. 2001. *Working group on Food-Based Dietary Guidelines for Thai people. Manual, Nutrition Flag: Healthy Eating for Thais*. Nutrition Division, Department of Health, Ministry of Public Health. First edition. Bangkok. Pie charts based on FAO calculations (see Annex 2).

» relative proportions of the food groups; and the food depicted. Such differences reflect health and nutrition problems, food availability, eating patterns and food cultures that are specific to each country (see **Annex 2** for more detail and **Annex 4**, Table A4.1 for additional examples of quantified national FBDGs).

When national FBDGs include quantitative recommendations, they can also be used as a tool to assess adherence to the guidelines in a given population (see Box 6). Quantitative recommendations facilitate the use of FBDGs for other research purposes, as well: the analysis of the cost and affordability of diets presented in Section 2.1 is an example (see Box 11 and **Annex 4**). At this time, however, only about a third of countries with FBDGs specify quantities, which presents challenges for assessing adherence to the guidelines and for research aimed at global and regional analyses.

While each country must define the best way to translate the basic principles for healthy diets into FBDGs appropriate for its own context, there have been efforts in recent years to define theoretical global healthy diet patterns (see Section 2.2). This is for the purpose of researching global dietary intake patterns and their relationship to health and environmental outcomes, and of enabling cross-country comparisons.

As the concept of healthy diets evolved with growing knowledge about the impacts of diets on health outcomes, the impacts of diets on the environment have come under increasing scrutiny. A growing body of scientific evidence reveals how the way we produce and consume food is taking a toll on the natural resource base and contributing to greenhouse gas emissions (see Section 2.2).[81,74,82] The environmental and health impacts will increase if trends in diet and population growth continue.[83] As populations become more affluent and urbanized, they demand more food, particularly more meat, fish, dairy, eggs, sugar, fats and oils,[84] which can contribute to higher risk of diet-related diseases as well as greater environmental impacts, for example those associated with consumption of animal source foods. In addition, projected population growth of 2 billion people by 2050, most of which is likely to occur in currently low- and middle-income countries, will further increase diet-related environmental pressure. In light of these trends, it is therefore crucial to promote healthy diets in ways that are environmentally sustainable.

Trends in food available for human consumption and aspects of diet quality in the world: a look at the evidence through different lenses

Global assessment of food consumption and diet quality poses many challenges. To date there is no single, validated composite index to measure the multiple dimensions of diet quality mentioned above across all countries: variety/diversity; adequacy; moderation; and overall balance. Alternative approaches used to assess the diet quality of populations include use of measures that capture a single facet of diet quality such as dietary diversity,[72] or consumption of food groups, single foods or food components whose intake should be increased or limited to protect health.[72,85] An additional challenge is the lack of robust, cross-country comparable data on individual dietary intake worldwide.[86] In its absence, different sources of data may be used for global assessment of food and nutrient intake and diet quality, each with certain strengths and limitations (see **Annex 2**).

An added issue which hampers comparability of dietary estimates and recommendations from different studies and countries is the use of different food group classifications and the total number of food groups used. Classification of foods into food groups can be done based on different aspects, such as the nutritional profiles of foods (e.g. protein-rich), purpose of the analysis (e.g. identify vitamin A and iron-rich foods), and botanical definition and their common use (e.g. tomatoes and eggplants are consumed as vegetables, but botanically they are fruits). Furthermore, imposing a classification on already existing data is circumscribed by the granularity of the data. For example, it is not possible to identify highly processed foods high in fats, sugars and/or salt using »

BOX 6
HOW DO CURRENT CONSUMPTION PATTERNS COMPARE WITH NATIONAL FOOD-BASED DIETARY GUIDELINES RECOMMENDATIONS? CASE STUDY FROM BELGIUM

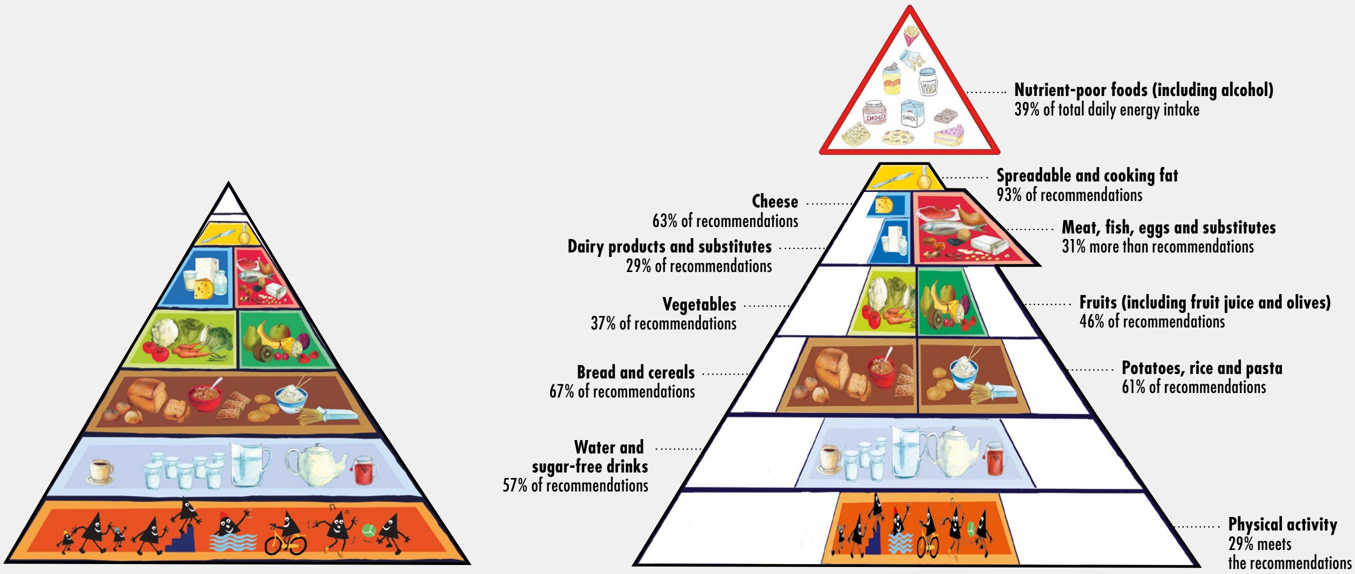
To help guide daily food choices, some FBDGs include recommended dietary intake patterns expressed as servings (often in grams) to be consumed from each food group per day by age and sex group. In such cases, if individual food consumption data are available for a given country, the adherence to FBDGs can be evaluated for specific population groups.

The image on the left side of the figure below shows the pyramid graphic chosen by Belgium to communicate the recommendations in its national FBDGs. The image on the right compares the mean habitual food consumption of 14–17 year-olds in Belgium taken from the 2014–2015 National Food Consumption Survey with the FBDGs recommendations for this age group.[78]

Looking at the graphic, it is evident that adolescents in Belgium are eating much less than the recommended amount for most food groups. This pattern is similar to that found in other European countries. A study covering ten cities in nine countries found that adolescents ate half of the recommended amount of fruits and vegetables and less than two-thirds of the recommended amount of milk (and dairy products), but consumed much more meat (and meat products), fats and foods and drinks containing high amounts of sugars than recommended. Nonetheless, median total daily energy intake was estimated to be nearly in line with the recommendations.[79]

Some countries have developed a Healthy Eating Index (HEI) based on their FBDGs, by converting their FBDGs messages into a score which is used to monitor diet quality over time. However, since an HEI needs to be developed, validated and updated whenever the FBDGs are revised, these indices are not very common, and currently not available for any lower-middle-income countries. In their absence, a "snapshot" comparing the current diet and FBDGs, as presented here for Belgium, can be very useful.

COMPLIANCE OF MEAN HABITUAL FOOD CONSUMPTION WITH THE FOOD-BASED DIETARY GUIDELINES IN ADOLESCENTS (14–17 YEARS)



SOURCE: Adapted from Bel, S., De Ridder, K.A.A., Lebacq, T., Ost, C., Teppers, E., Cuypers, K. & Tafforeau, J. 2019. Habitual food consumption of the Belgian population in 2014–2015 and adherence to food-based dietary guidelines. *Archives of Public Health*, 77(14), published under Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/). The authors used the 2011 Flemish active food triangle for comparison rather than the updated 2017 food pyramid that is also available in FAO (2020),[80] as the former included quantifiable recommendations (weights or volumes).

» Food Balance Sheets or Supply and Utilization Accounts data. The remainder of this section and Part 2 present various analyses which rely on slightly different food groupings. Nevertheless, each analysis is based on a relevant food group classification according to the study purpose and the type of data used.

Trends in global and regional food availability

Data on food availability from FAO Food Balance Sheets (FBS) have been widely used by economists, researchers and policymakers as a proxy of national average food consumption. They are used to identify very broad aspects of dietary patterns across the world. In fact, for some countries, particularly low-income nations, FBS may be the only data source available for this purpose.

FAO has put together FBS annually for most countries and territories since 1961. The balance sheets[87,88] are compiled from Supply and Utilization Accounts (SUA), which are detailed lists of over 400 food and agricultural items. The availability estimates are produced by balancing the data on a country's food supply (production, imports and opening stocks) against its food utilization (exports, availability for consumption, seeds, feed, post-harvest losses, other utilizations and closing stocks). The FBS provide information on quantities expressed in terms of primary equivalents for crops, livestock products and fish commodities. SUA provide more granular information of official or assessed quantities of commercialized food products. However, both FBS and SUA data provide information on food availability only at the national, aggregate level. They do not provide information on actual individual food or nutrient intake, or the distribution of access to the food available by the different population groups. In some cases, national SUA, as well as FBS, might not reflect production from some small farms or private households. Therefore, these caveats should be carefully considered when using and interpreting FBS and SUA data.

In the analysis below, SUA data are used to depict trends in availability of 10 selected food groups, and 3 meat subgroups, by region and by country income group for the years 2000–2017.[e] The contribution of all food groups (combined into 7 groupings) to total food and dietary energy supply in 2017 is also presented by country income group. The novelty of this analysis is three-pronged. First, it uses SUA data instead of FBS data. Second, foods are classified into food groups on the basis of their nutritional relevance following the classifications used in the FAO/WHO Global Individual Food consumption data Tool (GIFT)[89] instead of the FBS classification. Third, food quantities are adjusted for losses that may occur up to the retail level and for non-edible portions. This is done to estimate quantities that are closer to what people may actually be consuming. The estimates presented reflect food available (edible quantities) for human consumption. Thus, they are likely to be higher than actual individual intake (see **Annex 2** and Gheri *et al.* (forthcoming)[90] for an expanded description of the methodology, results and limitations of SUA and FBS data).

Low-income and lower-middle-income countries rely heavily on staple foods like cereals, roots, tubers and plantains. The availability of staple foods for the world has changed little between 2000 and 2017 (Figure 17). There were modest fluctuations in the availability of cereals across regions and country income groups. In 2017, cereal availability was highest in lower-middle-income countries (391 g/capita/day), and lowest in high-income countries (259 g/capita/day). Availability of roots, tubers and plantains increased in lower-middle-income countries, driven by a rise in Africa. It decreased in high-income countries, due primarily to reductions in Northern America and Europe. The global availability of pulses, seeds and nuts increased 24 percent from 2000 to 2017, with the largest increases in low- and lower-middle-income countries (Figure 18).

Only upper-middle-income countries and Asia have enough fruits and vegetables available to meet the FAO/WHO recommendation of consuming a minimum of 400 g per day.[91,92]

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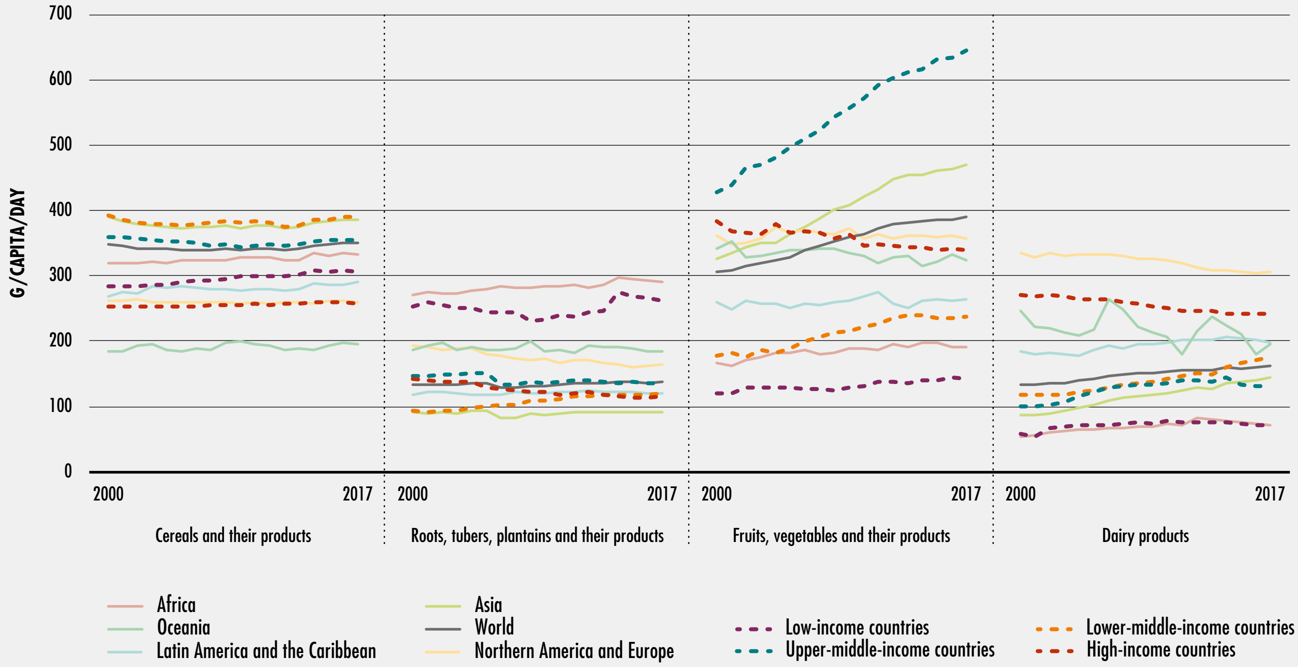
e Geographical regions were defined according to the United Nations Standard Country or Area Codes for Statistical Use (M49 standard) classification,[131] while countries were classified into four country income groups (high-income countries, upper-middle-income countries, lower-middle-income countries and low-income countries) using the World Bank classification for the 2020 year.[132]

FIGURE 17
FROM 2000 TO 2017, THE GLOBAL AVAILABILITY OF FRUITS AND VEGETABLES AND DAIRY PRODUCTS INCREASED, WHILE AVAILABILITY OF STAPLE FOODS REMAINED STABLE

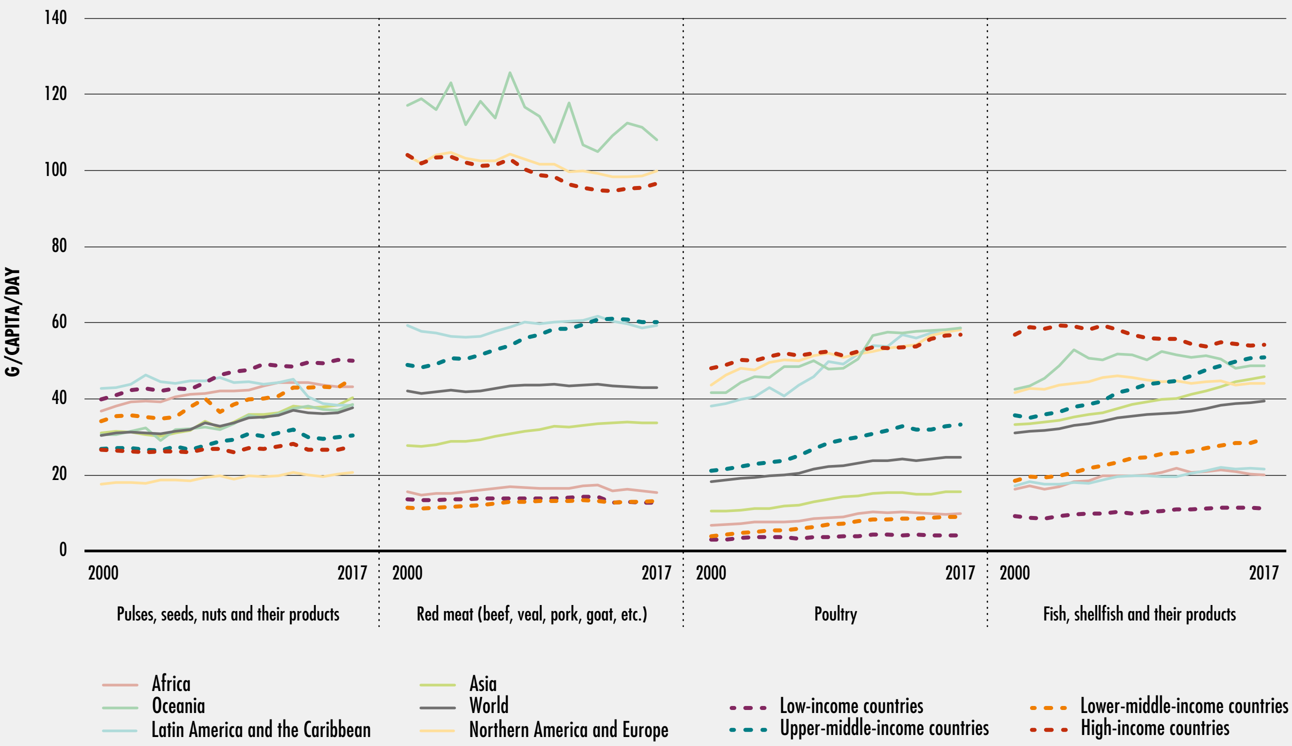


NOTES: The estimates presented here are adjusted for food losses that happen along part of the supply chain, from post-harvest up to (and including) retail, and are adjusted for inedible portions. The "fruits, vegetables and their products" group refer to all fresh, dry and processed (e.g. canned) fruits and vegetables. Fruit and vegetable juices and drinks are excluded. The "dairy products" group includes milk, fermented products, cheese and other milk products sourced from cattle equine and other mammals. For more details about the food groupings, see Annex 2.
SOURCE: FAO.

In 2000, in all regions, availability of fruits and vegetables for human consumption was below 400 g/capita/day. Out of all country income groups, only upper-middle-income countries surpassed that mark. Between the years 2000 and 2017, the world average availability of fruits and vegetables increased from 306 to 390 g/capita/day (Figure 17). Upper-middle-income countries showed the highest percentage change increase (50 percent) in total fruits and vegetables available. These countries had a notably higher total combined availability of fruits and vegetables (645 g/capita/day) than the other country income groups. For high-income countries, availability of fruits and vegetables has declined slightly over time.

From 2000 to 2017, the availability of fruits and vegetables in Africa increased from 167 to 191 g/capita/day. In low-income countries it grew from 121 to 142 g/capita/day. However, the total amounts available in Africa and low-income countries fall far short of the 400 g/capita/day consumption target. In 2017, Asia was the only region with enough fruits and vegetables available to meet the recommended amount (470 g/capita/day). However, even if the per capita availability appears to cover the recommended consumption at the population level, there is no assurance that consumption is distributed in a manner that satisfies the needs of all individuals.

FIGURE 18
FROM 2000 TO 2017, THE GLOBAL AVAILABILITY OF PULSES AND NUTS, AND POULTRY AND FISH INCREASED, WHILE AVAILABILITY OF RED MEAT INCREASED LARGELY IN UPPER-MIDDLE-INCOME COUNTRIES



NOTES: The estimates presented here are adjusted for food losses that happen along part of the supply chain, from post-harvest up to (and including) retail, and are adjusted for inedible portions. The "red meat" group includes all types of mammalian muscle meat (e.g. beef, veal, pork, lamb, mutton, horse and goat). The "poultry" group includes all types of bird muscle meat (e.g. chicken, turkey, duck). The "fish, shellfish and their products" group includes fresh and processed fish, shellfish and their products. For more details about the food groupings, see Annex 2.
SOURCE: FAO.

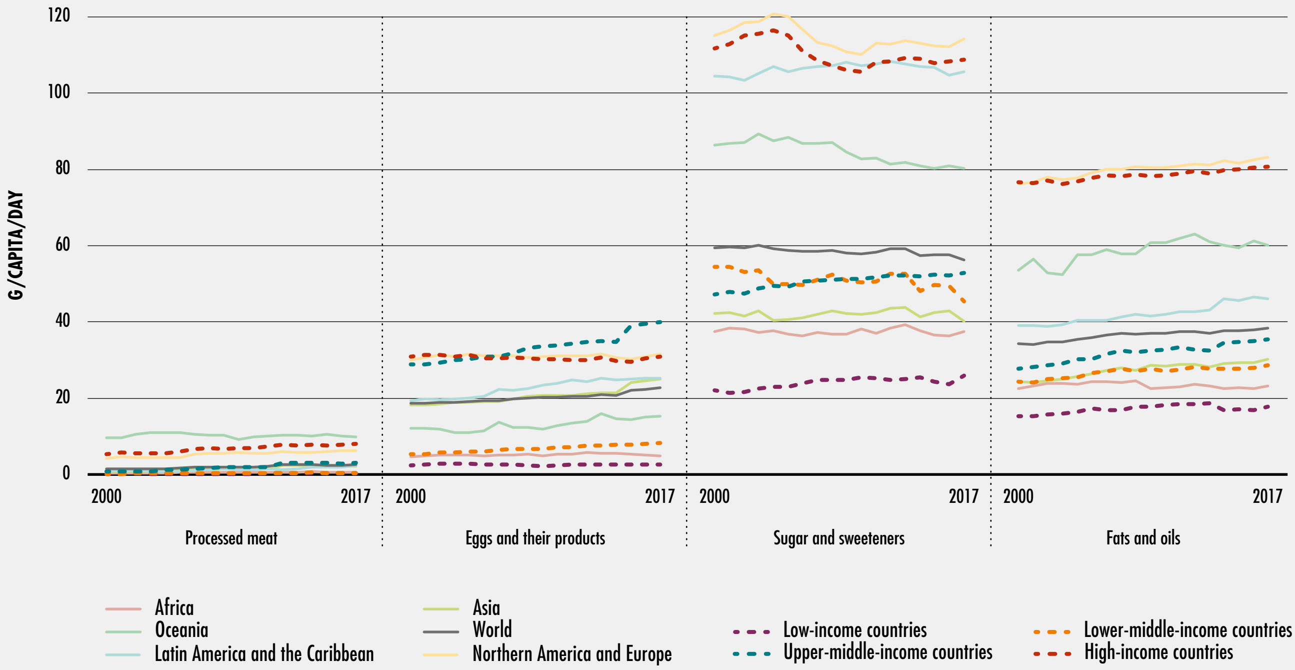
The results from this analysis are generally in agreement with the findings of two other studies based on individual-level data, which found that in most regions of the world, consumption of fruits and vegetables (among adults) is largely inadequate.[93,94]

Availability of animal source foods overall is highest in high-income countries, but it is fast growing in upper-middle-income countries. Global trends in the availability of animal source foods showed an increase for eggs, fish, poultry, processed meat and dairy products between 2000 and 2017 (Figures 17, 18 and 19).

Most of the global increases in animal source foods were observed in lower- and upper-middle-income countries. Asia showed the largest increase in the total amount of animal source foods available, driven mostly by increases in dairy products in Central and Southern Asia (not shown).

In high-income countries during the period 2000–2017, availability of meat and dairy

FIGURE 19
FROM 2000 TO 2017, THE GLOBAL AVAILABILITY OF PROCESSED MEAT, EGGS AND FATS INCREASED, WHILE AVAILABILITY OF SUGAR DECREASED



NOTES: The estimates presented here are adjusted for food losses that happen along part of the supply chain, from post-harvest up to (and including) retail, and are adjusted for inedible portions. The "processed meat" group includes meat that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation (e.g. sausages, ham, canned meat). The "eggs and their products" group includes fresh and processed eggs. The "sugar and sweeteners" group refers to sugar, sweeteners (e.g. glucose, fructose) and sugar crops (e.g. sugar cane, sugar beet). The "fats and oils" group includes all types of animal fats and oils, and vegetable oils. For more details about the food groupings, see Annex 2.
SOURCE: FAO.

products was double the amount available in other country income groups. In 2017, red meat availability for these countries was 97 g/capita/day, which translates into 35.4 kg/capita/year. Availability of processed meat increased in all regions and country income groups between 2000 and 2017, particularly in upper-middle-income countries, Asia and Latin America and the Caribbean. Dairy availability in high-income countries declined since 2000, particularly in Oceania and Northern America and Europe. Low-income countries had the lowest availability of meat, eggs and fish with minor variations. Large increases in availability of eggs and fish between 2000 and 2017 are noted in lower-middle- and upper-middle-income countries.

Increased availability of meat, which likely reflects increasing demand, may have positive or negative implications for health depending on the context. For poor and vulnerable people in most low-income countries, and for population groups with higher nutrient requirements, such as infants and women of reproductive age, a small increase in meat and other animal source foods can greatly improve the nutritional adequacy of their diets, because they are good sources of quality protein and important micronutrients.[95] However, a high consumption of red and processed meat can contribute to high saturated fat and/or salt intakes, and is associated with higher risk of certain types of cancer and other diet-related NCDs.[93,96] Furthermore, diets high in animal source foods, particularly beef, lamb, milk and other dairy products have a higher environmental impact than plant-based diets (see Section 2.2).

The availability of sugars and fats is highest in high-income countries, but the largest increases were seen in upper-middle-income countries. Availability of fats and oils increased steadily for all regions and country income groups from 2000 to 2017 (see Figure 19). The highest increases were observed in upper-middle-income countries. High-income countries had the highest availability over time, but the smallest increase in percentage change. Looking at sugars and sweeteners, the availability in high-income countries (109 g/capita/day or 39.8 kg/capita/year) was double that of upper- and lower-middle-income countries in 2017, and four times the amount available in low-income countries.

The findings presented in Figures 17, 18 and 19 are in line with other empirical evidence that shows that in recent decades, diets, particularly from upper-middle-income countries, have shifted away from staples towards more animal source foods, sugars, fats and oils.[84,97]

Food groups available for consumption differ across country income groups. At the global level, in 2017, cereals, roots, tubers and plantains represent the highest contribution to the total food available for human consumption, both in terms of edible quantities (34 percent) and dietary energy (51 percent) (Figure 20). Globally, and in all country income groups dietary energy availability has increased since 2000, with high-income countries showing the smallest increase (not shown). Fruits and vegetables represent the second-most available food group (in percentage of weight), whereas their contribution to total dietary energy availability is small (6 percent globally), which is to be expected as they tend to be low in dietary energy. Conversely, sugars and fats are the second-highest group in terms of total dietary energy contribution, but they represent a relatively small fraction in terms of quantity available.

In low-income countries, cereals, roots, tubers and plantains represent nearly 60 percent of all food available (by weight) in 2017. This percentage decreases gradually with country incomegroups, down to 22 percent in high-income countries. Likewise, the contribution from animal source foods (fish, meat, eggs and dairy), in percentage of weight, varies with the country income group. It is higher in high-income countries (29 percent) compared to upper-middle- and lower-middle-income countries (20 percent), and lowest in low-income countries (11 percent).

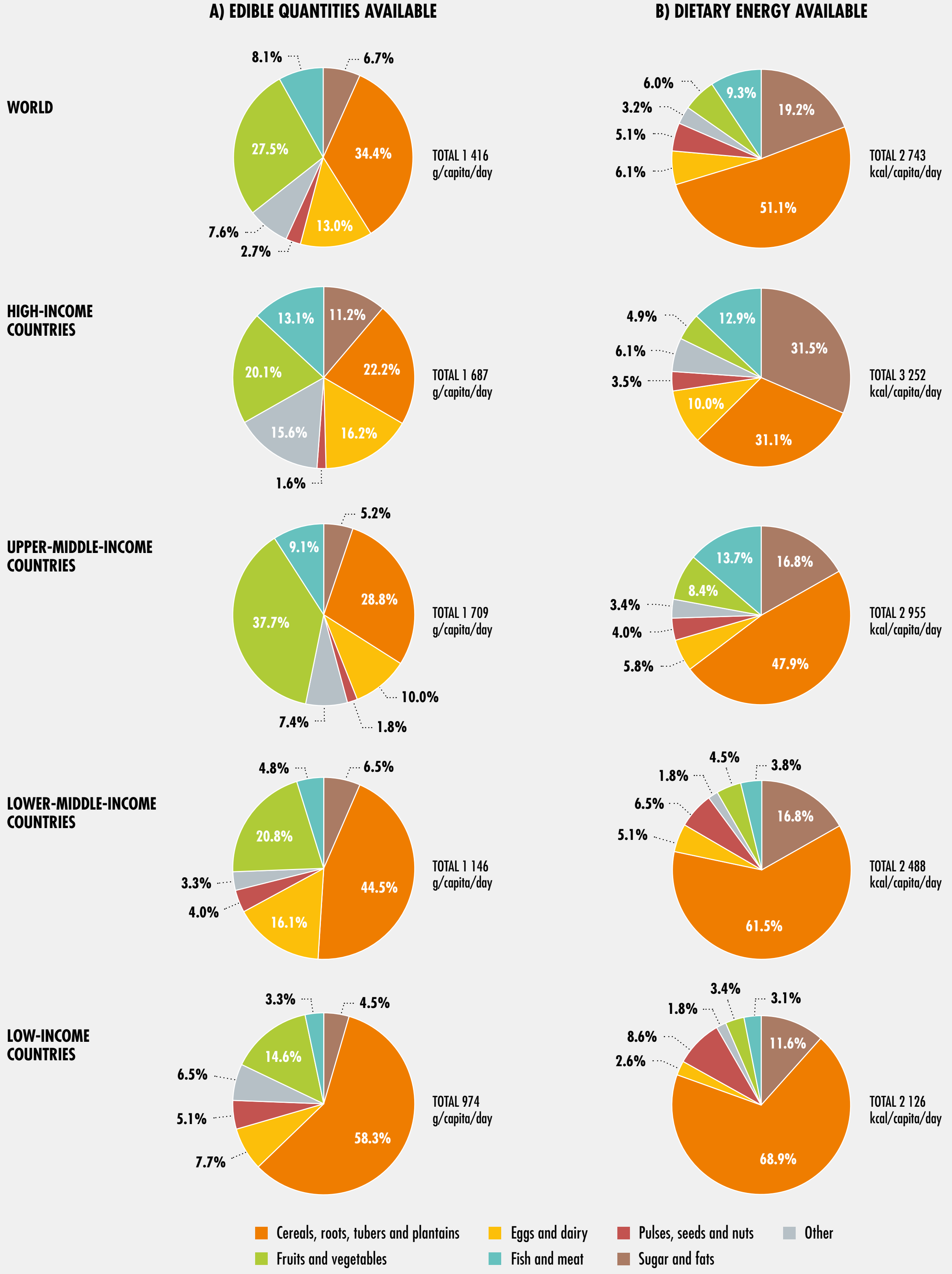
The SUA data that informs the above analyses reflect food availability for human consumption up to 2017. As such, this analysis does not factor in the effects of the COVID-19 pandemic on food availability. Box 7 summarizes some of the potential ways in which the COVID-19 pandemic is likely to impact the availability of nutritious foods and, consequently, diet quality of the population.

These analyses of national level food availability provide indirect information on trends in diet quality over time and across regions and country income groups. But it is information derived from actual food consumption and nutrient intake data – when available – that allows detailed assessments of diet quality in different populations. Indicators of dietary diversity like those used in the following section, compiled from such data, are an increasingly valuable component of the evidence base.

Dietary diversity of young children and women

A key element of diet quality is dietary diversity, or the variety of foods from different food groups that make up the diet. Eating a larger variety of foods tends to increase the chances that a person will consume adequate amounts of different nutrients necessary for their overall health and well-being. Several tools for measuring dietary diversity have been developed for specific populations, including the Minimum Dietary Diversity for Women (MDD-W) indicator (Box 8) and the Minimum Dietary Diversity (MDD) indicator for infants and young children. The latter is used for the global assessment below. The data that inform such indicators »

FIGURE 20
THE PROPORTIONS OF DIFFERENT FOOD GROUPS AVAILABLE FOR HUMAN CONSUMPTION DIFFER ACROSS COUNTRY INCOME GROUPS: A SNAPSHOT OF 2017



NOTES: The estimates presented here are adjusted for food losses that happen along part of the supply chain, from post-harvest up to (and including) retail, and are adjusted for inedible portions. The "other" group includes beverages (i.e. alcoholic, fruit juice, fruit juice concentrate, vegetable juice, vegetable juice concentrate and sweetened beverages), stimulants (tea, coffee and cocoa), spices and condiments, and sugar-preserved fruits. For more details about the food groupings, see Annex 2.
SOURCE: FAO.

BOX 7
POTENTIAL IMPACTS OF COVID-19 PANDEMIC ON AVAILABILITY AND ACCESS TO NUTRITIOUS FOODS AND OVERALL DIET QUALITY

Besides directly threatening people's health and well-being through viral infection, the COVID-19 pandemic will also impact access to nutritious foods and overall diet quality through social and economic channels and disruptions in food systems. Some of the likely impact channels include the following:

- The economic fallout may reduce purchasing power for sufficient, safe and nutritious foods, particularly for informal day labourers.[98] Migrants and their families will lose purchasing power due to the reduced flow of remittances, mostly used to purchase food.[99] Women,[100] youth[101] and persons with disabilities[102] will likely be much more affected, given that they are already disadvantaged in accessing economic and financial resources. In addition, restrictions in personal movement may decrease access to food even for those who have the economic means to obtain it.
- The economic impact of the pandemic may have more negative impacts on diet quality than on quantity, as grain supplies do not appear to be at risk. This is because their production is less labour-intensive and they can be stored for longer periods. Demand for staple foods has traditionally been less sensitive to price change than that of fruits, vegetables, meat and dairy products.
- In many countries, suppression measures like physical distancing requirements and restrictions on movement are affecting the production and transportation of high-value, labour intensive, perishable and nutritious foods, such as fruits and vegetables, meat, milk and other dairy products. Fresh produce, in particular, often requires many people to work in close proximity to cultivate, harvest and process. The crowded working conditions that characterize most dairy and meat processing plants also pose a challenge for meeting physical distancing needs. In addition, these perishable foods need to be moved quickly from farm to consumers, which makes them more vulnerable to travel restrictions and market shutdowns.
- Closure of informal markets may exacerbate the increasing inaccessibility of nutritious foods. In addition to their social and cultural importance, informal markets support healthy, nutritious diets as well as livelihoods of poorer population groups. The fresh foods sold in supermarkets and formal markets are often less affordable or inaccessible to urban poor groups.
- Highly processed, packaged foods that tend to be high in fats, sugars and/or salt are often less expensive than fresh and nutritious foods, especially in high- and upper-middle-income countries.[103] The lower price and the longer shelf life, coupled with limited access to fresh and nutritious foods, suggests that highly processed food products may be consumed in higher amounts leading to lower diet quality.[104]

The extent of the economic fallout and impact of physical distancing requirements is not yet known. The short-, medium- and long-term risks to food access and diet quality are yet to be fully understood.

» are generally collected using individual-level, non-quantitative food consumption modules, providing a much more direct assessment of what people are actually eating than the SUA data.

The first two years of life are marked by rapid physical growth and brain development. Children 6–23 months of age are especially vulnerable to growth faltering and nutrient deficiencies. To meet the energy and nutrient needs of infants and young children, a variety of foods and a minimum number of feedings a day are recommended.[105,106] UNICEF and WHO recommend a set of three indicators (minimum dietary diversity, minimum meal frequency and minimum acceptable diet) to assess the diet quality of young children through household »

BOX 8
MINIMUM DIETARY DIVERSITY FOR WOMEN: EVIDENCE FROM THREE COUNTRIES

The Minimum Dietary Diversity for Women (MDD-W) indicator is a proxy that reflects dietary diversity and micronutrient adequacy for women of reproductive age.[109] It is calculated by counting how many out of ten defined food groups* have been consumed over the previous 24 hours. If foods from five or more of these food groups have been consumed, minimum dietary diversity – which is associated with a greater chance of adequate intake of 11 micronutrients – is considered to be achieved.[110] Since the launch of the MDD-W in 2015, ten countries have collected nationally representative MDD-W data and many others have used it for research or impact evaluation at subnational level. The MDD-W indicator is one of the World Food Programme's (WFP) corporate indicators for stunting prevention and nutrition-sensitive programming in specific contexts. In 2018, there were data available for programmes in 29 countries.** In 2019, it was decided that the MDD-W would be included as a core indicator in the Demographic and Health Survey (DHS) Programme, which currently covers 90 countries.

Before this decision was taken, however, a few countries had already included the MDD-W in their national DHS. Nepal (2016), Tajikistan (2017) and Nigeria (2018) have reported the most recent available results.[111,112,113] The table in this box shows the percentage of women aged 15–49 years meeting MDD-W (≥5 food groups) in these three countries according to area of residence (urban/rural) and wealth quintile. Overall, 50 percent of women in Nepal achieved minimum dietary diversity; the figures for Nigeria and Tajikistan were 56 percent and 80 percent, respectively. A higher percentage of urban residents achieved minimum dietary diversity than their rural counterparts.

Foods from the "grains, white roots and tubers, and plantains" group were consumed most. Over 98 percent of the women in all three countries reported eating them. At least 70 percent of women in Nigeria and Tajikistan reported consuming food from the "meat, poultry and fish" group, compared with only 35 percent in Nepal. The percentage of women reporting consumption of "dark green leafy vegetables" was highest in Nigeria (72.7 percent) and lowest in Tajikistan (18.7 percent). For "other vitamin A-rich fruits and vegetables" the percentage was highest in Tajikistan (59.9 percent). For "other fruits", the percentage was lowest in Nigeria (35.7 percent).

PERCENTAGE OF WOMEN AGED 15–49 YEARS MEETING MDD-W (≥ 5 FOOD GROUPS) IN THE 24 HOURS PRECEDING THE INTERVIEW, ACCORDING TO URBAN/RURAL RESIDENCE AND WEALTH QUINTILE

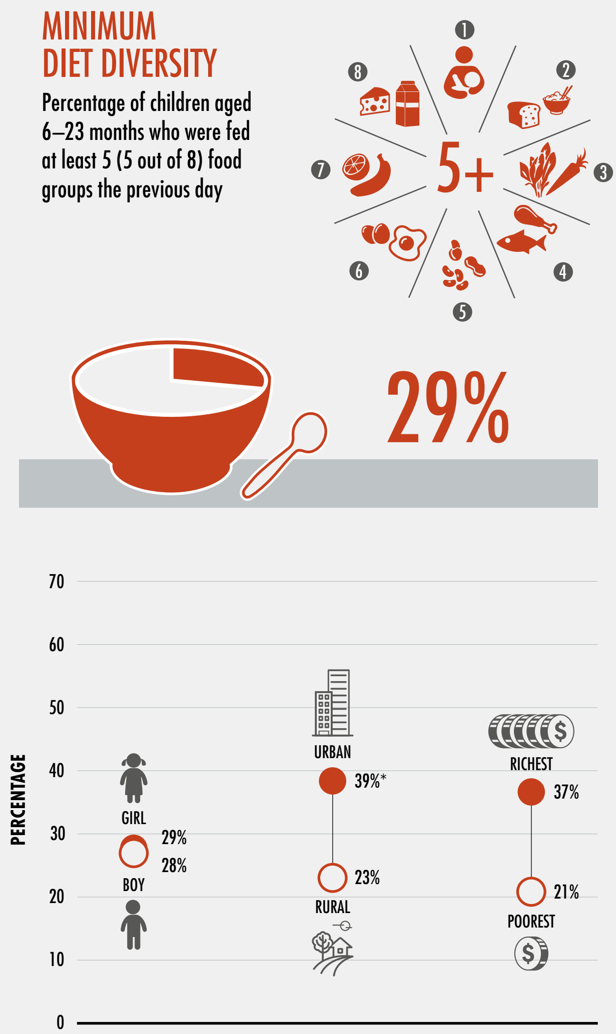
Background characteristic	Nigeria	Tajikistan	Nepal
Overall	56.0	80.0	50.0
By residence			
Urban	61.0	86.1	55.1
Rural	51.1	78.5	44.4
By wealth quintile			
Lowest	48.9	72.1	37.5
Second	48.0	76.3	44.3
Middle	53.4	81.3	43.6
Fourth	58.2	85.6	58.1
Highest	66.8	86.4	75.9

SOURCES: National Population Commission of Nigeria & ICF. 2019. *Nigeria Demographic and Health Survey 2018*. Abuja, Nigeria, and Rockville, USA; Statistical Agency under the President of the Republic of Tajikistan, Ministry of Health and Social Protection Population of the Republic of Tajikistan & ICF. 2018. *Tajikistan Demographic and Health Survey 2017*. Dushanbe, Republic of Tajikistan, and Rockville, USA; Ministry of Health of Nepal, New ERA & ICF. 2017. *Nepal Demographic and Health Survey 2016*. Kathmandu, Nepal, Ministry of Health of Nepal.

* The ten food groups are: 1) grains, white roots and tubers, and plantains; 2) pulses (beans, peas and lentils); 3) nuts and seeds; 4) dairy; 5) meat, poultry and fish; 6) eggs; 7) dark green leafy vegetables; 8) other vitamin A-rich fruits and vegetables; 9) other vegetables; and 10) other fruits.

** WFP has also introduced a modified way of scoring the MDD-W to capture the contribution to micronutrient intake from specialized nutritious foods such as super cereal, which substantially increase the likelihood of having an adequate micronutrient intake. Super cereal and other specialized nutritious foods, for example, are provided to pregnant and lactating women who receive food assistance or are targeted by social protection programmes.[114]

FIGURE 21
CHILDREN LIVING IN URBAN HOUSEHOLDS AND THOSE FROM RICHER FAMILIES HAVE BETTER DIETARY DIVERSITY



SOURCE: UNICEF Global Databases, 2019.

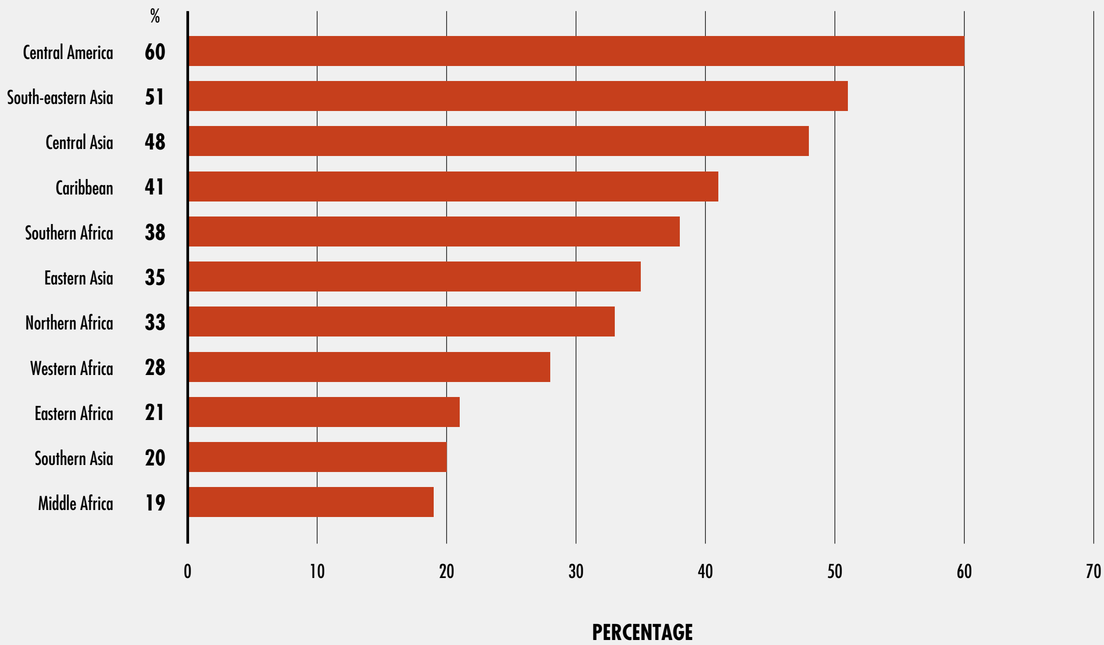
surveys.[107] These indicators consider the number of different food groups consumed and the number of times a child was fed in the 24 hours prior to the survey.

The MDD indicator[f] refers to the percentage of children 6–23 months of age who have consumed the recommended minimum number (five) of the following eight food groups: breastmilk; grains, roots and tubers; legumes and nuts; dairy products (infant formula, milk, yogurt, cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs; vitamin-A rich fruits and vegetables; and other fruits and vegetables. A proxy for the nutrient content of foods consumed by infants and young children, it is an indicator in the Global Nutrition Monitoring Framework for tracking progress towards WHA global nutrition targets for 2025 and 2030 SDG targets. Information on dietary diversity can be collected by simply asking about a child's consumption of foods from the different food groups during the previous 24 hours, as is done in the Demographic and Health Surveys and the UNICEF Multiple-Indicator Cluster Surveys. The data can also be constructed using 24-hour dietary recall data, as long as foods can be grouped into the standard groups listed above. UNICEF has been collecting data and maintaining a database on children's diets since the early 1990s when the initial set of global standard indicators were established. Indicators assessing the quality of children's diets such as MDD were developed relatively recently (2008–2010) and have been included in global databases since 2014.

Globally, less than one in three children 6–23 months of age (29 percent) met the minimum dietary diversity, i.e. ate foods from at least five out of eight food groups on the day prior to the interview, although there is wide variation across the world (Figure 21).[108] Dietary diversity was low in the majority of the regions, with less than 40 percent of children meeting minimum dietary diversity in seven out of the eleven subregions (Figure 22). Nearly three in five

f Following a technical consultation on infant and young child feeding practices in 2017, the definition for this indicator was revised. In order to meet minimum dietary diversity, children are required to eat foods from five out of eight rather than the previous cut-off of four out of seven food groups with breastmilk being the eighth food group.

FIGURE 22
PERCENTAGE OF CHILDREN 6–23 MONTHS OF AGE EATING FOODS FROM MINIMUM NUMBER OF FOOD GROUPS. THE VAST MAJORITY OF CHILDREN 6–23 MONTHS OF AGE ARE NOT MEETING THE MINIMUM DIETARY DIVERSITY



SOURCE: UNICEF Global Databases, 2019.

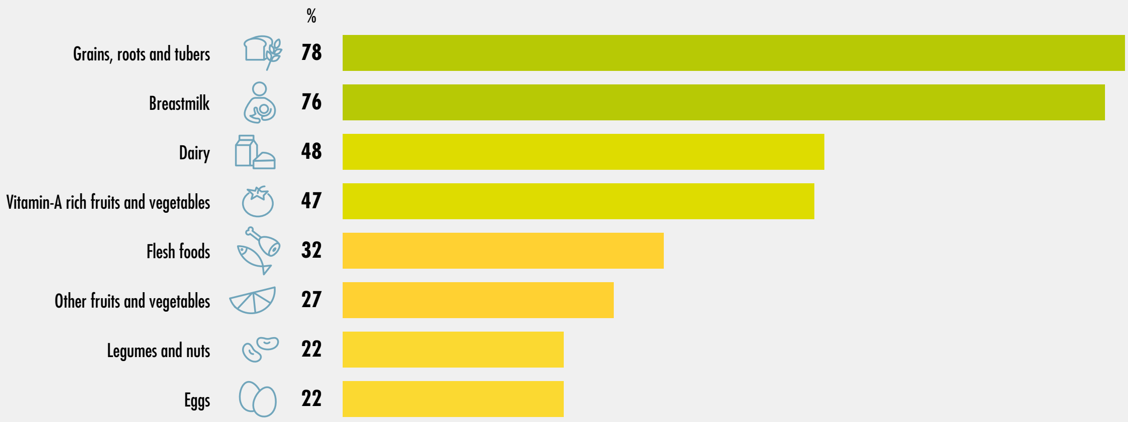
children 6–23 months of age met the minimum dietary diversity in Central America compared with only one in five in Southern Asia and Middle Africa. Overall, there are no notable differences in dietary diversity between boys and girls, but there are stark disparities in the prevalence of minimum dietary diversity by the place of residence (urban/rural) and wealth status. The prevalence of children eating foods from at least five out of eight food groups is on average 1.7 times higher among children living in urban areas than in rural, and those living in the richest households compared to the poorest (Figure 21).

Looking at consumption patterns by food group, three in four children consume grains/starchy foods and breastmilk. The Pan American Health Organization (PAHO) and WHO guiding principles for feeding breastfed and non-breastfed children indicate that flesh foods and eggs should be consumed daily (or as often as possible) because they are rich sources of many key micronutrients like iron and zinc.[105,106] However, less than one in three children consumed flesh foods such as meat, poultry and fish, and only one in five children consumed eggs in the previous day (Figure 23).[108]

How does food insecurity affect what people eat?

Households and individuals that experience food insecurity face uncertainties about their ability to obtain enough safe and nutritious foods for an active and healthy life, due to lack of money or other resources. As a consequence, they may have poorer diets than those that are food secure or only mildly food insecure.

FIGURE 23
THE MAJORITY OF CHILDREN IN THE WORLD CONSUME GRAINS, ROOTS AND TUBERS. FEW CHILDREN ARE BEING FED FLESH FOODS OR EGGS



NOTES: Analysis based on a subset of 72 countries with data available between 2013 and 2018 covering 61 percent of the global population.
SOURCE: UNICEF. 2019. *The State of the World's Children 2019. Children, Food and Nutrition: Growing well in a changing world*. New York, USA. Data from UNICEF Global Databases.

Much of the existing evidence highlighting the association between household food insecurity levels and dietary outcomes comes from Northern and Latin America and is based on data collected using experience-based food insecurity measures similar to the FIES. Studies from different countries have shown that both dietary diversity and consumption of nutritious foods, such as fruits, vegetables, dairy and meat, tend to worsen as food insecurity becomes more severe.[115,116,117,118,119] Preliminary analysis of FIES data, combined with data collected using new cross-country comparable metrics of diet quality, point to a similar association (Box 9). The body of evidence that is comparable across countries is growing as more countries include the FIES, or compatible scales, in national population-based surveys that also collect food consumption data.

The analysis presented below expands on previous studies by considering cross-country comparable measures of food insecurity that are calibrated against the global FIES scale. It explores dietary patterns according to levels of food insecurity based on the analysis of food security and food consumption data from two lower-middle-income countries, Kenya and Sudan, and two upper-middle-income countries, Mexico and Samoa.[g] Population average estimates of usual consumption for 11 food groups and of total dietary energy are computed for each food insecurity class. The food groupings were defined on the basis of their nutritional relevance following the classifications used in the FAO/WHO GIFT,[89] with some exceptions. Only statistically significant results are reported.[h] »

g The four surveys are nationally representative and include either the FIES (Kenya, Samoa and Sudan) or the ELCSA (Latin America and Caribbean Food Security Scale), which is a similar experience-based food insecurity measure (Mexico). The mean consumption (per capita per day) was estimated for a selection of 11 food groups, along with the dietary energy for all food groups. For the analysis of dietary energy with HCES data (Kenya, Sudan and Samoa) only food items reported in terms of quantities were considered; food items reported only as expenditure (e.g. lunch consumed away from home) were excluded. In the analysis of dietary energy with Mexico ENSANUT 2012 (individual dietary intake data), all items were considered.

h Regression analyses are followed by Tukey's pairwise post-hoc tests to determine whether there was a difference between the mean of all possible pairs, except for Samoa, where differences across groups were assessed with regression analysis only.

BOX 9

ASSOCIATION BETWEEN FOOD INSECURITY BASED ON THE FIES AND DIET QUALITY BASED ON NEW METRICS: EVIDENCE FROM GHANA AND THE UNITED REPUBLIC OF TANZANIA

As mentioned at the beginning of Section 1.3, diet quality is a multifaceted construct, comprising diversity, adequacy, moderation and overall balance. A Diet Quality Questionnaire (DQ-Q) has been developed with the aim of measuring diet quality at the population level in a way that is comparable across countries.[121] It takes five minutes or less to administer. It is designed to gather data on consumption of food groups, which is then used to create a suite of healthy diet indicators.

Three of the indicators of diet quality, described in greater detail in **Annex 2**, are:

- Food Group Diversity Score (FGDS)
- Score of consumption of nutritious foods that contribute to healthy diets (FLAVOURS)
- Score of consumption of dietary components that should be limited or avoided (FAD)

The FGDS reflects dietary diversity for the general population.* The other two indicators reflect the likelihood of meeting current WHO global dietary recommendations.** These indicators can be used to identify problem areas of diets at the population level, such as too-low consumption of fruits and vegetables, whole grains, legumes, nuts and dietary fibre (FLAVOURS), or excessive intake of free sugars, salt, total fat and saturated fat (FAD).

In 2019, the Gallup© World Poll (GWP) implemented both the DQ-Q and the FIES in Ghana and United Republic of Tanzania.*** Preliminary analyses are presented here to assess the association between food security status and diet quality (see **Annex 2** for more details). The models controlled for household size, age, gender, marital status, education and income.

In both countries, those who are food insecure consume less diverse diets and fewer nutritious foods that contribute to healthy diets. Diet quality worsens with increasing severity of food insecurity. In addition, food insecure individuals in these two countries are also less likely to consume dietary components that should be limited, such as highly processed, energy-dense foods high in fats, sugars and/or salt. In other countries that have different socio-economic contexts, food insecurity could be associated with greater consumption of these foods. All three indicators of diet quality are important to monitor, especially in light of evidence pointing to dietary and nutrition transitions and the multiple burden of malnutrition in lower-middle and upper-middle-income countries.[122] In the United Republic of Tanzania, gender is also associated with differences in diet quality. Women consumed less diverse diets, fewer nutritious foods and also fewer energy-dense foods high in fats, sugars and/or salt than men.****

In summary, the findings show that in both countries, food insecurity is associated with lower diet quality in terms of both food group diversity and nutritious foods. In the United Republic of Tanzania, being female is associated with the same reduction in diet quality.

* FGDS uses the same ten food groups as the Minimum Dietary Diversity for Women of reproductive age (MDD-W).

** These recommendations are based on WHO (2018)[73] in addition to IARC (2018).[123]

*** The DQ-Q was implemented as part of the Global Diet Quality Project, which aims to measure diet quality across countries globally through the Gallup© World Poll (GWP). The DQ-Q survey module can be adopted and implemented by other survey mechanisms, enabling capacity for diet quality monitoring at country level.

**** In Ghana, there is no notable association between gender and diet quality; being female is associated with only slightly higher diet diversity.

» In Kenya, Samoa and Sudan, food consumption information was collected at the household level in Household Consumption and Expenditure Surveys (HCES).[i] In Mexico, it was captured at the individual level using an individual-level food consumption survey. Individual-level surveys provide detailed quantitative individual food and nutrient intake information that can be disaggregated at many levels (e.g. sex and age). Due to their high cost and complexity, the number of recent, nationally representative surveys is relatively small. Food consumption data from HCES, on the other hand, are more widely available, across countries and over time. However, HCES are not purposefully designed to capture food consumption. Instead, they provide information at the household level, albeit not for individual household members. For this reason, while the food insecurity status in the analysis that follows is comparable across countries, the food consumption levels should be compared with caution (see **Annex 2** and Alvarez-Sanchez *et al.* (forthcoming)[120] for a full description of the methodology and the results).

Overall, the analysis reveals that people who experience moderate or severe food insecurity consume less meat and dairy products (in all four countries) and less fruits and vegetables (Kenya and Sudan) than those who are food secure or mildly food insecure (from here on, referred to as "food secure") (Figure 24). Consumption of cereals, roots, tubers and plantains, and pulses, seeds and nuts either decreases slightly, remains similar, or increases, resulting in a higher proportional contribution of these food groups to the total diet. The more food insecure people are, the larger the share of staples in their diet. This holds true even if food insecure people in Kenya and Sudan reduce their consumption of staples, because they reduce consumption of other food groups even more.

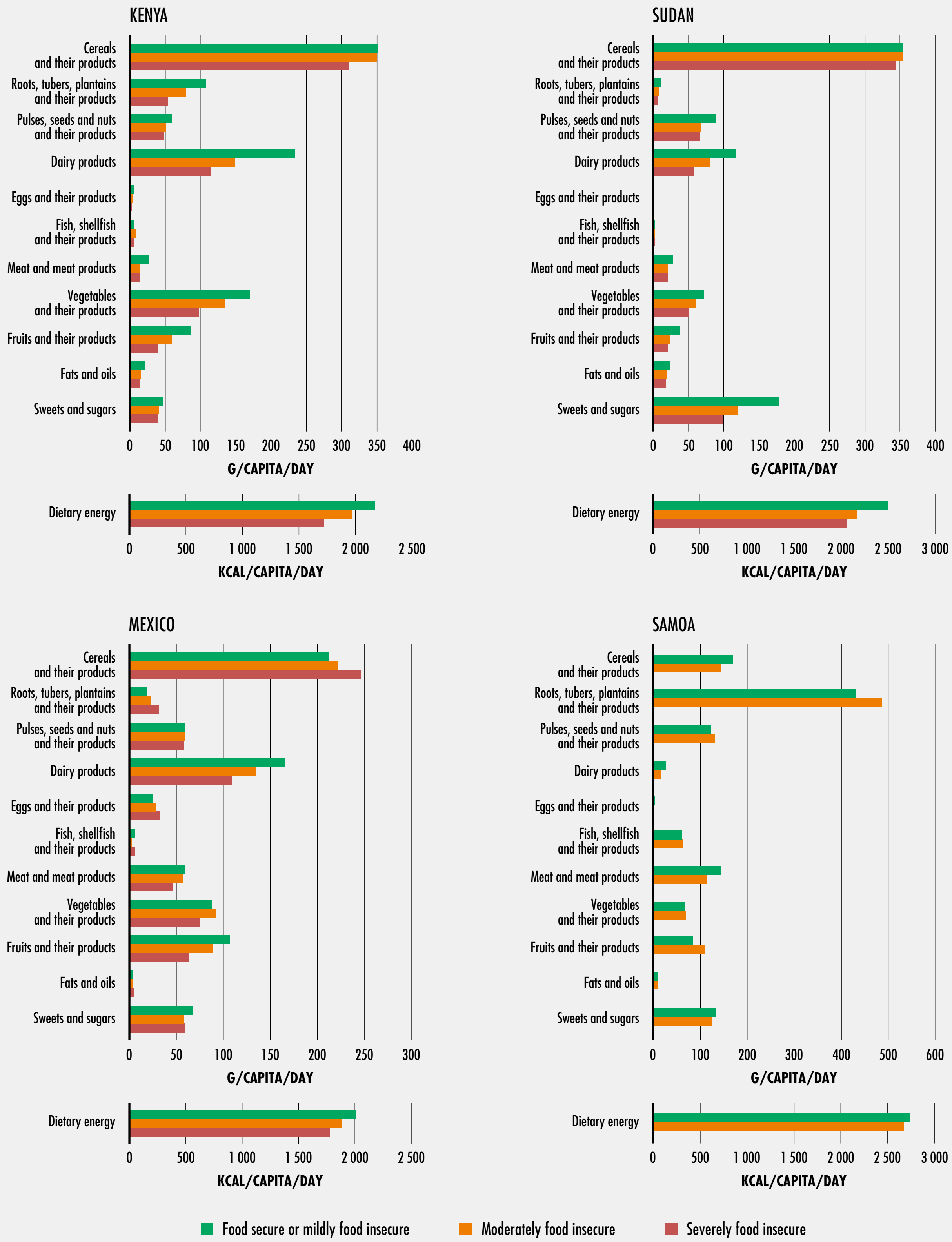
i The three HCES used in this analysis (from Kenya, Samoa and Sudan) collected information on food consumed at the household level (i.e. apparently consumed; this may include food waste at the household level). This is in contrast to the individual-level food consumption survey from Mexico that collected information on individuals' food intake (i.e. food ingested). However, for simplicity, herein, we use the term "consumption" to refer to food estimates and "intake" to refer to dietary energy estimates, from both household and individual-level data. Our use of the term "consumption" differs from that of economists who refer to "consumption" as food and non-food expenditures.[133]

In Kenya and Sudan, those who experience moderate food insecurity consume lower quantities of all food groups than those who are food secure – with the exception of cereals in both countries and fish in Kenya – and have a lower dietary energy intake. People experiencing severe food insecurity consume lower quantities of roots, tubers and plantains, dairy, vegetables, fats and oils, sweets and sugars (Kenya and Sudan), cereals, fruits, eggs and fish (Kenya) than those who are moderately food insecure. In Kenya, food insecure people consume a slightly higher amount of fish, compared with those who are food secure. This could be explained by the fact that subsistence fishing is practiced by some of the poorest and most food insecure communities in the country.[124]

In Mexico and Samoa, notable variations in the diet are also observed between the food secure and the food insecure groups, but they follow a different pattern than Kenya and Sudan. As food insecurity becomes more severe, dietary energy intake remains relatively stable in Samoa and declines less markedly in Mexico compared to Kenya and Sudan. There is a reduction in the consumption of some animal source foods (such as dairy and meat), but minimal change (or even an increase) in the consumption of some plant-based foods (such as cereals, roots, tubers and plantains, pulses, seeds and nuts, and vegetables) and sweets and sugars. In Mexico, fruit consumption decreases with food insecurity, whereas in Samoa it increases. Conversely, consumption of eggs in Mexico is higher for those who are food insecure.

The finding that diet quality worsens with increasing severity of food insecurity is consistent with the theoretical construct of food insecurity on which the FIES is based: people experiencing moderate food insecurity face uncertainties about their ability to obtain food and have been forced to compromise on the nutritional quality and/or quantity of the food they consume. On the other hand, people experiencing severe food insecurity have typically run out of food and, at worst, gone one or more days without eating.[125] »

FIGURE 24
AS FOOD INSECURITY BECOMES MORE SEVERE, FOOD CONSUMPTION AND DIETARY ENERGY INTAKE DECREASE AND STAPLES MAKE UP A LARGER SHARE OF THE DIET



NOTES: Food consumption estimates shown for selected food groups only. In Kenya, Sudan and Samoa, food insecurity was measured with the FIES, and food group and dietary energy consumption were calculated excluding food items reported only in terms of monetary value (with no food quantities attached). In Samoa, the prevalence of severe food insecurity was very low, thus, the prevalences of moderate and severe food insecurity were combined. In Mexico, food insecurity was measured with the "*Escala Latinoamericana y Caribeña de Seguridad Alimentaria*" (ELCSA), and food group and dietary energy consumption were calculated considering all food items. For details about the food groupings, see Annex 2.
SOURCE: FAO, with data from from the Kenya Integrated Household Budget Survey 2015, the Sudan Study of Consumption Patterns and Nutrition 2018, Mexican *Encuesta Nacional de Salud y Nutrición* (ENSANUT) 2012, and the Samoa Household Income & Expenditure Survey 2018.

» The ways in which moderately food insecure people modify their diets vary according to the income level of the country. In the two lower-middle-income countries studied (Kenya and Sudan), there is a marked decrease in consumption of most food groups, and an increase in the share of staples in the diet. In the two upper-middle-income countries examined (Mexico and Samoa), people who are moderately food insecure consume more foods that are typically cheaper on a per-calorie basis (cereals, roots, tubers and plantains), and consume lesser amounts of expensive foods (meat and dairy), compared with those who are food secure. Mexico in particular shows a decrease in fruit and dairy consumption as the severity of food insecurity increases. This is in line with studies that show that the purchase of fruits and milk is sensitive to changes in income and prices.[126] The increase in fruit consumption with worsening food insecurity in Samoa may be explained by the fact that those who are food insecure consume more fruits from their own-production instead of purchasing it.[127]

There are several plausible reasons why food insecurity, as measured by experience-based scales like the FIES, may contribute to different dietary outcomes in lower-middle- and upper-middle-income countries, to the extent that these countries may be exemplary of other countries in the same income-level groups. First, healthy diets may generally be less affordable in lower-middle-income countries than in upper-middle-income countries. As discussed in Section 2.1 of this report, healthy diets are unaffordable to many people, especially the poor, in every region of the world. Second, social protection programmes may receive less funding in lower-middle-income countries.[128] Lastly, vulnerable people's access to food, especially perishable nutritious foods, may be more compromised in lower-middle-income countries than in upper-middle-income countries, due to lack of physical infrastructure and food processing and storage technology, as well as food safety issues.[129] Problems like these associated with the food supply chain tend to drive up the cost of nutritious foods, as discussed in Section 2.3 of this report.

One possible reason the difference in dietary energy intake between food secure and moderately food insecure people is smaller in Mexico and Samoa than in Kenya and Sudan is that Mexico and Samoa are well into the nutrition transition, which is characterized by a rapid shift in diet composition towards a higher intake of highly processed, energy-dense foods that have minimal nutritional value and are cheap and widely available.[97]

As more countries collect good quality household- or individual-level food security and food consumption data, this analysis can be expanded to shed more light on the links between food insecurity and diet quality around the world. Combined with ongoing efforts to develop national FBDGs and address the challenges of global monitoring of diet quality, more and better evidence will soon be available to guide actions aimed at guaranteeing universal access to enough nutritious foods for healthy diets. ■

1.4 CONCLUSIONS

With ten years to go until 2030, the world is off track to achieve the SDG targets for hunger and malnutrition. After decades of long decline, the number of people suffering from hunger has been slowly increasing since 2014. The trends shown by the prevalence of undernourishment and the prevalence of severe food insecurity based on the FIES both point to failed progress. Beyond hunger, a growing number of people have been forced to compromise on the quality and/or quantity of the food they consume, as reflected in the increase in moderate or severe food insecurity since 2014. Projections for 2030, even without considering the potential impact of COVID-19, serve as a warning that the current level of effort is not enough to reach Zero Hunger ten years from now.

As for nutrition, progress is being made on decreasing child stunting and low birthweight and increasing exclusive breastfeeding for the first six months of life. However, prevalence of wasting is notably above the targets and the prevalence of both child overweight and adult obesity is increasing in almost all regions, a worrisome trend that will add to the global burden of disease and increase public health service and health care costs. These trends in hunger, food insecurity and malnutrition must be reversed. COVID-19 is expected to exacerbate these trends, rendering vulnerable people even more vulnerable. Urgent action is needed in order to meet the 2030 targets, even as the world braces for the impact of the pandemic.

Increasing availability of and access to nutritious foods that make up healthy diets must be a key component of stronger efforts to achieve the 2030 targets. The availability of dietary energy per person has increased globally over the past two decades. However, this has not translated into an increase in the availability of nutritious foods that contribute to healthy diets. There are large discrepancies in the per capita availability of foods from different food groups across countries of different income levels. Low-income countries rely more on staple foods and less on fruits and vegetables and animal source foods than high-income countries. An increase in per capita availability of fruits and vegetables has been observed since 2000. And yet, according to the analysis presented, only upper-middle-income countries and Asia have a daily per capita availability above the recommended level of consumption. Worldwide, less than a third of young children are eating foods from the minimum number of five food groups needed to meet their energy and nutrient needs.

The quality of people's diets worsens with increasing constraints on their access to food, putting them at higher risk of undernutrition as well as overweight and obesity. Among other factors, cost is a key determinant of access to food. Part 2 of this report sheds light on how food prices and affordability of diets contribute to food insecurity and inequalities in diet quality. It also maps out actions needed to reshape food systems in ways that guarantee universal access to enough nutritious foods that contribute to healthy diets. The remaining years of the UN Decade of Action on Nutrition 2016–2025 present an opportunity for policymakers, civil society and the private sector to work together and accelerate efforts. There is still time to get back on track towards achieving Zero Hunger and ending all forms of malnutrition by 2030. ■

ECUADOR
Freshly caught fish arrives at the artisanal Fishery Cooperative of Santa Rosa de Salinas in Ecuador.
©FAO/Camilo Pareja

PART 2
TRANSFORMING FOOD SYSTEMS TO DELIVER AFFORDABLE HEALTHY DIETS FOR ALL

PART 2

TRANSFORMING FOOD SYSTEMS TO DELIVER AFFORDABLE HEALTHY DIETS FOR ALL

Policies that aimed to increase food availability and energy intake with less focus on improving the quality of the food have long been a key element of the efforts to end hunger. But this paradigm is changing. The prevailing strategy to end hunger and eliminate malnutrition must address other multifaceted challenges: i) there are multiple burdens of malnutrition; ii) food policies have overemphasized calories and protein quantity, neglecting a wider range of dietary quality required for people's health and development; and iii) any approach to addressing hunger and all forms of malnutrition must also consider the sustainability of food systems.

As shown in Part 1 of this report, most countries are not on track to meet the SDG 2 targets to end hunger and food insecurity (SDG Target 2.1) and all forms of malnutrition (SDG Target 2.2) by 2030. The COVID-19 pandemic will make it more difficult to get back on track. Part 1 shows that undernourishment and food insecurity are not the only challenges, but also overweight and obesity and other forms of malnutrition. In this respect, food and diet quality is a critical link between food security and nutrition outcomes, in all its forms, particularly overweight and obesity. No doubt, the link should be strengthened to achieve SDG 2.

The health impacts associated with poor quality diets are significant. Unhealthy diets are a leading cause of non-communicable diseases (NCDs), mainly cardiovascular diseases, cancers and diabetes, that result in death.[1] Both overweight and obesity are significant risk factors for NCDs, and increasing healthcare costs linked to rising obesity rates are a trend across the world. Out of 56.9 million deaths globally in 2016, 40.5 million deaths, or 71 percent, were attributable to NCDs.[2]

A healthy diet ensures adequate calories and nutrients. It includes a balanced, diverse intake of foods from several different food groups. It is intended to meet all requirements of nutrient adequacy and help prevent malnutrition in all its forms, as well as NCDs. Diet quality is an important link between food security and nutrition outcomes and is a crucial part of all efforts to achieve the hunger, food security and nutrition targets of SDG 2. Meeting these targets will only be possible if people have enough food to eat and *what* they are eating is nutritious.

One of the biggest challenges of achieving this, is the cost and affordability of healthy diets. New evidence presented in this part of the report shows that healthy diets are unaffordable for many people in every region of the world, especially for the poor and those facing economic challenges. Evidence presented in this part of the report also demonstrates that the higher cost and unaffordability of healthy diets is associated with increased food insecurity and different forms of malnutrition, including stunting and adult obesity. Shocks, like the COVID-19 pandemic, exacerbate this because they negatively affect poor people's quality of diet and make healthy diets less accessible in many parts of the world.

The story does not end there. There are also hidden costs and externalities associated with current food consumption patterns, notably those related to the health and environmental consequences of our dietary choices. They increase the costs of dealing with health problems and adverse effects of climate variability, among other environmental challenges. However, these costs are not reflected in the price of foods and diet.

These issues must be considered within the context of a world where hunger continues to increase, 2 billion people experience food insecurity, and the burden of malnutrition in all its forms remains a challenge. With just a decade away from the endpoint of the 2030 Agenda for Sustainable Development (2015–2030) and with only five years remaining in the UN Decade of Action on Nutrition (2016–2025), hard questions remain. How can the world end hunger and all forms of malnutrition, while transforming food systems to provide affordable healthy diets for all? How can the remaining years of the Decade of Action on Nutrition be leveraged to accelerate action? What are the costs and trade-offs of actions? This part of the report provides new evidence that addresses these important questions and identifies the main drivers that make access to affordable healthy diets challenging. Further, this part of the report also identifies the main drivers behind the high cost of nutritious foods and provides guidance on policy and investments for countries to transform their food systems to provide access to affordable healthy diets for everyone, while tackling trade-offs and making the most of synergies for environmental sustainability. ■

2.1 THE COST AND AFFORDABILITY OF HEALTHY DIETS AROUND THE WORLD

KEY MESSAGES

➔ While we still face significant challenges in just accessing food, challenges are even more important in terms of accessing healthy diets. One of the biggest challenges is the current cost and unaffordability of healthy diets.

➔ Analyses conducted for this report show that healthy diets cost 60 percent more than diets that only meet the requirements for essential nutrients and almost 5 times as much as diets that meet only the dietary energy needs through a starchy staple.

➔ The cost of a diet increases incrementally as the diet quality increases – from a basic energy sufficient diet to a nutrient adequate diet and then to a healthy diet including more diversified and desirable food groups – across all regions and country income groups globally.

➔ The high cost and unaffordability of healthy diets is associated with increasing food insecurity and different forms of malnutrition, including child stunting and adult obesity.

➔ The unaffordability of healthy diets is due to their high costs relative to people's incomes, a problem likely to be exacerbated by COVID-19.

➔ Healthy diets – that reflect global guidelines and include foods from several groups and have greater diversity within food groups – are unaffordable for more than 3 billion people, and more than 1.5 billion people cannot even afford a diet that only meets required levels of essential nutrients.

➔ Most of the people who cannot afford healthy diets live in Asia (1.9 billion) and Africa (965 million). Many others live in Latin America and the Caribbean (104.2 million), with the fewest in Northern America and Europe (18 million).

➔ The cost of a healthy diet is much higher than the international poverty line, established at USD 1.90 purchasing power parity (PPP) per day. This puts healthy diets beyond the reach of those living in poverty or just above the poverty line.

➔ The cost of a healthy diet exceeds average food expenditures in most countries in the Global South. More than 57 percent or more of the population throughout sub-Saharan Africa and Southern Asia cannot afford a healthy diet.

➔ The challenges are greater for countries with a protracted crisis situation. While the cost of a healthy diet in these countries is comparable to the global average, 86 percent of the population in these countries cannot afford it. This is more than double the world average figure (38 percent) and is 57 percent higher than what is estimated for the Global South.

➔ Food systems transformation is required to address the problem of millions of people not being able to afford healthy diets because of high food price and income constraints. At the same time, this transformation should create supportive food environments, encourage people to learn about nutrition and spur behaviour change that can lead to healthy food choices.

Cost and affordability of healthy diets are critical for food security and nutrition

The world faces immediate challenges in making healthy diets accessible for everyone, an essential requirement in meeting the hunger and nutrition targets of SDG 2. The COVID-19 pandemic has made the situation even more difficult. One of the biggest challenges is the current cost and unaffordability of healthy diets.

What does the evidence tell us?

The cost and affordability of the foods that form a healthy diet are important determinants of food choices. As such, they can affect food security, nutrition and health. The cost refers to what people have to pay to secure a specific diet. Affordability, on the other hand, is the cost of the diet relative to income.[j] Evidence shows that the cost and affordability of a diet is linked to the quality of the diet, and to food security and nutrition outcomes.[3,4,5,6,7]

Overweight and obesity are the outcomes of a myriad of socio-economic factors along with childhood undernutrition.[k] However, there is strong evidence that the higher prices of healthy food options – and cheaper, less nutritious food options – are contributing to the growing trend of overweigth and obesity. Changes in relative prices between energy-dense foods of minimal nutritional value and nutritious foods also make a difference. The strongest effects are seen among people struggling on low incomes, who are most sensitive to and most affected by the cost of food.[8]

A recent global study comparing the relative caloric unit costs of nutritious foods and energy-dense foods that are high in fat, sugar and/or salt[l] has found that food price variation helps explain international patterns in child stunting and adult overweight and obesity.[7] The relative cheapness of these energy-dense foods was found to be positively associated with excess body weight in adults. There was a strong link between the overweight prevalence among adults and low prices of sugar, as well as foods and drinks containing high amounts of sugars. This is consistent with a growing literature linking the consumption of these products to weight gain.[9,10]

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j In this report the cost of a diet refers to the sum of the value of all the food items that make up the diet. The value, in turn, is the price per unit for each food item multiplied by the quantity of the food item.

k Evidence points to the fact that childhood undernutrition also increases the risk of later overweight and obesity. See, for example, Wells *et al.* (2020).[338]

l Associations between relative calorie prices (RCPs) for sugar, soft drinks, oils/fats and salty snacks and adult overweight prevalences revealed statistically significant coefficients for all four energy-dense foods, although the associations are stronger for sugar and soft drink prices.[7]

These results not only apply to high-income countries but also to lower-middle and low-income countries, where overweight and obesity are a pervasive and growing problem. Income growth of countries is associated with lower levels of stunting, as well as with increases in overweight and obesity.[11] The relative inexpensiveness of energy-dense foods high in fat, sugar and salt is implicated in high rates of obesity. This is seen in high-income countries[12] as well as in transitional economies, such as China, India and urban Africa. New research also shows that overweight increases in lower-middle-income countries are mainly due to very rapid changes in food systems, particularly the availability of cheap, highly processed food and sugar-sweetened beverages.[13]

Recent evidence shows that reductions in child stunting, which also reduces the risk of overweight and obesity, are associated with lower relative prices of fresh cow's milk, eggs, meat, fish and fortified infant foods.[7,14] However, evidence is not conclusive and additional studies are needed, including the potential nutritional impacts of eggs and cow's milk in key target groups.[15,16,17,18,19]

New analysis in this report provides further evidence of the association between cost and affordability of a healthy diet (see Box 10 for definition and **Annex 3** for the methodology of the healthy diet) and food security and nutrition outcomes.[m] It shows that, across regions and country income groups, the more unaffordable a healthy diet is, the greater the prevalence of undernourishment (PoU) and child stunting becomes (Figure 25). Regional differences and development context matter, however. Looking at country income groups in Figure 25a, we see that high-income countries, mainly representing Europe and Northern America, are concentrated in the bottom left of the graph, denoting average lower levels of undernourishment and higher affordability of healthy diets than in other countries.

Similarly, African countries, represented by blue dots in Figure 25d, report the highest rates of stunting associated with higher unaffordability of healthy diets (with few exceptions).

The association between adult obesity and affordability of a healthy diet is the inverse of the other associations. High-income countries have the highest affordability figures of the healthy diets and, at the same time, the highest rates of adult obesity. Likewise, Latin America and the Caribbean have also among the highest adult obesity rates, although with slightly higher unaffordability (Figure 25e-f), as the cost of the healthy diet in this area is higher than the average in high-income countries (USD 3.98 vs. USD 3.43). In fact, results in these regions align with recent research on the different stages of the so-called "obesity transition", in which as countries develop and GDP per capita grows, the prevalence of overweight and obesity increases substantially. However, this picture hides demographic and socio-economic differences within countries and, over time, different groups are affected. Where cheap energy-dense foods of minimal nutritional value are available, the poor will buy these foods, as healthy diets are still too expensive for them.[20,21] Many high-income countries, notably the United States of America and Europe, have for some time been in that stage of the "obesity-transition" where the prevalence of obesity among those with lower socio-economic status surpasses that of those with higher socio-economic status. However, it should be noted that, although this is not the only variable that influences weight gain, the focus of this report remains on the cost and affordability.

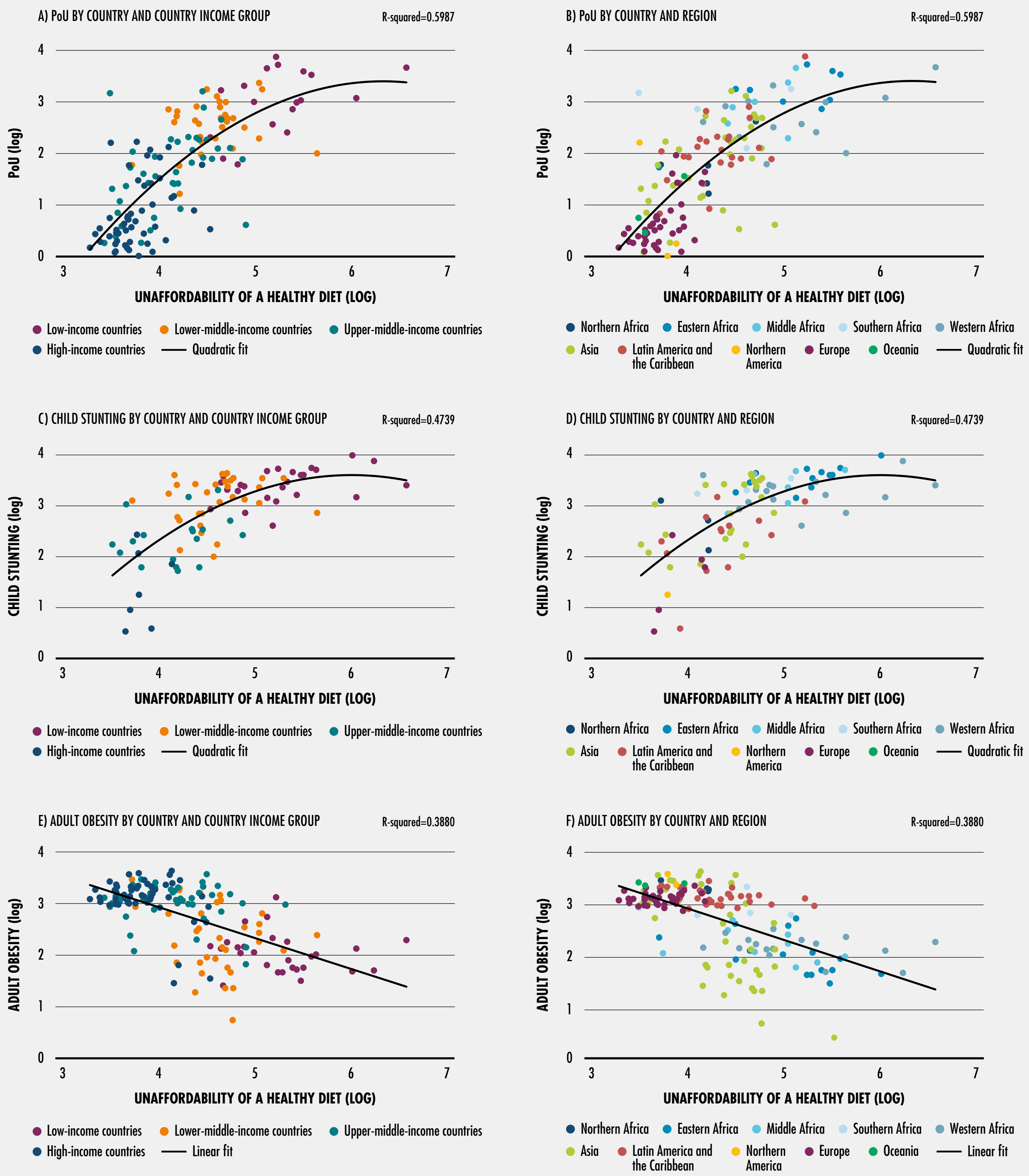
How do costs and affordability of diets constrain access to food?

Cost and affordability measure one aspect of food systems, namely the degree to which food choices are constrained by food prices and household (or per capita) income. Of all the barriers to food access, cost and affordability are among the most important, particularly in the case of nutritious food.[22,23] According to FAO and WHO (2019),[24] "Sociocultural aspects of food choice notwithstanding, people generally eat what they can afford." »

m These findings are aligned with the findings from other studies: Esfarjani *et al.* (2013),[339] Dagnelie, Van Staveren and Hautvast (1991),[340] Krasevec *et al.* (2017),[341] Branca and Ferrari (2002)[342] and Rah *et al.* (2010).[343]

FIGURE 25

THE UNAFFORDABILITY OF A HEALTHY DIET IS STRONGLY ASSOCIATED WITH FOOD INSECURITY AND DIFFERENT FORMS OF MALNUTRITION, INCLUDING CHILD STUNTING AND ADULT OBESITY



NOTES: The figure shows simple regression analysis between the PoU, child stunting and adult obesity (vertical axis), and the unaffordability of a healthy diet (horizontal axis) by country income group and region. Higher values on the horizontal axis reflect higher levels of unaffordability of the healthy diet expressed as a percentage of average country food expenditures measured in year 2017. All variables are expressed in logarithms. For each country, the most recent data on child stunting available between year 2014 and 2019 are used, whereas the PoU refers to year 2017 and adult obesity refers to year 2016. The R-squared denotes the percent of the variance in the variable on the vertical axis explained by affordability of the diet. See Box 10 for the definition of the healthy diet and Boxes 11 and 12 for the cost and affordability methodology. For the full methodological notes and data sources, see Annex 3.

SOURCE: FAO for PoU; UNICEF, WHO and International Bank for Reconstruction and Development/World Bank. 2019. UNICEF-WHO-The World Bank: Joint child malnutrition estimates – Levels and Trends (March 2019 edition) [online]. https://data.unicef.org/topic/nutrition; www.who.int/nutgrowthdb/estimates; https://data.worldbank.org; and affordability data can be found in Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» Access to food is generally determined by physical access (e.g. own production, distance to markets, availability in markets, natural resources and biodiversity that provide wild foods) and economic or financial access (e.g. purchasing power, access to credit). In some circumstances social access (e.g. ability to secure food through social networks, based on extended family, ethnicity, religion or political affiliation) may substitute for financial and physical access.

Globally, enough food is being produced or in stock to meet dietary energy needs. Nonetheless, both food availability and food access vary across regions and country income groups, especially with regards to foods that contribute to a healthy diet. Although food systems facilitate food availability in markets at all levels, there are still physical, economic and social barriers that prevent many people from having sustainable access to food for an active and healthy life. Physical barriers may include poor road infrastructure, or simply the absence of transport and the long distances required to reach marketplaces.

During the COVID-19 outbreak, for example, food has been by and large available. However, it remains to be seen to what extent, over time, food supply chains remain undisrupted and prices generally unaffected; countries can continue to import food; and food consumption of vulnerable populations is not compromised due to income losses and the containment measures enacted by governments around the world. All of this could potentially translate into problems of food availability and access, but information is too scarce at the time of writing to draw conclusions. The next editions of this report will monitor and analyse the future implications.

To reiterate, what people eat depends on what is available and what they can afford – a function of the cost of food and incomes.[25] Once food is available, food choices are the result of the interaction between incomes, prices and preferences, whereby higher incomes and lower prices provide for more choices, allowing people to consume more and diverse foods. Affordability is also a relative concept that encompasses the market price of a food in relation to other household expenses and household income.

Once food access is assured, food choices can be determined by other individually modifiable factors, such as time and convenience, nutrition knowledge,[n] tastes and habits. These are shaped by the food environment, including marketing, advertising, labelling and other forms of promotion, as well as social factors and forces outside the food system, such as gender equality, child care, intra-household allocation, housing and transportation.[26] For example, a food preparer's time and the cost of fuel and water are all required for food preparation. Social barriers are also important in some societies where certain groups are prohibited from consuming particular foods.

How do food prices and income affect the choice and consumption of foods?

To understand the effect of prices and income on the consumption of healthy diets, it is important to consider the extent to which the quantity of food consumed shifts in response to price and income changes. This extent of response, or elasticity, describes the percentage change in the demand of a given food item after a percentage change in its price or a person's income. Generally, there is a negative association between food prices and the quantity of food demanded, while the association is positive between income and the quantity of food demanded.

Own-price elasticities refer to changes in demand for an item based on a change in its price, and they are generally negative.[o] The degree to which quantity goes down varies, however. For example, usually staple cereals are considered a necessary good, so these goods have inelastic demand (i.e. they are more price inelastic). An increase or decrease

n For example, studies show that women's nutritional knowledge plays a key role in nutritional outcomes of their children (see Maitra[344] for a detailed review). Women's decision-making power is also crucial: in developing countries, they generally take on a more active role than men in providing nutrients to children through food.[345] If women were given equal decision-making power as men in the home concerning food, it is estimated that child malnutrition could decrease by 13 percent.[346] Research has shown that if women can gain increased control of household income, other beneficial outcomes in addition to improving children's well-being, such as improved education and overall household economic security, can be achieved.[347]

o One exception is a Giffen good: this is a special case, under rare circumstances, where people consume more of a food as the price rises and vice versa.

in the price of cereal would not alter demand for cereals by much compared with other food items. There are also cross-price elasticities, in which the demand for one item changes in response to a change in the price of another item, if these items are either substitutes or complements. Income elasticities of demand define the extent to which demand changes due to income changes.

The own-price and cross-price elasticities and income elasticities of demand for any particular set of foods reflect a combination of substitution effects (e.g. substituting potatoes for rice when the price of rice increases) and income effects (e.g. consuming more of other foods when the price of all starchy staples decreases). For example, if the price of basic staples declines, the reduction in the cost of a basic diet comprising those staples frees up money to buy more expensive foods. It translates into a higher real income level, all other things remaining constant. These concepts are critical to understanding how the cost and affordability of foods affect people's diets.

The price and income elasticities of demand for staple foods are known to be very small and not significantly different from zero at least in the short term.[27] Even large swings in prices or incomes are not associated with significant changes in total calories of staple foods consumed. However, the short-term response of dietary intake to changes in price and income does affect diet composition, as people will substitute among foods to meet their daily energy needs.

Price elasticities for nutritious foods are larger than for basic staples.[28,29] This is due to both substitution and income effects. A meta-analysis shows that a 10 percent increase in the price of fruits and vegetables is associated with an average reduction in their consumption by 6.1 percent, while a 10 percent increase in the price of cereals is associated with an average decrease in cereal consumption of 5.2 percent.[30] Furthermore, it is shown that price elasticities estimated at the product level (e.g. apples) tend to be higher in absolute terms than those estimated for broader product categories (e.g. fruits). This might be due to substitution possibilities between products in the same food category, which reduce the average own price response of the product category (**Annex 5,** Table A5.1).[30,31]

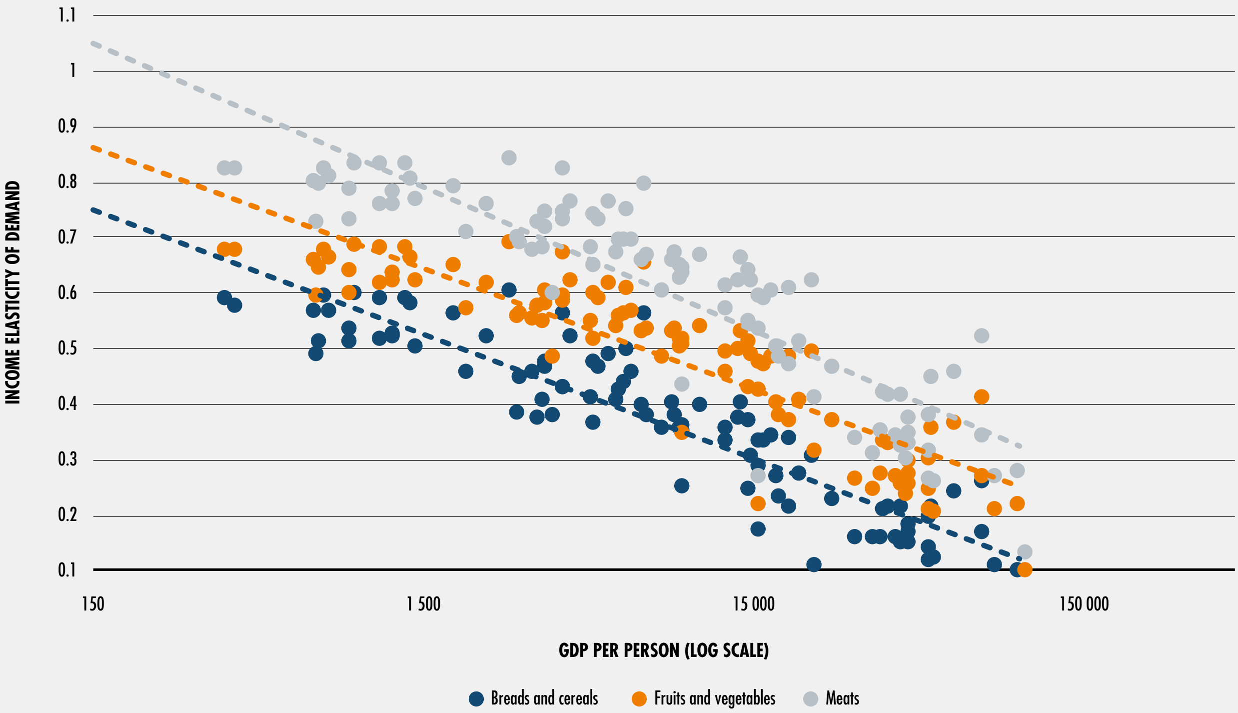
Food consumption is generally inelastic with regard to income, although large differences exist as income elasticities of demand tend to be higher in countries where income per capita is relatively lower (Figure 26). Within countries, it is possible to see high income elasticities of demand in poorer segments of the population, even in high-income countries. There are also considerable differences in income responsiveness across food items. Demand for food staples, such as grains, is generally less elastic than demand for fruits and vegetables or meat and dairy products.

Price elasticities tend to increase for countries with lower economic development, meaning that increases in the price of all foods result in greater reductions in food consumption in poor countries (**Annex 5,** Table A5.2).[28] Studies for high-income countries and emerging economies show that people living on low incomes are most likely to respond to changing prices.[8] Changes in food prices had the largest own-price effects in low-income countries. Cross-price effects were more varied and were found to reinforce, undermine or alleviate the own-price effects, depending on country income group.[29,32,33,34]

Looking at income elasticities, a rise in income leads to a rise in consumption of nutritious foods, such as fruits and vegetables.[35] Income elasticities for animal source foods, as well as fruits and vegetables, are positive and virtually always greater than for grains and tubers. Nutritious foods, such as horticultural products, meat and dairy, have a high income elasticity of demand in poor countries, such as those in sub-Saharan Africa. In general terms, these food items are less affordable than staple foods. In fact, staple foods, such as cereals, have smaller demand responses to income changes than high-valued food items, such as meat, fish and dairy.[3,28,36]

In low- and middle-income countries, high socio-economic status or living in urban areas is associated with some elements of healthy dietary patterns, including higher intakes of fruits and

FIGURE 26
INCOME ELASTICITIES OF DEMAND FOR FOOD PRODUCTS TEND TO BE HIGHER IN COUNTRIES WHERE INCOME PER CAPITA IS LOWER



NOTES: The figure shows the relationship between income elasticity and gross domestic product (GDP) per capita by food category. Although income elasticities are systematically higher for some products (e.g. meat) than for others (e.g. breads and cereals), they tend to decrease with GDP per capita in absolute terms.
SOURCE: Schmidhuber, J., Pound, J. & Qiao, B. 2020. *COVID-19: channels of transmission to food and agriculture*. Rome, FAO. (also available at https://doi.org/10.4060/ca8430en).

vegetables, better diet quality, increased dietary diversity and higher vitamin and mineral intakes. However, high socio-economic status or living in urban areas was also found to be related to higher energy, cholesterol and saturated fat intakes due to concurrent consumption of highly processed foods.[37]

In summary, lowering food prices – which can potentially result from changes triggered by both supply[38] and demand – is not likely to affect demand for calories, but *which* food prices are lowered will have a large impact on consumption choices. That is, the cost of nutritious foods specifically is important in understanding economic access to healthy diets. This cost is proving too high for many people to afford, as shall be seen next.

Healthy diets are unaffordable for many people in all regions of the world, especially the poor

Evidence of cost comparisons of individual food items and/or food groups from existing studies indicates that the cost of nutritious foods, such as fruits, vegetables and animal source foods, is typically higher than the cost of more energy-dense foods high in fat, sugar and/or salt, and higher than the cost of starchy staples, oils and sugars. However, these costs vary across the world and by a country's gross national income per capita.[4,39,40]

The relative prices of nutritious foods and energy-dense foods with minimal nutritional value have also been shown to differ systematically across income levels and regions.[7,14] Most noncereal foods are relatively cheap in high-income countries, including sugar- and fat-rich foods. In lower-income countries, nutrient-rich or fortified foods are generally expensive, especially most animal source foods and fortified infant foods. Prices for vegetables and animal source foods are shown to be systematically higher than prices of starchy staples around the world.[7,14]

Studies have also shown that the relative caloric unit costs of most nutritious foods are substantially higher in poorer countries, although there are some exceptions.[7,41] Moreover, the cost of nutritious foods tends to vary more across geographic locations. Nutritious foods are often highly perishable and less tradable. As such, their prices are largely determined by local productivity and value chain efficiency, including transport and cold chains.[7,42]

There is some evidence that the cost difference between nutritious foods and energy-dense foods is increasing over time in some parts of the world.[4] For example, a study from the United States of America found that the price disparity between nutritious foods and highly energy-dense foods with minimal nutritional value has grown between 2004 and 2008 in parts of the country.[42] Results from South-eastern Asia show similar patterns.[43]

Most evidence currently available on the cost of nutritious foods, however, relates to the cost comparisons of individual food items and/or food groups. There is limited evidence comparing the costs and affordability of diets as a whole,[p] and few comprehensive global cross-country analyses.[44] Analysis of economic access to food has been limited to either income or food price indices that do not clearly relate to healthy diets.

This report bridges some of these knowledge gaps. It offers new analysis on the cost and affordability of diets of increasing diet quality around the world, by region and different development contexts. Three diets are simulated in order to determine the affordability of three levels of increasing diet quality, starting from a basic energy sufficient diet meeting calorie needs to a nutrient adequate diet, and then to a healthy diet, including an estimation of recommended intake of more diversified and desirable food groups. A full description of the three diets is provided in Box 10.

The cost and affordability analysis of the three diets aims to answer three questions: i) what is the cost and affordability of the three different levels of diet quality? ii) what is the relative difference in cost and affordability moving from a diet that is energy sufficient to one that is nutrient adequate and then to one that is healthy? iii) how many people are unable to afford each type of diet and where are they in the world? The analysis explores these questions from a global, regional and development context perspective.

When actual dietary patterns are compared, the world's poorest people consume something close to a basic energy sufficient diet. Any additional income above subsistence is typically spent to improve the starchy staple-based diet, with small amounts of a second and third food group that is more expensive per calorie but provides at least some variety and adds nutritional value.

Further income increases are typically associated with acquisition of more diverse foods, often achieving higher levels of most nutrients but using more expensive ingredients than the least-cost nutrient adequate diet in an effort to achieve higher levels of palatability, convenience and other attributes beyond essential nutrients. In the case of high-income countries, where a reverse wealth gradient of obesity exists, lower income correlates with obesity, according to the "obesity-transition" as explained above, due to the "nutrition transition".

Between the energy sufficient diet and nutrient adequate diet, there are other diets that contain more than just staple food for basic energy »

p The World Food Programme's Fill the Nutrient Gap project has recently conducted analyses of the cost and affordability of diets in a number of lower-middle-income countries (LMICs) and in fragile/refugee settings. By 2019 analysis was done for 27 countries, and over ten more have been started in 2020. Project reports with published results are available for El Salvador, Ghana, Lao People's Democratic Republic, Madagascar, Mozambique, Niger, Pakistan, Philippines, Sri Lanka and Tajikistan. Please see WFP (2019)[60] for more details.

BOX 10
DESCRIPTION OF THE THREE DIETS USED IN THE COST AND AFFORDABILITY ANALYSIS

For the purpose of this analysis, three reference diets are analysed for cost and affordability to simulate incremental levels of diet quality, starting from a basic energy sufficient diet to a nutrient adequate diet and then to a healthy diet.

"ENERGY SUFFICIENT DIET"
This diet provides **adequate calories** for energy balance for work each day. This is achieved using only the basic starchy staple for a given country (e.g. maize, wheat or rice only).

"NUTRIENT ADEQUATE DIET"
This diet not only provides **adequate calories** (per the energy sufficient diet above), but also **relevant nutrient intake values** of 23 macro- and micronutrients through a balanced mix of carbohydrates, protein, fat, essential vitamins and minerals within the upper and lower bounds needed to prevent deficiencies and avoid toxicity. Macronutrient intakes are within the Acceptable Macronutrient Distribution Range (AMDR) set by the Institute of Medicine (2006).[45]

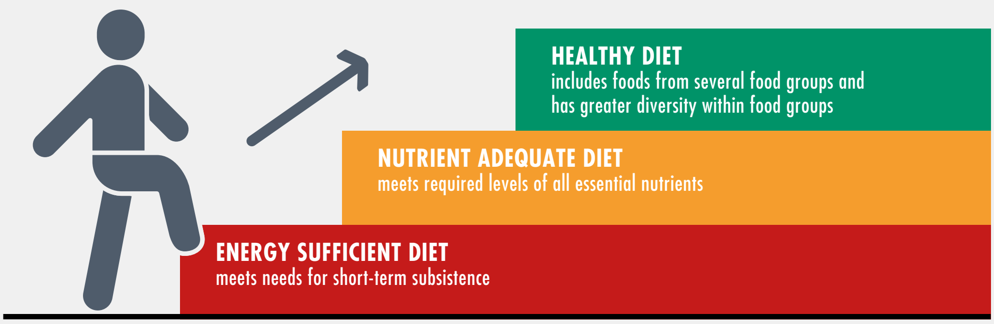
"HEALTHY DIET"
This diet provides **adequate calories and nutrients** (per the energy sufficient and nutrient adequate diets above), but also includes a **more diverse intake of foods from several different food groups**. As described in the last section of Part 1 of this report, this diet is intended to meet all nutrient intake requirements and to help prevent malnutrition in all its forms, including diet-related non-communicable diseases (see Part 1, Box 5).

The healthy diet is based on global guidelines[46,47,48] that are nationally adapted to a country's individual characteristics, cultural context, locally available foods and dietary customs through national food-based dietary guidelines (FBDGs). At this time, however, there are relatively few countries that have quantified national FBDGs. Therefore, for analysis purposes, the healthy diet in this section is guided by the quantified recommendations from ten national FBDGs, which represent a range of dietary recommendations articulated by countries. These are then locally adapted to each country through the assignment of least-cost food items available by food group in each country (see Box 11 and **Annex 4**, Table A4.1 for the description of the ten FBDGs). Although the healthy diet is not selected on the basis of nutrients but is determined by FBDGs, this diet meets on average 95 percent of nutrient needs, and it can be therefore almost always considered as nutrient adequate.[49]

THE AIM OF THE COST AND AFFORDABILITY ANALYSIS
The ultimate aim of the analysis presented in this section is to measure whether food systems bring these three levels of diet quality within reach of the poorest, using those foods that meet each standard at the lowest possible cost. In this case, the least cost of the three diets are theoretical and do not necessarily represent diets currently consumed.

See Boxes 11 and 12 for a brief description of the methodology for estimating the cost and affordability of the three diets and its caveats. For a full description of the definition, methodology and data sources of the three diets, see **Annex 3**.

THREE INCREASING LEVELS OF DIET QUALITY



SOURCE: FAO.

» needs but are still low in essential nutrients. These diets may be deemed as unhealthy as they may be abundant in unhealthy fats and sugars and/or salt, or may simply lack enough nutrient rich-foods to meet nutrient requirements (e.g. due to poverty or subsistence farms with limited access to markets).

For people who cannot afford a healthy diet due to relatively high costs of nutritious foods, unhealthy options such as sugary drinks and snacks high in sugars or saturated fat or salt are more affordable, and can be attractive because they are convenient, ready-to-eat or highly marketed. People for whom healthy choices are still largely unaffordable may also face other pressures related to income earning and time constraints to prepare balanced meals. These unhealthy diets, however, are not analysed in this report as the purpose of the affordability analysis is to determine the lowest possible cost to meet certain nutritional targets.

A brief summary of the methods used to compute the cost of the three diets that have been simulated for the analysis is provided in Box 11, and the methods to compute the affordability of the diets is provided in Box 12. A full description of the methodology and data sources, as well as limitations of the analysis are found in **Annex 3**.

Analysis of cost and affordability of three diets

Lowest cost of the three diets around the world

The global average cost, converted to international dollars using purchasing power parity (PPP), of meeting calorie needs using the cheapest starchy staple at each time and place – the energy sufficient diet – was USD 0.79 per person per day in 2017[q] (Table 7). The cost was lowest in low- and high-income countries (USD 0.70 and USD 0.71, respectively) and highest in lower- and upper-middle-income countries (USD 0.88 and USD 0.87, respectively). Among geographic regions, the highest cost for an energy sufficient diet was in Latin America and the Caribbean (USD 1.06), where it was 34 percent higher than the global average cost. The mean cost was lowest in Northern America and Europe (USD 0.54) and Oceania (USD 0.55), which was around 30 percent lower than the global average cost.

As expected, the cost of the diet increases incrementally as the diet quality increases. The cost of a healthy diet is 60 percent higher than the cost of the nutrient adequate diet, and almost 5 times the cost of the energy sufficient diet. This pattern holds across all regions and country income groups (Table 7). At the global level, a nutrient adequate diet was USD 2.33 per person per day in 2017, whereas the healthy diet was USD 3.75 per person per day.

The average cost of a diet varies by region and country income group. However, there is a wide and overlapping cost range among countries across these regions and country income groups of the world (see **Annex 3**, Table A3.2 for cost of the three diets by country, income level and population). For example, the healthy diet in this analysis was on average more costly per person per day in lower-middle-income countries, estimated at USD 3.98, but the cost across these countries ranged from USD 2.85 to USD 5.00. The next most costly healthy diet was in upper-middle-income countries (USD 3.95, range USD 2.80–5.60) and low-income countries (USD 3.82, range USD 2.77–5.72). Healthy diets were cheapest in high-income countries (USD 3.43, range USD 1.88–5.50).

Geographically, the cost of a healthy diet was highest in Latin America and the Caribbean (USD 3.98, range USD 2.80–5.60) and in Asia (USD 3.97, range USD 2.81–5.50), especially in Eastern Asian countries (Table 7), with ranges showing cross-country variations within regions. The cost of a healthy diet was lowest in Oceania (USD 3.06, range USD 2.37–4.06), Northern America and Europe (USD 3.21, range USD 1.88–4.42), and Africa (USD 3.87, range USD 2.77–5.72).

Among the ten national food-based dietary guidelines used in the estimation of the cost of a healthy diet (see Box 11), the cost ranges between USD 3.27 and USD 4.57 per person per day, with a point estimate based on a median »

q To estimate the cost of the three diets, this report uses retail prices from the World Bank's International Comparison Program (ICP) for internationally standardized items for 2017, which was the most updated available at the time of writing.

BOX 11
COMPUTING THE LOWEST COST OF THE THREE DIETS USED IN THE COST AND AFFORDABILITY ANALYSIS

The three reference diets used in the cost and affordability analysis are described in Box 10. The analysis of the cost of these three diets is based on a sample of 170 countries for which retail price data are available in year 2017. Prices are obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). The cost of each diet is estimated for each country using the least expensive combination of retail items whose food composition achieves the specific criteria for each diet, which are empirically determined at each time and place. This is what this report calls "least-cost diets". The least-cost diets for the energy sufficient and nutrient adequate diets are estimated from a linear programming model that selects foods in the quantities needed to minimize cost subject to energy and nutrient constraints. For the healthy diet, a rank order optimization is used. Specifically, the three least-cost diets are defined as follows:

Cost of an energy sufficient diet: This is the cost of a single, cheapest starchy staple available at retail markets in sufficient quantities to meet dietary energy intake of 2 329 kcal, required for a reference group represented by an adult woman of reproductive age. This hypothetical benchmark[50] helps establish a lower bound on the cost of short-term survival and identify the additional cost required to achieve longer-term goals specified in the other two diets. The objective of this diet is to set a benchmark that is used as a point of comparison for discussing affordability of the nutrient adequate and healthy diets. Costing a typical diet would involve some combination of modelling based on current dietary intake estimates in poor populations, or arbitrary decisions about how much of other foods to include to reach dietary energy requirements. The global community's vision for food security is that no one should have to eat just one single food (or even just two or three), but this is still in fact the reality for some people in certain times and places of the world.

Cost of a nutrient adequate diet: This is the minimum cost of foods that meet all known requirements for essential nutrients and provide an energy intake of 2 329 kcal, required for an adult woman of reproductive age. Calculating this cost at local level is based on the least expensive combination of retail items whose food composition achieves said criteria, which are empirically determined at each place and time. Typically, the linear programming model results in the selection of 6–8 different items, including a starchy staple plus one or more leguminous grains, such as beans, and small quantities of low-cost vegetables, fruits and animal source foods, like dried fish and eggs. This nutrient adequate diet helps estimate the cost and affordability of acquiring all nutrients in the required proportions, so as to identify the ability of each country's food system to deliver nutrient adequacy at all times and places. The minimal cost of a nutrient adequate diet also provides a useful lower bound on the cost of nutrients.

Cost of a healthy diet: Given that the exact make-up of a healthy diet varies by local context, countries have developed national food-based dietary guidelines (FBDGs) to reflect their specific cultural context, locally available foods and dietary customs. FBDGs, however, are not available for all countries or, if available, they do not always include specific food quantities.[38] To overcome this data limitation, this analysis applies the quantified recommendations within and across food groups from the ten FBDGs, which represent a range of dietary recommendations articulated by countries. These are then locally adapted to each country, whereby the specific country preferences, in terms of eating patterns, are captured by identifying local food items at retail prices in each country.

The local cost of a healthy diet is calculated using a rank order optimization method to select the two food items in each group that fill each category at the lowest cost and provide energy intake of 2 329 kcal. For each country, ten costs of healthy diets are calculated by applying the ten different quantified FBDGs, as each is associated with a slightly different cost. Finally, the cost of a healthy diet is computed for each country by taking the average of the ten cost estimates (see **Annex 3** for a full description of the methodology). This method is a more robust way of estimating the least-cost healthy diet than applying a single global quantified description of a healthy diet. Calculating the cost of this diet helps identify the ability of each country's food system to deliver diets that encompass acceptable dietary patterns, greater diet diversity and promote and protect long-term health. The minimal cost of a healthy diet provides a useful lower bound on the cost one needs to incur when pursuing food security and nutrition through market purchases.

BOX 11 (CONTINUED)

For the healthy diet, food preferences are taken into account only as far as prices reported in the World Bank's International Comparison Program[50] reflect culturally acceptable foods that have a significant level of expenditure share. Incorporating a greater degree of food preferences would increase the estimated costs of the diets as well as the estimates of numbers of people who cannot afford them.

The lowest-cost healthy diet ensures energy sufficiency and a balance between food groups and diversity within food groups. It typically reaches nutrient adequacy but may not ensure adequacy of all nutrients in all cases. The cost of the healthy diet is sensitive to the definition of the FBDGs. A complete description of methods can be found in **Annex 3** and the description of FBDGs can be found in **Annex 4**.

Sources of data to compute cost: To estimate the cost of the three diets, the following data are used: i) retail prices from the World Bank's International Comparison Program (ICP) for internationally standardized items for 2017 (for each food item, one price is provided per country, representing an average across markets and throughout the year); ii) food composition data from the United States Department of Agriculture's (USDA) nutrient data bank for internationally standardized items, complemented by other food composition data; and iii) quantities of food items within and across food groups that together help meet the recommended nutrient intake amount. They are derived from ten published FBDGs representing a range of dietary recommendations articulated by countries (see **Annex 4**).

» cost of USD 3.75 (**Annex 4** and Figure A4.1). This is comparable to, for example, a range of between USD 3.31 and USD 3.61 for the least-cost versions of the four diet variants of the EAT-Lancet reference diet (flexitarian, pescatarian, vegetarian and vegan), giving a point estimate based on a median cost of USD 3.44 (Figure A4.1). The EAT-Lancet reference diet refers to the recommended intake values proposed by the EAT-Lancet Commission that seek to address the need to feed a growing population a healthy diet, while also defining sustainable food systems that minimize damage to our planet.[r] Four variant diets of the EAT-Lancet reference diet are also analysed for the valuation of the related health and climate-change costs in the next section.

Calculating ratios between the cost of diets across regions and country income groups brings to light an important finding: significant premiums (i.e. additional costs) must be paid in order to afford a higher diet quality across regions and development contexts. Worldwide, the cost of a nutrient adequate diet is on average 3.4 times (range 1–9) more expensive than an energy sufficient diet. A healthy diet is 1.7 times (range 1–2.8) more expensive than a nutrient adequate diet and 5.4 times (range 2–11) more expensive than an energy sufficient diet.

In general, low-income countries followed by lower-middle-income countries face relatively higher premiums to move from a nutrient adequate diet to a healthy diet than other countries. Geographically, Africa and Asia stand out as having the highest premiums to reach a healthy diet from a nutrient adequate diet. This is a significant challenge, considering that most of the food insecure and malnourished populations in lower-middle-income countries and low-income countries are consuming diets near to the energy sufficient diet. For example, it would cost a person living in a low-income country around 6 times more to move from an energy sufficient to a healthy diet.

r The EAT-Lancet Commission consists of 37 world-leading scientists from 16 countries from various scientific disciplines. It seeks to reach scientific consensus on targets for healthy diets and sustainable food production. In 2019, the Commission published what is referred to as the "EAT-Lancet reference diet", which quantitatively describes a universal healthy reference diet, based on an increase in consumption of nutritious foods (such as vegetables, fruits, whole grains, legumes and nuts), and a decrease in consumption of energy-dense foods (such as red meat, sugar and refined grains) that would provide major health benefits, and also increase the likelihood of attainment of the SDGs. See Willett *et al.* (2019).[79] There are four variants of the reference diet (flexitarian, pescatarian, vegetarian and vegan).

TABLE 7
THE COST OF A HEALTHY DIET IS 60 PERCENT HIGHER THAN THE COST OF THE NUTRIENT ADEQUATE DIET, AND ALMOST 5 TIMES THE COST OF THE ENERGY SUFFICIENT DIET IN 2017

Regions	Energy sufficient diet	Nutrient adequate diet	Healthy diet
WORLD	**0.79**	**2.33**	**3.75**
AFRICA	**0.73**	**2.15**	**3.87**
Northern Africa	0.75	2.90	4.12
Sub-Saharan Africa	0.73	2.06	3.84
Eastern Africa	0.61	1.98	3.67
Middle Africa	0.73	2.09	3.73
Southern Africa	0.86	2.29	3.99
Western Africa	0.80	2.05	4.03
ASIA	**0.88**	**2.18**	**3.97**
Central Asia	0.84	2.04	3.39
Eastern Asia	1.27	2.63	4.69
South-eastern Asia	0.92	2.42	4.20
Southern Asia	0.80	2.12	4.07
Western Asia	0.74	1.87	3.58
LATIN AMERICA AND THE CARIBBEAN	**1.06**	**2.83**	**3.98**
Caribbean	1.12	2.89	4.21
Latin America	1.00	2.78	3.75
Central America	1.13	3.04	3.81
South America	0.91	2.61	3.71
OCEANIA	**0.55**	**2.07**	**3.06**
NORTHERN AMERICA AND EUROPE	**0.54**	**2.29**	**3.21**
COUNTRY INCOME GROUPS			
LOW-INCOME COUNTRIES	**0.70**	**1.98**	**3.82**
LOWER-MIDDLE-INCOME COUNTRIES	**0.88**	**2.40**	**3.98**
UPPER-MIDDLE-INCOME COUNTRIES	**0.87**	**2.52**	**3.95**
HIGH-INCOME COUNTRIES	**0.71**	**2.31**	**3.43**

NOTES: The table shows the USD cost per person per day of the three reference diets (energy sufficient, nutrient adequate and healthy diet) by region and country income group in 2017. The analysis is based on a sample of 170 countries for which retail food price data are available in year 2017. Prices are obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). The cost of each diet represents a simple average of the cost incurred by countries belonging to a specific region or country income group. See Box 10 for the definition of the three diets and Box 11 for a brief description of the cost methodology. For the full methodological notes and data sources, see Annex 3.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries.* Background paper for *The State of Food Security and Nutrition in the World 2020.* Rome, FAO.

The results are more striking for high-income countries as 75 percent of them pay as much as 7.4 times more for a healthy diet than they would for an energy sufficient diet. This stems from the fact that the cost of an energy sufficient diet in high-income countries (USD 0.71 per person per day) is much cheaper compared with the world average value (USD 0.79 per person per day). While rich countries have managed to make calories cheap, they have neglected to also make nutritious foods cheap. A person in a high-income country, on average, would have to pay 6 times more to move from an energy sufficient to a healthy diet.

Dairy, fruits, vegetables and protein-rich foods (plant and animal-sourced) are the highest-cost food groups globally, in terms of quantity recommended for consumption per day for a healthy diet (Figure 27a). There are regional differences, with fruits and vegetables being notably more expensive in Eastern Asia, and dairy being more expensive in sub-Saharan Africa, Eastern and South-eastern Asia but cheaper in Western and Northern Europe, Australia and New Zealand. Starchy staples and oils account for only 20 percent of the cost of a healthy diet. Fruits and vegetables account for a little less than 40 percent of its cost, and dairy and protein-rich foods combined account for a little more than 40 percent (Figure 27b).

These proportions vary somewhat by country income group, with dairy being notably more expensive in low-income countries (see **Annex 5**, Figures A5.1 and A5.2). These findings imply that the cost of nutritious foods that contribute to a healthy diet, particularly dairy, vegetables, fruits and protein-rich foods, needs to decrease in order for their consumption to increase.

Affordability of the three diets around the world

After analysing the cost of this report's three reference diets, the next important step is to examine their affordability. In this analysis, affordability is measured comparing the estimated cost of the least-cost diet per person per day for each of the three reference diets described for these analyses with: i) the international poverty line; ii) typical food expenditures in each country; and iii) average estimated income in each country. The methodology is described in Box 12.

Affordability comparing cost of the diets to the international poverty lines

Findings show that while most of the poor around the world can afford an energy sufficient diet, as defined here, they cannot afford either a nutrient adequate or a healthy diet (Figure 28). A healthy diet is far more expensive than the full value of the international poverty line of USD 1.90 PPP per day, let alone the upper bound portion of the poverty line that can credibly be reserved for food (63 percent) of USD 1.20 PPP per day (Figure 28). It is assumed that a minimum of 37 percent of expenditures must be reserved for non-food expenditures, such as housing, transport, education and health, and farm inputs.[51,52,53,54] On average, the cost of a nutrient adequate diet and a healthy diet are respectively 2 and 3 times greater than the poverty threshold of USD 1.20 per person per day. This is true by any of the definitions of healthy diets (based on national food-based dietary guidelines) used in these analyses (see **Annex 4**, Figure A4.1).

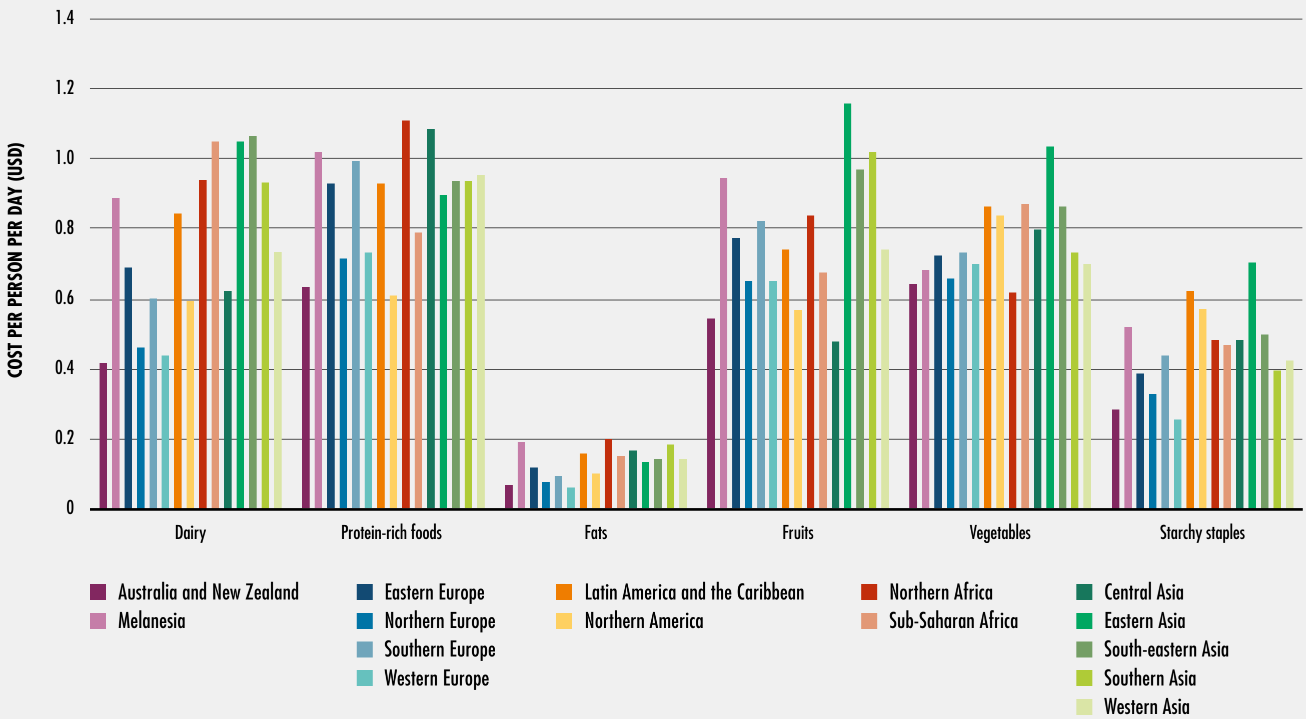
A nutrient adequate diet and a healthy diet are unaffordable for those living below the poverty line. They are also unaffordable for even the populations who are vulnerable to become poor because their incomes are just above the poverty line, and the cost of these diets well exceeds the poverty line of USD 1.90 per person per day.

This holds true across regions as well. Both the nutrient adequate and the healthy diets exceed USD 1.20 (63 percent of the poverty line) in sub-Saharan Africa, as they are 1.7 and 3.2 times higher than the poverty line, respectively. In Latin America and the Caribbean, they are 2.3 and 3.3 times higher, respectively, and in Asia, they are 1.8 and 3.3 times higher, respectively. In Northern America and Europe, both the nutrient adequate and heathy diets are unaffordable for the poor, as they are 1.9 and 2.6 times higher than the poverty line, respectively.

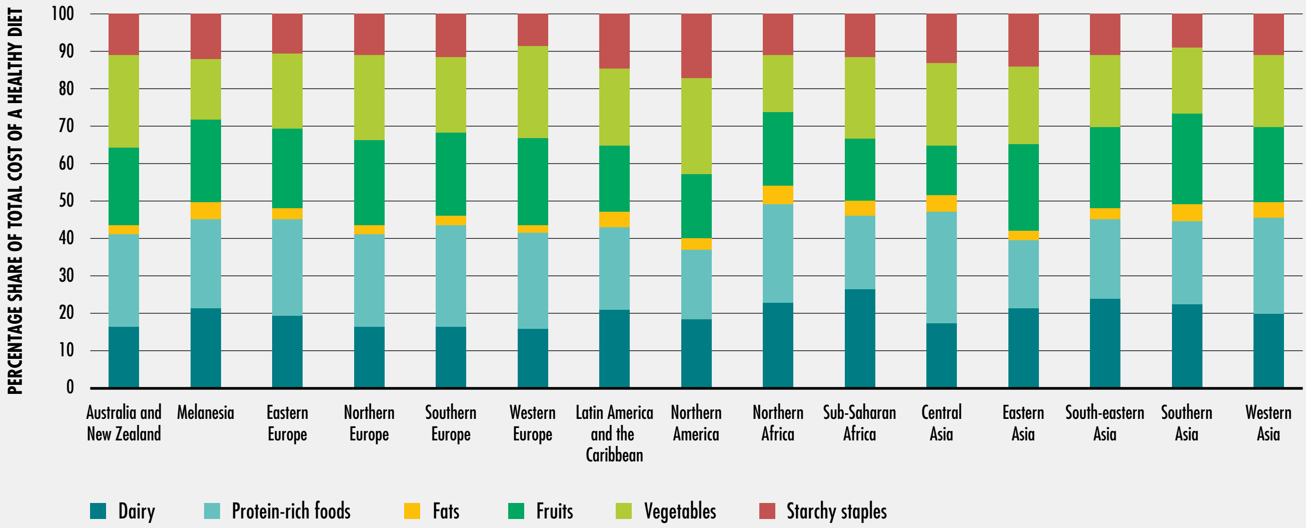
While a healthy diet costs more than USD 1.20 in every country, the least-cost nutrient adequate diet falls below this threshold only in Qatar, and falls between USD 1.20 and USD 1.90 for seventeen African, eleven Asian, six European, one Latin American and one Oceanian country. In comparison, the least-cost energy sufficient diet is affordable (still using the USD 1.20 threshold) for the poor around the world, except in Bolivia (Plurinational State of) (USD 1.42), British Virgin Islands (USD 1.56), Dominica (USD 1.22), Ecuador (USD 1.31), El Salvador (USD 1.46), Grenada (USD 1.33), Japan (USD 3.03), Nicaragua (USD 1.44), Saint Vincent and the Grenadines (USD 1.32), Sint Maarten (USD 1.72), South Africa (USD 1.26), Taiwan (USD 1.46) and Togo (USD 1.94). »

FIGURE 27
DAIRY, FRUITS, VEGETABLES AND PROTEIN-RICH FOODS ARE THE HIGHEST-COST FOOD GROUPS FOR A HEALTHY DIET GLOBALLY IN 2017

A) COST PER PERSON PER DAY BY FOOD GROUP AND REGION IN 2017 (USD)



B) COST CONTRIBUTION (PERCENTAGE SHARE OF TOTAL COST) OF EACH FOOD GROUP IN A HEALTHY DIET BY REGION IN 2017



NOTES: The bar chart in panel a) shows the cost per person per day of six food categories by a set of subregions and the stacked columns in panel b) show the ratio between the average regional cost of each food group and the total cost of a healthy diet. The analysis is based on a sample of 170 countries for which retail food price data are available in year 2017. Prices are obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). See Box 10 for the definition of the three diets and Box 11 for a brief description of the cost methodology. For the full methodological notes and data sources, see Annex 3. For the analysis on food group cost contribution by country income group, see Annex 5, Figures A5.1 and A5.2.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

BOX 12
COMPUTING THE AFFORDABILITY OF THE THREE REFERENCE DIETS

To gauge a degree of affordability, the cost of each of the three diets described for these analyses (see Box 11) needs to be compared with a standard of income or expenditures. Our analysis uses the following three standards.

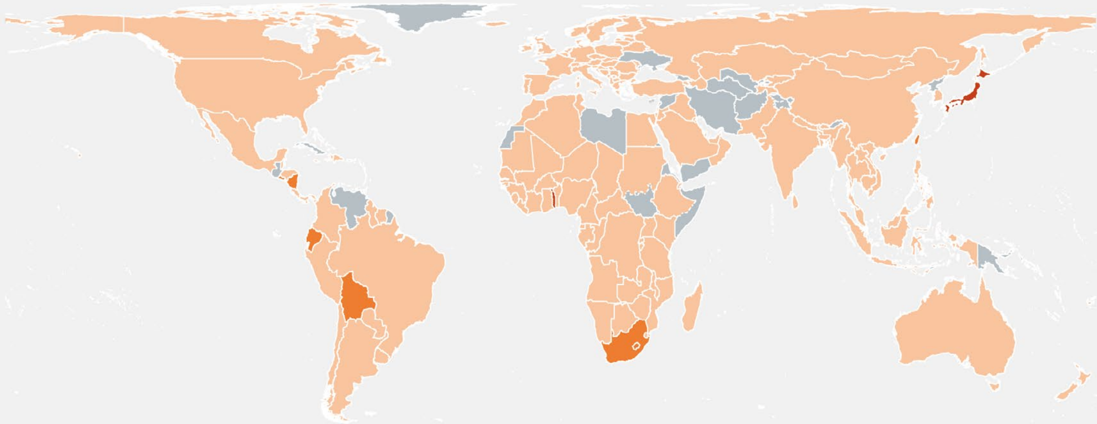
1. **International poverty line:** The first measure of affordability compares the cost of each diet with 63 percent of the international poverty line of USD 1.90 PPP per day, which is equal to USD 1.20 (see Figure 28). The 63 percent accounts for a portion of the poverty line that can be credibly reserved for food, based on observations that the poorest people in low-income countries spend, on average, 63 percent of their incomes on food (World Bank Global Consumption Database).[55]* It is assumed that a minimum of 37 percent of expenditures must be reserved for non-food expenditures, such as housing, transport, education and health, and farm inputs.[51,52,53,54] In reality, 37 percent of expenditures is a conservative assumption. For instance, non-food expenditures may have a higher share in high-income countries.
2. **Average daily food expenditures in each country:** The second measure of affordability compares the cost of each diet with average daily food expenditures in each country. The national average per capita food expenditures used in this measure of affordability is calculated by Herforth *et al.* (2020)[40] based on data from ICP, and is expressed using ratios or percentages. Ratios are defined as the cost of a diet divided by average country food expenditures: ratios above 1 indicate that a diet is unaffordable as its cost exceeds average food expenditures in a given country (see Figure 29). Alternatively, the cost of a diet can be expressed as a percentage of average food expenditures in a given country: a diet is unaffordable for values greater than 100 percent (see Table in Box 13 and Figure A5.3).
3. **Average estimated income in each country:** The third measure of affordability compares the cost of each diet with the average income in a given country, using income distributions from the World Bank PovcalNet interface.[57]** Specifically, a diet is considered unaffordable when its cost exceeds the 63 percent of the average income in a given country, following the same rationale behind the first measure of affordability. This third measure of affordability provides estimates on the percentage of people for whom the cost of a specific diet is unaffordable. Percentages are then multiplied by the 2017 population in each country, to arrive at the estimated number of people who cannot afford a given diet in a given country (see Table 8 and table in Box 13). Since income distributions estimated by the World Bank are not available for year 2017, income distributions in year 2018 are used that are based on household surveys across 164 economies (see **Annex 3** for a full description of the methodology and data sources). Out of the 170 countries included in this analysis, information on the percentage and number of people who are not able to afford the diets is available on 143 countries. Furthermore, to provide a range to these estimations, lower- and upper-bound estimates of this measure of affordability are computed and presented in **Annex 3** (Table A3.3). The cost and affordability of the three diets are shown in Table A3.2 (**Annex 3**). Global maps showing ranges of affordability are presented in Figure A5.3 (**Annex 5**) for the 143 countries analysed.

* Among the countries used to calculate the USD 1.25 poverty line (later deflated to USD 1.90), the mean food share of the 28 countries with complete data to separate the food and non-food poverty lines is 56 percent (with a range from 26 to 79). Thus, mean non-food share is 44 percent with a range of 21–74 percent.[58]

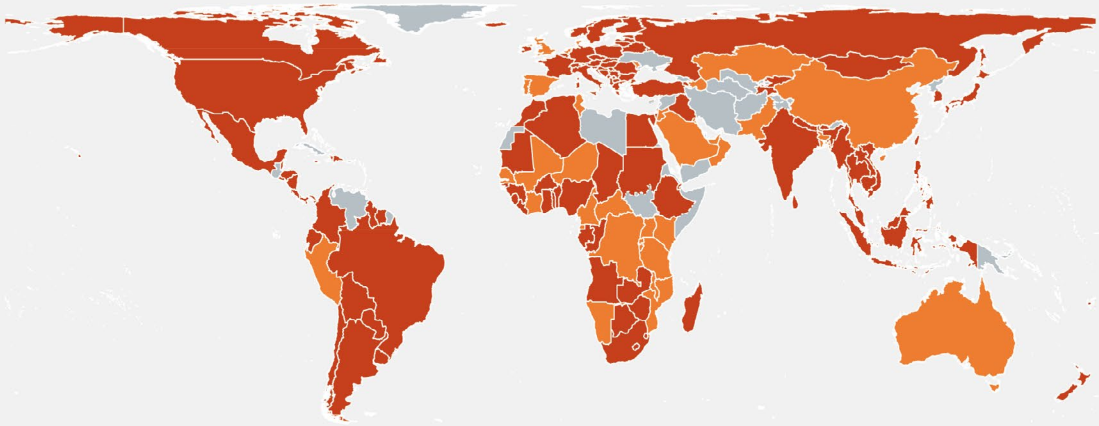
** 2017 is a reference year in this exercise because the cost analysis uses retail prices from the World Bank's International Comparison Program (ICP) for internationally standardized items for 2017 (see Box 11).

FIGURE 28
A HEALTHY DIET IS UNAFFORDABLE FOR THE POOR IN EVERY REGION OF THE WORLD IN 2017

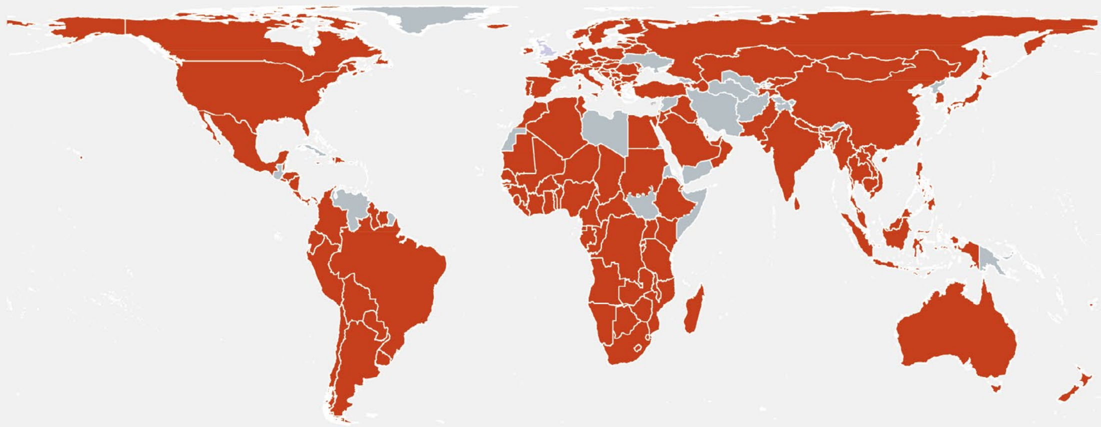
A) COST OF AN ENERGY SUFFICIENT DIET COMPARED WITH THE INTERNATIONAL POVERTY LINE



B) COST OF A NUTRIENT ADEQUATE DIET COMPARED WITH THE INTERNATIONAL POVERTY LINE



C) COST OF A HEALTHY DIET COMPARED WITH THE INTERNATIONAL POVERTY LINE



No data   < USD 1.20   USD 1.20–USD 1.90   > USD 1.90

NOTES: The maps show the cost of the three reference diets (energy sufficient, nutrient adequate and healthy diet) compared with the international poverty line (USD 1.90 purchasing power parity (PPP) per day) for 170 countries in year 2017. A diet is considered unaffordable when its cost exceeds USD 1.20, i.e. 63 percent of USD 1.90 PPP per day. The 63 percent accounts for a portion of the poverty line that can be credibly reserved for food. See Box 10 for the definition of the three diets and Boxes 11 and 12 for a brief description of the cost and affordability methodology. For the full methodological notes and data sources, see Annex 3. For disclaimers on map boundary lines, see Annex 5.

SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» These results imply that the international poverty line may need to be adjusted to avoid misguidance, as it is the basis for programme targets and social safety net programmes, but currently does not support the ability of people to access even the least-cost versions of a healthy diet. Specifically, poverty lines are not high enough to reflect incomes/consumption needed to support food security and nutrition needs. Poverty lines are determined by applying typical food consumption patterns expressed by food expenditure shares, using what is called a "basic needs approach". This approach uses food prices to determine the cost of calorie needs weighted by food expenditure shares. The cost analysis of a healthy diet above shows that the poverty line, which includes provision for basic food needs, does not provide for having either a nutrient adequate or a healthy diet in most countries. Hence there is a need for new food price metrics, based around global nutritional and dietary goals, to estimate food poverty lines that are nutrition-sensitive. This issue is flagged as an area for further research in the last section of this report (see Box 29).

Affordability comparing cost of the diets to average daily food expenditures in each country

Looking now at diet costs compared with average national food expenditures per person per day, this report finds that the energy sufficient diet is affordable for most countries in the world (Figure 29a). On average, this diet represents 19 percent of the average food expenditure in the world, indicating affordability. However, the degree of this affordability varies across country and development contexts.

As expected, an energy sufficient diet is most affordable in high-income countries (costing 10.5 percent of average food expenditure), with the degree of affordability decreasing as income level of the country declines. It is the least affordable in low-income countries (40 percent), followed by lower-middle-income countries (23 percent) and upper-middle-income countries (16 percent). The energy sufficient diet is least affordable in Western African low-income countries (50 percent). Moreover, this is the only region with two countries where the energy sufficient diet is not affordable, costing more than the average food expenditure. Specifically, the cost of an energy sufficient diet is 1.3 times higher than per capita food expenditures in Liberia, and 1.4 times higher in Togo (Figure 29a).

There are many more countries in the world where a nutrient adequate diet is not affordable (Figure 29b). For low-income countries as a whole, this diet is unaffordable as it represents 113 percent of the average food expenditure, meaning that it costs, on average, 1.13 times more than the average food expenditure. A nutrient adequate diet is affordable in high-income countries (costing 34 percent of average food expenditure), in upper-middle-income countries (46 percent) and also in lower-middle-income countries but to a lesser extent (62 percent).

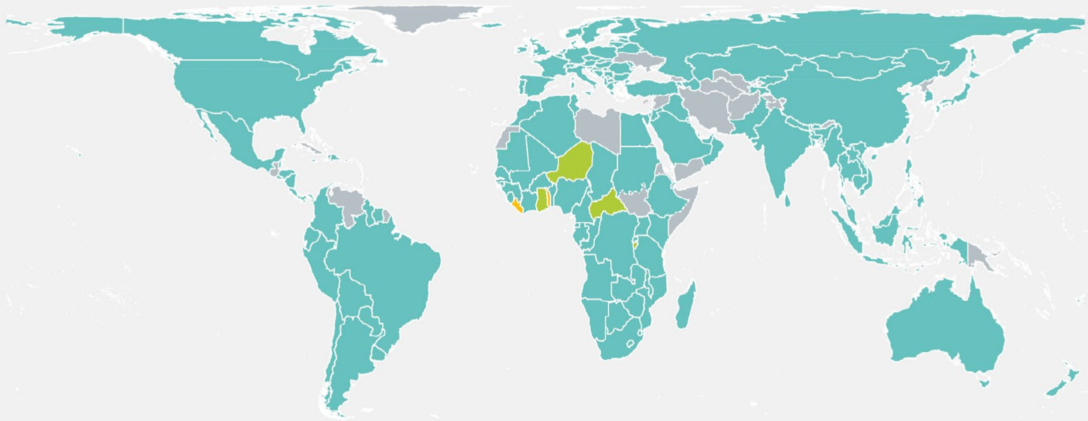
A nutrient adequate diet is overall affordable in sub-Saharan Africa (91 percent). However, in this region affordability varies across its subregions and countries (Figure 29b). In fact, the nutrient adequate diet is not affordable in Western Africa as it represents 109 percent of average food expenditures, with countries such as Niger and Liberia where this diet costs, respectively, two and almost four times more than the average national food expenditure. Although this diet is on average affordable in Latin America and the Caribbean (57 percent) and in Asia (43 percent), it is less affordable for several countries in these regions (Figure 29b).

At the global level, on average, a healthy diet is affordable, with the cost representing 95 percent of average food expenditures per capita per day. However, there are wide variations in affordability of this diet around the world and across development contexts. Most striking is that the cost of a healthy diet exceeds national average food expenditures in most countries in the Global South.[s] A healthy diet is not affordable in lower-middle-income countries (105 percent), and it is far from being affordable – almost 3 times the average food expenditure – in low-income countries (226 percent). On the other hand, a healthy diet is generally affordable in high-income countries, representing on average 50 percent of the average food expenditure, and in upper-middle-income countries but to a lesser degree (71 percent). »

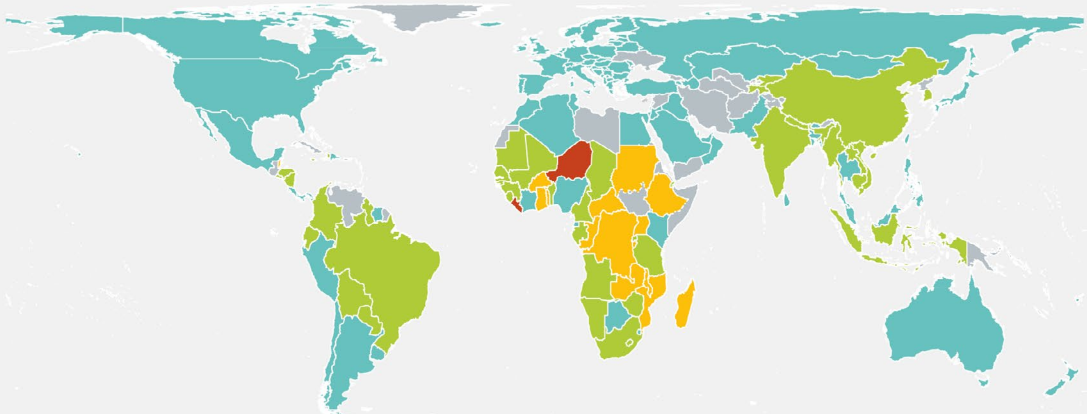
s See Annex 6 for the list of countries included in the Global South.

FIGURE 29
IN MOST COUNTRIES IN THE GLOBAL SOUTH, THE COST OF A HEALTHY DIET EXCEEDS AVERAGE NATIONAL FOOD EXPENDITURES PER CAPITA IN 2017

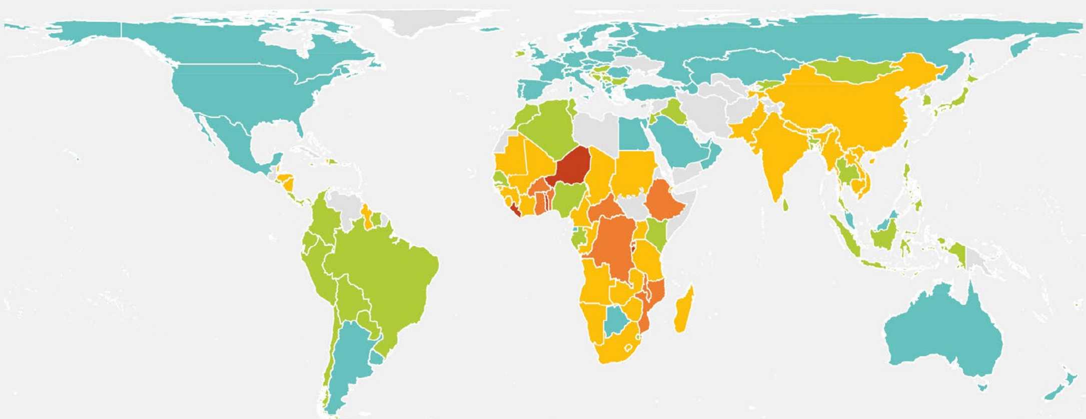
A) RATIO OF THE COST OF AN ENERGY SUFFICIENT DIET AND AVERAGE NATIONAL FOOD EXPENDITURES PER CAPITA



B) RATIO OF THE COST OF A NUTRIENT ADEQUATE DIET AND AVERAGE NATIONAL FOOD EXPENDITURES PER CAPITA



C) RATIO OF THE COST OF A HEALTHY DIET AND AVERAGE NATIONAL FOOD EXPENDITURES PER CAPITA



No data   < 0.5   0.5–1   1–2   2–4   > 4

NOTES: The maps shows affordability expressed as the ratio between the cost of each of the three reference diets (energy sufficient, nutrient adequate and healthy diets) and average food expenditures per capita per day in a given country. Affordability is shown for 170 countries in year 2017. Each diet is considered unaffordable when the ratio between the cost of a diet and average food expenditure in a given country is greater than 1. A ratio greater than 1 shows how many times a diet is more expensive than the average food expenditures. See Box 10 for the definition of the three diets and Boxes 11 and 12 for a brief description of the cost and affordability methodology. For the full methodological notes and data sources, see Annex 3.
For disclaimers on map boundary lines, see Annex 5.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» Of all the regions in the world, the affordability of a healthy diet poses the greatest challenge in Africa. In this continent, the average cost of a healthy diet exceeds the average food expenditure (USD 3.87 vs. USD 3.57), and it is 2.2 times higher in Western Africa (USD 4.03 vs. USD 2.66) (Figure 29c). Some countries show a much more disproportionate cost of this diet compared with their average food expenditures. In Burundi, Liberia, Niger and Togo, in particular, the cost of healthy diets is between 4 and 7 times higher than average food expenditures, with Liberia reporting the highest unaffordability.

While a healthy diet is on average affordable in North Africa (71 percent of average food expenditures), it is not affordable in three subregions of sub-Saharan Africa (Eastern, Middle and Western Africa). In Western Africa, it is 2.2 times more expensive than the average food expenditure, followed by Eastern Africa and Middle Africa, where the diet is 1.8, and 1.4 times higher than average food expenditures, respectively. It is affordable in Southern Africa where the healthy diet represents 92 percent of average food expenditures. Overall, a healthy diet is not affordable for more than 70 percent of the countries in Africa (35 out of 50).

In Asia, a healthy diet is on average affordable (78 percent of average food expenditures), owing to the affordability seen in Western Asia (56 percent), Eastern Asia (81 percent), Central Asia (85 percent), and South-eastern Asia (88 percent). However, it is not affordable in Southern Asia (102 percent). For 10 countries in Asia, out of 40 countries analysed, the cost of a healthy diet exceeds the average food expenditure.

Countries in food crisis face even greater challenges in accessing a healthy diet, especially countries with a protracted crisis situation which are characterized by complex, multidimensional conflicts and extreme fragility. In these contexts, the cost of a healthy diet is similar to the global average (USD 3.80 and USD 3.75 per person, respectively); however, the proportion of the people who cannot afford this diet is significantly higher compared with the world average. Most or 86 percent of the population in countries with a protracted crisis situation cannot afford a healthy diet. This is double the world average figure (38 percent) and is 57 percent higher than what is estimated for the Global South (Box 13).

More than 3 billion people in the world cannot afford a healthy diet

Affordability comparing cost of the diets to average estimated income in each country

The above analysis has shown clearly that a nutrient adequate and a healthy diet are significantly less affordable than an energy sufficient diet. In many countries, the poor would have to use most or all of their total income in order to acquire adequate quantities of essential nutrients and a diversity of nutritious food groups; and for a number of countries, even this amount would not be enough. In such situations, affordability imposes an insurmountable obstacle, so price and income constraints need to be addressed within supportive food environments for nutrition knowledge and behaviour change to be effective in influencing choices.

Ultimately, the aim of the cost and affordability analysis presented so far is to quantify the number of people for whom even a lowest-cost healthy diet is out of reach. Table 8 presents estimates of the prevalence and the total number of people for whom each of the three levels of diet quality is not affordable, based on average estimated income. These estimates assume that people spend on average 63 percent of their income on food, where this chosen percentage represents the food share expenditure of the poorest segment of the population in low-income countries, according to the World Bank (see Box 12 and **Annex 3**). To give a range of confidence to these estimates, the prevalence and number of people who cannot afford the three diets are also computed using lower-bound and upper-bound estimates that are shown in **Annex 3** (Table A3.3).

Based on this analysis, it is estimated that more than 3 billion people in the world could not afford a healthy diet in 2017. Most of these people live in Asia (1.9 billion) and Africa (965 million), although there are millions that live in Latin America and the Caribbean (104.2 million), and in Northern America and Europe (18 million). The highest proportion of the population that could not afford a healthy diet is seen in Western Africa (82 percent), »

TABLE 8
MORE THAN 3 BILLION PEOPLE IN THE WORLD CANNOT AFFORD A HEALTHY DIET IN 2017

	Energy sufficient diet		Nutrient adequate diet		Healthy diet	
	%	Total number (million)	%	Total number (million)	%	Total number (million)
WORLD	**4.6**	**185.5**	**23.3**	**1 513.0**	**38.3**	**3 021.5**
AFRICA	**11.3**	**148.6**	**51.0**	**680.6**	**73.8**	**964.8**
Northern Africa	1.4	2.9	29.2	84.3	46.0	136.1
Sub-Saharan Africa	12.5	145.8	53.4	596.3	76.9	828.8
Eastern Africa	9.4	28.9	53.9	224.2	75.3	325.1
Middle Africa	18.5	27.9	59.8	112.5	78.5	142.4
Southern Africa	10.0	11.1	41.7	33.8	64.3	40.3
Western Africa	13.1	77.9	53.5	225.8	81.6	320.9
ASIA	**0.4**	**21.6**	**11.7**	**754.5**	**36.6**	**1 933.9**
Central Asia	0.3	0.1	11.0	2.4	33.2	7.4
Eastern Asia	0.3	2.0	1.8	13.0	15.6	230.4
South-eastern Asia	0.7	6.3	20.7	145.4	46.2	325.5
Southern Asia	0.5	12.9	17.9	586.1	57.6	1 337.4
Western Asia	0.3	0.3	3.8	7.4	21.7	33.2
LATIN AMERICA AND THE CARIBBEAN	**3.7**	**10.5**	**18.1**	**66.8**	**26.5**	**104.2**
Caribbean	3.4	1.3	23.0	8.3	36.7	13.0
Latin America	3.8	9.1	16.8	58.5	23.6	91.2
Central America	4.9	2.2	22.6	20.4	28.5	31.6
South America	3.0	7.0	13.1	38.1	20.5	59.6
OCEANIA	**0.1**	**0.1**	**5.0**	**0.2**	**21.0**	**0.5**
NORTHERN AMERICA AND EUROPE	**0.3**	**4.8**	**1.7**	**11.0**	**3.7**	**18.0**
COUNTRY INCOME GROUPS						
LOW-INCOME COUNTRIES	**12.7**	**48.3**	**61.4**	**354.9**	**86.2**	**506.6**
LOWER-MIDDLE-INCOME COUNTRIES	**6.3**	**112.2**	**33.1**	**1 041.5**	**58.9**	**2 087.4**
UPPER-MIDDLE-INCOME COUNTRIES	**2.1**	**19.0**	**11.5**	**104.5**	**24.2**	**408.3**
HIGH-INCOME COUNTRIES	**0.3**	**6.0**	**0.9**	**12.1**	**2.0**	**19.2**

NOTES: The table presents the average percentage (%) and the total number (million) of population in each region and country income group who cannot afford the three reference diets (energy sufficient diet, nutrient adequate diet and the healthy diet) in the year 2017. This measure of affordability compares the cost of each diet with the average estimated income in a given country, under the assumption that 63 percent of the income available can be credibly reserved for food. A diet is considered unaffordable when its cost exceeds the 63 percent of the average income in a given country. See Box 10 for the definition of the three diets and Boxes 11 and 12 for a brief description of the cost and affordability methodology. For the full methodological notes and data sources, see Annex 3. Lower-bound and upper bound estimates of affordability are also computed and shown in Annex 3, Table A3.3.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

BOX 13
COUNTRIES WITH A PROTRACTED CRISIS SITUATION FACE IMMENSE CHALLENGES IN ENSURING THE AFFORDABILITY OF HEALTHY DIETS

Countries in food crisis face even greater challenges in ensuring the availability of nutritious foods and the affordability of a healthy diet. This is especially the case for countries with a protracted crisis situation,* which are generally characterized by complex, multidimensional and prolonged conflicts and extreme fragility.

Countries with a protracted crisis situations present specific challenges related to the cost and affordability of healthy diets.[59] Almost all these countries have experienced some form of violent conflict over prolonged periods. Their populations face frequent food price fluctuations and spikes, disruptions in food supply and access to functioning markets, and greater uncertainties, risks and inefficiencies in food systems. Most of these countries are also characterized by very weak governance, breakdown of local institutions, poor health of the affected populations, higher risk of climate variability and climate change impacts and high prevalence of natural disasters. Moreover, a significant proportion of the population in these contexts are acutely vulnerable to hunger, malnutrition, disease and disruptions to livelihoods over prolonged periods.

FAO currently identifies 22 countries with a protracted crisis situation, but information on cost and affordability is not available for seven of them: Afghanistan, Democratic People's Republic of Korea, Eritrea, Somalia, South Sudan, Syrian Arab Republic and Yemen (see **Annex 6**). The table below presents the analysis of the costs and affordability of the three reference diets (i.e. energy sufficient, nutrient adequate and healthy) for the 15 countries with a protracted crisis situation for which price data are available.

The cost and affordability analysis highlights the immense challenge in ensuring affordable healthy diets in these contexts. The findings show that while the cost of a healthy diet in these contexts is comparable to the global average, the proportion of the population who cannot afford a healthy diet is significantly higher. Specifically, the cost of a healthy diet is on average slightly higher than the global average (USD 3.80 and USD 3.75 per person, respectively). However, this is unaffordable for most (86 percent) of the population in countries with a protracted crisis situation – a figure that is double the world average (38 percent), and is 57 percent higher than what is estimated for the Global South.

Within-country analysis of variations in cost and affordability is available for a number of the most affected countries with a protracted crisis situation.** The results show that compared with countries with a stable context, the cost of an energy sufficient diet is usually only slightly higher. However, the cost of a nutrient adequate diet is significantly higher due to inefficiencies in supply and lower availability of nutritious foods.

For example, in North Burundi, Tanganyika region in the Democratic Republic of the Congo, Maradi and Zinder in Niger and the plateau Dogon in Mali, a nutrient adequate diet would be unaffordable for nearly everyone (above 90 percent).[60] In the Democratic Republic of the Congo and in Somalia, rural markets tend to offer significantly less variety of foods than urban markets in the same regions, especially animal source foods.*** When comparing the cost of a nutrient adequate diet to an energy sufficient diet, the nutrient diet in these regions was found to be 4–7 times higher, as opposed to 2–4 times higher in stable country settings.

Given the extreme severity and persistence of food insecurity and malnutrition they suffer, countries with a protracted crisis situation require special attention and approaches to transforming food systems in order to ensure affordable healthy diets for all.[59,61,62]

* FAO defines protracted crisis situations as "characterized by recurrent natural disasters and/or conflict, longevity of food crises, breakdown of livelihoods and insufficient institutional capacity to react to the crises". There are three criteria used to define a country with a protracted crisis situation: i) longevity of the crisis; ii) humanitarian aid flow to the country; and iii) the country's economic and food security status (see Annex 6).

** In these within-country studies, food price data were used to estimate the lowest cost of energy sufficient and nutrient adequate diets and these were compared with household food expenditure curves to estimate the proportion of households within a country that would be able to afford each diet.

*** Study findings are from the WFP Fill the Nutrient Gap (FNG) studies in Kasai and Tanganyika regions in the Democratic Republic of the Congo (unpublished), Maradi and Zinder (Niger),[63] South Madagascar,[64] Karamoja (Uganda),[65] Somalia (unpublished), North Burundi (unpublished) and Mali (unpublished). The last four were in preparation and will be published at WFP Fill the Nutrient Gap.[60]

WHILE THE COST OF A HEALTHY DIET IS COMPARABLE TO THE GLOBAL AVERAGE, THE PROPORTION OF PEOPLE WHO CANNOT AFFORD THIS DIET IS SIGNIFICANTLY GREATER IN COUNTRIES WITH A PROTRACTED CRISIS SITUATION

				Cost and affordability of energy sufficient diet			Cost and affordability of nutrient adequate diet			Cost and affordability of healthy diet		
Country	**Region**	**WB income classification**	**Population 2017 (millions)**	**Cost (USD)**	**% food expenditure**	**% population cannot afford**	**Cost (USD)**	**% food expenditure**	**% population cannot afford**	**Cost (USD)**	**% food expenditure**	**% population cannot afford**
Burundi	Africa	Low-income	10.8	0.65	73.8	36.5	1.40	160.3	81.0	3.57	407.4	97.4
Central African Republic	Africa	Low-income	4.6	0.62	50.3	38.9	1.41	113.7	74.5	3.47	279.6	93.6
Chad	Africa	Low-income	15.0	0.53	27.3	10.3	1.92	98.8	62.8	3.26	167.8	83.9
Democratic Republic of the Congo	Africa	Low-income	81.4	0.41	26.7	14.7	1.57	100.7	78.3	3.26	209.6	95.1
Djibouti	Africa	Lower-middle-income	0.9	0.62	25.7	3.2	2.17	90.7	38.1	3.72	155.1	68.3
Ethiopia	Africa	Low-income	106.4	0.58	40.5	1.7	1.94	136.9	47.7	3.39	238.7	84.0
Haiti	Latin America and the Caribbean	Low-income	11.0	0.86	32.2	11.3	2.63	98.9	61.9	4.91	184.5	88.0
Kenya	Africa	Low-income	50.2	0.77	21.3	9.5	1.70	47.1	47.5	3.24	89.9	79.1
Liberia	Africa	Low-income	4.7	0.97	127.3	24.3	2.96	387.9	85.9	5.45	714.9	97.8
Mali	Africa	Low-income	18.5	0.60	23.3	4.0	1.71	66.3	60.6	3.19	123.8	89.6
Mauritania	Africa	Low-income	4.3	0.88	26.3	1.7	2.50	75.0	33.2	4.42	132.8	70.3
Niger	Africa	Low-income	21.6	0.44	62.9	1.0	1.47	209.5	50.2	3.58	510.3	91.5
Sierra Leone	Africa	Low-income	7.5	0.45	21.2	0.5	1.97	91.9	68.6	2.84	132.4	85.1
Sudan	Africa	Lower-middle-income	40.8	1.08	24.2	6.8	5.96	133.5	93.4	4.93	110.6	89.0
Zimbabwe	Africa	Low-income	14.2	0.73	32.4	5.1	2.14	94.7	57.7	3.80	168.2	80.0
Simple averages				**0.68**	**41.0**	**11.3**	**2.23**	**127.0**	**62.8**	**3.80**	**241.7**	**86.2**
Global average				**0.79**	**19.3**	**4.6**	**2.33**	**55.6**	**23.3**	**3.75**	**95.3**	**38.3**

NOTES: The table shows the cost and affordability of the three reference diets (energy sufficient, nutrient adequate and healthy diet) for 15 countries with a protracted crisis situation, by region (column 2), development status (column 3) and population in year 2017 (column 4). The cost of the three diets is based on retail food price data obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). Two measures of affordability are presented. One shows the cost of each diet as a percentage of average food expenditure per capita per day in a given country (columns 6, 9 and 12): each diet is unaffordable for values greater than 100 percent. The other measure shows the percentage of people who cannot afford the three reference diets: each diet is unaffordable when its cost exceeds the 63 percent of the average income in a given country (columns 7, 10 and 13). The 63 percent accounts for a portion of average income that can be credibly reserved for food. See Box 10 for the definition of the three diets and Boxes 11 and 12 for a brief description of the cost and affordability methodology. For the full methodological notes and data sources, see Annex 3.
SOURCE: FAO elaboration from Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries.* Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» Middle Africa (78 percent), Eastern Africa (75 percent), Southern Africa (64 percent), followed by Southern Asia (58 percent), South-eastern Asia (46 percent), the Caribbean (37 percent), Central Asia (33 percent) and Central America (28 percent). Looking at country income groups, the highest proportion is seen in low-income countries (86 percent) and lower-middle-income countries (59 percent), whose populations face the greatest challenges in affording healthy diets.

In summary, 77 percent or more of the population throughout sub-Saharan Africa and 58 percent in Southern Asia cannot afford healthy diets. Furthermore, high proportions of people throughout other parts of Asia (30 percent) and Latin America and the Caribbean (26 percent) cannot afford healthy diets either (see **Annex 5**, Figure A5.3).

These findings imply that: i) the cost of nutritious foods that constitute healthy diets needs to decrease, including dairy, fruits, vegetables and protein-rich foods; and ii) poverty lines may need to rise, as they are the basis for programme targets and social safety net programmes, and currently do not provide a good gauge of people's ability to access even the least-cost versions of a healthy diet. That is, they do not support food security and nutrition.

National FBDGs reflect the translation of global guiding principles of a healthy diet that takes into account a country's nutrition situation, food availability, culinary cultures and eating habits (see Section 1.3 in Part 1 of this report). FBDGs are intended to establish a basis for food and nutrition, public health, education, social protection and agricultural as well as other sectoral policies and programmes, and also for food and nutrition education programmes to foster healthy eating habits. The findings indicate that as part of comprehensive strategies in order to shift population consumption towards recommended diets by enabling all people to access healthy diets, prices of those diets need to decline.

Costs and affordability within countries

The cost and affordability of diets varies around the world, across regions and in different development contexts. They may also vary within countries due to temporal and geographical factors, as well as variations in the nutritional needs of individuals across the life cycle. These within-country variations in cost are not captured in the above global and regional analysis.

Within-country variation driven by temporal and geographical factors

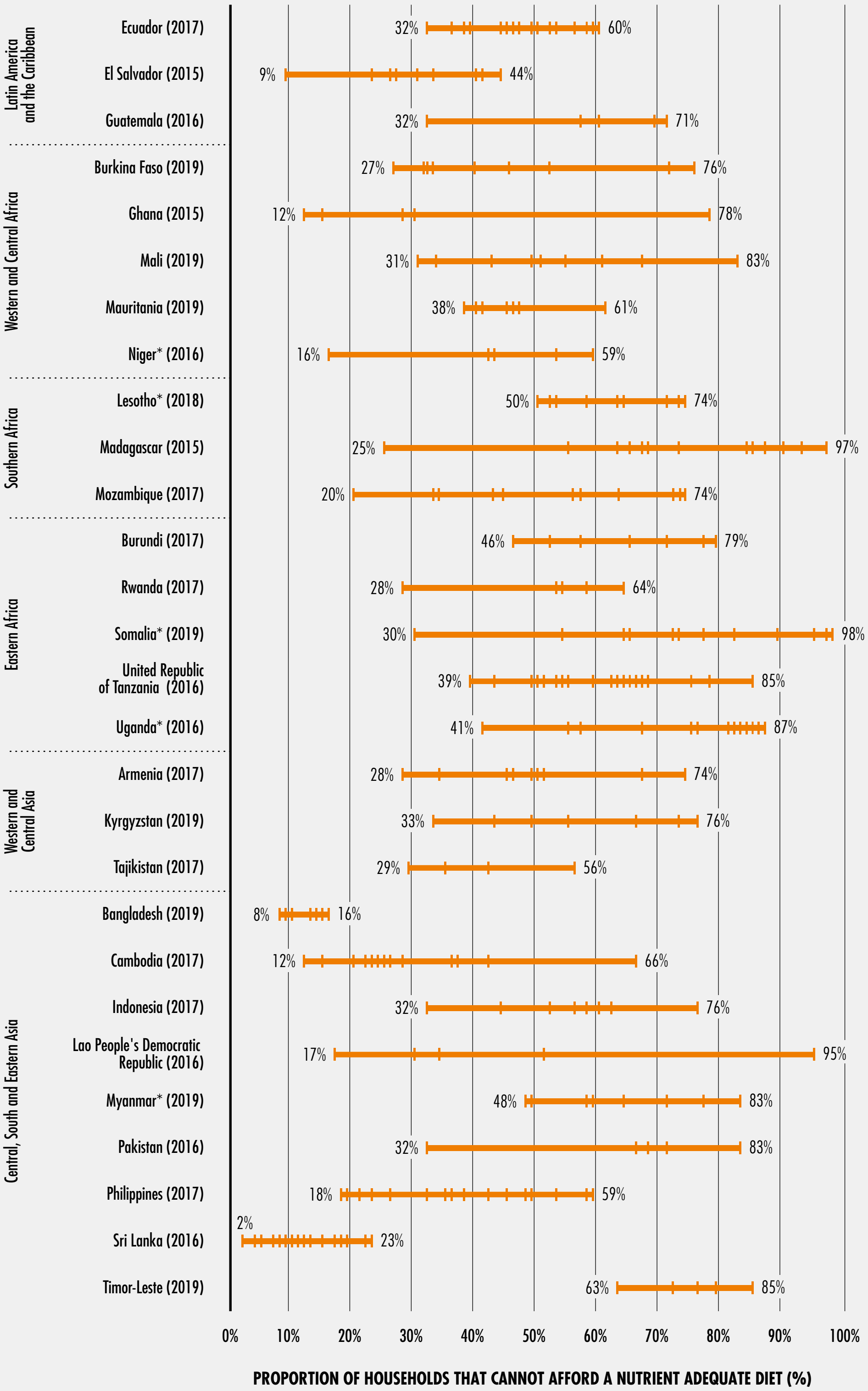
The affordability of a healthy diet can vary widely within a country, driven by variation among regions with regard to higher prices of nutritious food, lower economic status of a population, limited availability and diversity of nutritious foods or a combination of these factors. There are significant temporal and geographical patterns in the cost variations. For example, in a study of Southern Asia, for some countries, the price of a nutrient adequate food basket varied more by season and has been increasing at a faster rate than the price of a typical food basket. This phenomenon was largely due to the variable cost of vegetables.[66]

Food price data are also used in a selection of country studies to estimate the lowest-cost nutrient adequate diets,[t] which were then compared with household food expenditure curves to calculate the proportion of households within a country that would be able to afford it.[u] Figure 30 shows the range of within-country variation in unaffordability of a nutrient adequate diet for 25 countries. For example, in Madagascar, there was a wide variation: unaffordability of a nutrient adequate diet ranged from 25 percent to 97 percent. »

t Conducted by WFP in collaboration with the bureau of statistics or other national agency from specific countries; see WFP.[60]

u The cost of the nutrient adequate diet discussed here follows the same methodological approach as the above global and regional analysis, but differs in some aspects as it is a within-country estimation. Indeed, it is estimated using a household that typically includes five individuals, and it is then expressed as a per capita average. The modelled household varies by country but typically includes one breastfed child aged 12–23 months, one school-aged child (6–7 years), one adolescent girl (14–15 years), one lactating woman and one adult man. Unaffordability is measured by the proportion of households in a country whose food expenditure is not sufficient to afford a nutrient adequate diet in their local environment (see Annex 3 for the difference between methodologies).

FIGURE 30
AFFORDABILITY OF A NUTRIENT ADEQUATE DIET VARIES WIDELY WITHIN MANY COUNTRIES DUE TO TEMPORAL AND GEOGRAPHICAL VARIATIONS IN PRICES AND DIFFERENCES IN INCOMES



NOTES: The figure indicates the range of unaffordability of a nutrient adequate diet across different countries and different years. Unaffordability is measured by the proportion of households in a country whose food expenditure is not sufficient to afford a nutrient adequate diet in their local environment. The nutrient adequate diet includes, per person, the average energy needs and the recommended intake for protein, fat, four minerals and nine vitamins. The modelled household varies by country, but typically includes one breastfed child aged 12–23 months, one school-aged child (6–7 years), one adolescent girl (14–15 years), one lactating woman and one adult man. Each data point represents an area of the country. Each vertical line in the range represents a particular administrative area, e.g. a province or district. * Denotes that there was a consumer price index (CPI) adjustment made to expenditure data to match the year for which the food price data were collected.
SOURCE: WFP (see WFP. 2019. *Fill the Nutrient Gap* [online]. Rome. [Cited 27 April 2020]. www.wfp.org/publications/2017-fill-nutrient-gap for published country data).

» Varying food prices, which directly impact the cost of a nutrient adequate diet, often mirror urban-rural divides. In the urban south of Mozambique, the prices of eggs and tomatoes, which are imported from South Africa, were 4–5 times higher than in the rural central region, where they were mainly produced by local households. However, a nutrient adequate diet was more affordable in the urban south, even if it was more expensive, because incomes were higher. This is a typical observation in many countries. Rural areas were also impacted more strongly by seasonality, with food prices in rural areas rising higher in the lean season compared with those in urban contexts.

In all contexts, food prices varied by ecological system and livelihood. In rural Myanmar, the "breadbasket" region of Ayeyarwady, where most of the rice and other crops are produced and sold on rural markets, the cost of a nutrient adequate diet was 10 to 25 percent lower than in remote regions of the country where transport, storage and retail are required to get the foods there. In the pastoralist belt of north Burkina Faso, 82 percent of households were unable to afford a nutrient adequate diet. In contrast, the agricultural southern regions showed variation in unaffordability of a nutrient adequate diet from 35 to 43 percent.

Furthermore, higher food prices and the higher cost of a nutrient adequate diet were also seen in remote mountainous communities of Lesotho and El Salvador due to the challenges of food supply and the difficulties in meeting nutrient requirements from the foods that are locally available. In El Salvador, the number of nutritious foods available on the market decreased with altitude, increasing the cost of meeting nutrient requirements. Unaffordability of a nutrient adequate diet varied from 23 percent in the plains to 44 percent in the high-altitude Morazan region.

Even assuming relatively uniform food prices across a country, the ability to afford a nutrient adequate diet can also vary among different areas depending on levels of poverty and income. In the Zambezia, Gaza and Nampula provinces of Mozambique, where there are fewer income-earning opportunities and considerably lower income, households spent only half as much money on food compared with what households in Maputo Province in the south do.[v] Similarly, the Amazon region of Ecuador had among the lowest cost of a nutrient adequate diet in the country (on average USD 7.40 per five-person household per day compared with USD 8.60 national average). However, this does not translate into greater affordability of nutrient adequate diets in these regions because of the region's poor economic status. As shown above, a reference healthy diet has been shown to be more expensive than a reference nutrient adequate diet, so it is likely that families will struggle even more to be able to afford a healthy diet to promote and protect long-term health.

Within-household variation driven by life-cycle needs

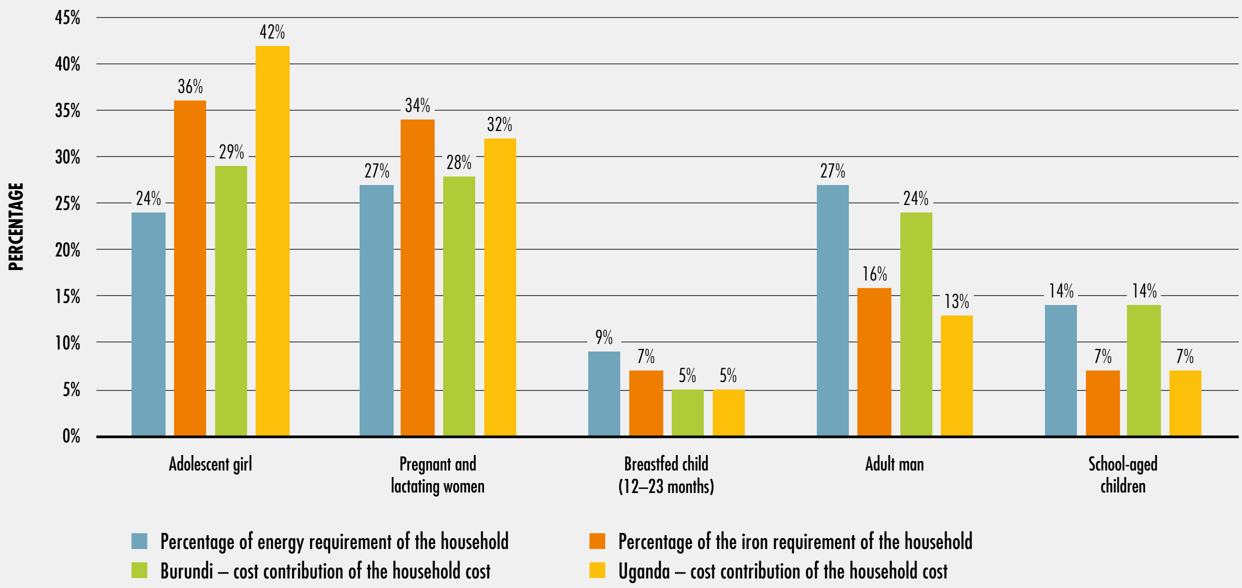
Nutritional needs vary across the life cycle, and hence dietary intake requirements differ both in terms of quantity and diversity. This has implications for cost and affordability, and risk of micronutrient deficiencies.[67] Within the same household, the cost of a nutrient adequate diet is not the same for everyone, as members are generally at different stages of life. This is mainly due to the increased need for some nutrients during phases which should be met with foods of higher nutritional value, such as pregnancy or adolescence, which tend to be more expensive.[49]

For example, in Malawi, pregnant and lactating women and adolescent boys faced the highest cost for a nutrient adequate diet. The average cost of a nutrient adequate diet of these groups was more than USD 1.50 per day, which was much higher than the 70 percent of international poverty line and the food expenditure per capita per day in Malawi.[49] In terms of the cost per 1 000 kcal, females in general faced a higher cost compared with males, as they require more nutritious foods. This trend is the same at the global level, showing adolescent girls and older females facing particular challenges in terms of the need for highly nutritious foods.[49]

A recent study that modelled the cost of a nutrient adequate diet based on locally available foods in four countries (El Salvador, Ghana, Lao

v WFP (see WFP [2019][60] for published country data).

FIGURE 31
PREGNANT AND LACTATING WOMEN AND ADOLESCENT GIRLS HAVE HIGHER DIETARY ENERGY AND IRON NEEDS, WHICH INCREASES THE COST OF A NUTRIENT ADEQUATE DIET: BURUNDI AND UGANDA CASE STUDIES



NOTES: The figure shows the contribution (percentage) of different household members to a household's total needs for energy and iron requirements, and the contribution of different household members to a household's total cost of a nutrient adequate diet (using the least-cost diet), in Uganda (year 2016) and Burundi (year 2017). The nutrient adequate diet includes, per person, the average energy needs and the recommended intake for protein, fat, four minerals and nine vitamins. The modelled household for Burundi and Uganda includes one breastfed child aged 12–23 months, one school-aged child (6–7 years), one adolescent girl (14–15 years), one lactating woman and one adult man.
SOURCE: WFP (see WFP. 2019. *Fill the Nutrient Gap* [online]. Rome. [Cited 27 April 2020]. www.wfp.org/publications/2017-fill-nutrient-gap for published country data on Burundi and Uganda).

People's Democratic Republic and Madagascar) found that in a five-person household, meeting the needs of an adolescent girl would cost the most, exceeding not only the diet cost of an adult man but also of a lactating woman.[64,68,69,70] The higher cost of a nutrient adequate diet was mainly driven by the elevated need for calcium, iron and vitamin A to fuel growth and compensate nutrients lost through menstruation. In the countries studied, these nutrients would be met most cost-efficiently through foods like meat and dairy, which cost more than less nutritious foods such as starchy staples.

In Ghana, a nutrient adequate diet for an adolescent girl would cost 3 times more than a nutrient adequate diet for a boy of the same age and twice as much as a nutrient adequate diet for an adult man. The girl's nutrient needs, and therefore diet cost, are elevated further if she happens to be pregnant or breastfeeding due to the increased nutrient intake requirements. Analyses for El Salvador and Lao People's Democratic Republic found that pregnancy on average increased the cost of a nutrient adequate diet for an adolescent girl by 12 percent and by 18 percent if she is breastfeeding.[68,69,70]

Figure 31 shows the proportion of a household's total needs for dietary energy and iron required by different population groups in Burundi and Uganda. The share of iron needed by adolescent girls and pregnant or lactating women is higher than that of energy, whereas it is lower for breastfed children, adult men and school-aged children. The share of adolescent girls and pregnant or lactating women in the household's cost of a nutrient adequate diet tends to be higher than their share of the energy, but as the data show, this varies, as it depends on the cost of the local foods that contain the most-needed nutrients.[w] This is likely to be worse in countries where – due to lack of awareness and gender dynamics – women, girls, and young children do not get a larger share of more nutritious foods to meet their higher nutrient needs. Despite the higher costs, ensuring optimal nutrition of girls, women and especially adolescent girls is a wise return on investment to ensure the health of the girls and women and also the health of future generations due to the intergenerational cycle of malnutrition.

Another stage of life that requires foods of high nutritional value is the period between 6 and 23 months. At this age, children have high nutrient needs for growth but can only eat small quantities of food because of their small stomachs; therefore, they require breastfeeding and nutrient-dense complementary foods. Although the cost of complementary feeding for a child of 6–23 months of age is the lowest in the household, the number and quality of foods selected for that child is higher than for an adult man, because of the nutrient density required. For example, per 100 kcal of food, a breastfed infant of 6–8 months of age needs 9 times as much iron and 4 times as much zinc as an adult man.[71]

Conclusion

In summary, the analysis of the costs and affordability of the three reference levels of diet quality presented in this section helps determine where, geographically, attention needs to be paid if a healthy diet is to become affordable for all, across and within countries, by regions and country income groups. The evidence presented serves to highlight where the cost of a healthy diet must fall to be an affordable level for all, as well as where the need is most pressing, so that people can then have more choice options. It shows that healthy diets are unaffordable to many people, especially the poor, in every region of the world. In fact, for more than 3 billion people, even the lowest-cost healthy diet is unaffordable. In many countries of the world, the cost of a healthy diet is much higher than both the international poverty line, established at USD 1.90 PPP per day, and average food expenditures. More than 77 percent of the population cannot afford these diets throughout sub-Saharan Africa, and 57 percent cannot afford it in Southern Asia, and the challenges are even greater for countries with a protracted crisis situation. More than 1.5 billion people in the world cannot even afford a diet that only meets required levels of essential nutrients.

Aside from recognizing the prohibitive costs of healthy diets for many of the world's populations, it is also important to understand what is making these diets costly. Evidence points to a number of different factors driving up the price of nutritious foods throughout food systems. The following sections further explore this in order to identify the key areas of policy intervention and food systems transformations. ■

w WFP (see WFP [2019][60] for published country data).

2.2 THE HIDDEN HEALTH AND ENVIRONMENTAL COSTS OF WHAT WE EAT

KEY MESSAGES

➔ Current food systems have clearly been successful at producing low-cost calories, but healthy diets remain costly and unaffordable for billions of people in the world. However, considering only the cost and affordability of different diets fails to account for the hidden costs associated with food production and consumption.

➔ All diets around the world, from those that meet only dietary energy needs to those that are considered nutrient adequate and healthy diets, have hidden costs that must be understood in order to identify trade-offs and synergies that affect the achievement of other SDGs.

➔ Two hidden costs of our dietary patterns and of the food systems supporting them relate to the health-related costs for many people (SDG 3) and the climate-related costs that the world as a whole incurs (SDG 13).

➔ The first hidden cost: If current food consumption patterns continue, diet-related health costs linked to non-communicable diseases and their mortality are projected to exceed USD 1.3 trillion per year by 2030. On the other hand, shifting to healthy diets would lead to an estimated reduction of up to 97 percent in direct and indirect health costs, thus creating significant savings that could be invested now to lower the cost of nutritious foods.

➔ The second hidden cost: The diet-related social cost of greenhouse gas (GHG) emissions associated with current dietary patterns is projected to exceed USD 1.7 trillion per year by 2030. The adoption of healthy diets that include sustainability considerations would reduce the social cost of GHG emissions by an estimated 41–74 percent in 2030.

➔ Not accounting for the hidden costs of diets would result in a serious cost underestimation of achieving food security and nutrition, and ignore the challenges of achieving environmental sustainability and health for all.

➔ Shifting to healthy diets that include sustainability considerations could help to reduce health and climate-change costs by 2030, as their hidden costs are lower compared with those of current food consumption patterns. There is a range of healthy diet patterns that can contribute to reducing GHG emissions and allow climate adaptation, depending on country contexts, individual preferences and the nutrient needs of different population groups in each country.

➔ Healthy diets can play an important role in increasing the environmental sustainability of food systems; however, not all healthy diets are sustainable and not all diets designed for sustainability are always healthy. This important nuance is not well understood and is often missing from ongoing discussions and debates on the potential contribution of healthy diets to environmental sustainability.

➔ A shift towards healthy diets that also include sustainability considerations will require significant transformations in food systems, and there is no one-size-fits-all solution for countries. Assessing context-specific barriers, managing short-term and long-term trade-offs and exploiting synergies will be critical.

➔ In countries where the food system also drives the rural economy, care must be taken to mitigate the potential negative impacts on incomes and livelihoods as food systems transform to deliver affordable healthy diets.

➔ Low- and lower-middle-income countries, where populations still suffer undernutrition and nutrient deficiencies, may need to increase the consumption of nutritious foods even when they might result in higher national carbon footprints in order to meet recommended dietary needs and nutrition goals, particularly to prevent undernutrition.

➔ Other countries, especially upper-middle-income and high-income countries, where diet patterns exceed optimal energy requirements and people consume more animal source foods than required, require major changes in dietary practices and system-wide changes in food production, food environments and trade.

Current food systems have been successful at producing low-cost calories that have fuelled a fast-growing and more urbanized population, and economic development more broadly. However, these productivity gains and cheap calories have not improved access to healthy diets, which remain costly and unaffordable for billions of people in the world. But the issue of cost of diets is problematic in another sense as well, one that should not be overlooked.

Considering only the cost and affordability of different diets, as done in Section 2.1, fails to account for the hidden costs associated with current food production and consumption. Understanding them is critical to identify trade-offs and synergies for other SDGs. The two most critical hidden costs relate to health- (SDG 3) and climate-related (SDG 13) consequences of our dietary patterns and the food systems that support these. These costs are "hidden" because health and environmental costs accrue years after the observed production and consumption.[x]

The health impacts associated with poor quality diets are significant for many people in the world. In addition to the health and social costs associated with undernutrition, unhealthy diets are a leading risk factor for deaths and disability associated with from non-communicable diseases (NCDs). Increasing healthcare costs linked to rising obesity rates are a trend across the world, and both overweight and obesity are significant risk factors for NCDs. Out of 56.9 million global deaths in 2016, 40.5 million, or 71 percent, were due to NCDs.[2] The four main NCDs are cardiovascular diseases, cancers and diabetes.

Current global methods of food production also result in negative environmental impacts,[72] with repercussion for society as a whole. This is seen for example in countries where energy intake and consumption of animal source foods is too high, a rebalancing of the diets to a higher content of plant-based foods may be needed to reduce negative environmental impacts, including on land use, freshwater extraction and biogeochemical flows.[73]

The health and environmental consequences of unhealthy diets translate into actual costs for many people in the world and for society as a whole, such as increased medical costs and the costs of climate change, respectively. These costs incurred in the production and consumption of food are currently not reflected in the price of food, even though they are a result of the production and consumption of this food. They are what economists call negative externalities, and they can lead to market failures, overconsumption, and production of energy-dense foods and diets that are harmful to environmental sustainability. According to economic theory, correcting such market failures requires integrating the previously unaccounted costs in the price of those foods, so that consumers and producers can make their decisions based on full costs.

Properly valuating these hidden costs or externalities of food systems would significantly modify the assessment of what is "affordable". To show the significance of this, this section presents new estimates of an economic valuation of the health and climate change consequences associated with dietary choices, but not currently reflected in their costs.

Specifically, this section presents new estimates of the health and climate-change costs associated with current food consumption patterns. Based on the estimates, the section determines the impacts of shifting dietary patterns towards healthy diets that include sustainability considerations.[y] This exercise can inform food policy to incentivize dietary changes towards healthy diets that are more environmentally sustainable.

x There are no universally agreed-upon discount rates – rates used to convert future damages to present values. Therefore sensitivity analysis is necessary, but it is also important to consider equity issues – especially intergenerational equity issues – hidden in discount rates. Stern (2008)[348] presents an interesting discussion on the difficulties and common mistakes made in estimating a discount rate for climate-change economic analysis.

y In order to examine these impacts, particularly in terms of the associated health and climate-change costs, current food consumption patterns are compared with four alternative dietary patterns that include aspects of environmental sustainability. For presentational purposes, the remainder of this report refers to these as "four alternative healthy diets" based on a comprehensive review of the literature on healthy eating and food system sustainability. However, the four alternative diet scenarios are only examples of many other possible healthy dietary patterns, and may not be the most healthy and appropriate diets for all population groups.

Considering total global consumption, a rebalancing of consumption towards healthy diets that takes into account environmental sustainability would significantly reduce negative externalities, creating synergies for other SDGs. However, this global pattern does not need to result in a decrease in each country. At the national level, the impact of this rebalancing depends on a country's existing food security and nutrition situation, the speed at which it has been able to make progress, and the magnitude of health and environmental externalities. For some countries, a shift may imply trade-offs, and the downsides may last for some time. For example, the current diet of a young child in a low-income country may have a low environmental footprint, but its nutritional content may be inadequate. In this case, the environmental impact may have to increase to meet the desired nutritional targets first. Another example is the diversification of production that is needed for healthy food items. To minimize unfavourable trade-offs, the livelihoods of family farmers and smallholder producers for whom transition to diversification is not immediately feasible should be prioritized, particularly in countries where food systems not only provide food but also drive the rural economy. Hence, this section offers ideas for prioritizing and making the most of synergies while avoiding unfavourable trade-offs along the transformation of food systems.

A valuation of hidden costs of dietary patterns

This report's valuation of hidden costs of dietary patterns includes separate valuations of health and climate-change costs, but does not consider many other potential environmental costs. Nonetheless, health and climate-change costs are critical to consider in any transformation of food systems aimed at delivering affordable, healthy diets that include sustainability considerations. While these two costs are different in nature – one directly affecting only some people (health), the other affecting the world as a whole – here they are also evaluated together to understand their full impact on current and future food production systems.

The two hidden costs have been estimated for five different dietary patterns: one baseline or benchmark diet, representing current food consumption patterns and four alternative healthy diet patterns that include sustainability considerations.[z] The four alternative healthy diet patterns analysed here differ from the healthy diet analysed in Section 2.1, in that these four diets not only are optimized for health, but also include environmental sustainability considerations. For estimating the health costs, updated estimates of the health burden of dietary risks (associated with their contribution to diet-related NCDs) were combined with cost-of-illness estimates. For estimating climate-change costs, food-consumption estimates were combined with updated GHG emissions footprints and estimates of the costs of climate damages associated with such emissions, as expressed in the social cost of carbon. Hence, a number of environmental costs are not being accounted for. A brief description of the methods and baseline data for this estimation are provided in Box 14, with a more comprehensive description of the data and methodology provided in **Annex 7.**

For the analysis, this report focuses on the projected health and climate change burden in the year 2030 as a politically relevant timeframe in light of the target year of the SDGs, and more specifically for achieving the SDG 2 targets for ending hunger, food insecurity and all forms of malnutrition.[aa]

Underlying the valuation of the health and climate-change cost analysis are estimates of current and future food consumption and the four alternative consumption scenarios that have been devised as being healthy and include sustainability considerations. Current food demand, referred to »

z The analysis has been carried out in collaboration with the University of Oxford, and is an update to a previous analysis on the valuation of the health and climate-change benefits of dietary change.[84] In particular, the new analysis of this report increases the number of dietary risk factors covered in the health analysis and valuation; uses more recent emissions data in the environmental analysis; and updates the diet scenarios to a standardized set of healthy diets that include sustainability considerations that are analysed as a means of reducing the negative health and climate-change costs imposed on society.

aa Analyses for the years 2010, 2020 and 2050 were carried out for sensitivity analysis.

BOX 14

VALUATION OF HEALTH AND CLIMATE-CHANGE COSTS: BASELINE DATA AND METHODS

The quantification of the health and environmental costs are related to a dietary shift from national average food consumption patterns to healthy diets that include sustainability considerations. To quantify health costs, a region-specific health model that covers dietary and weight-related risk factors was used. To quantify environmental costs, emissions accounting and economic valuation models were used.

BASELINE DATA AND FOUR ALTERNATIVE HEALTHY DIET PATTERNS

For the baseline diet, food availability estimates in the year 2010 are taken from a harmonized data set of FAO Food Balance Sheets (FBS) that includes the full set of 16 food commodities. Food availability estimates are used as a proxy for national average food consumption, after applying regional data on food wastage at the consumption level combined with conversion factors into edible matter (see **Annex 7**). Underlying the analysis, there are estimates of national average food consumption in the base year 2010, as well as future food consumption projected in year 2030, which is estimated considering expected changes in income, population and dietary preferences.[75] In this analysis, national average food consumption is referred to as the **benchmark** diet (**BMK**) or current food consumption patterns in reporting results.

Starting from food availability estimates, the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT)[74] was used to simulate the benchmark as well as four alternative healthy diet patterns that include sustainability considerations in 157 countries in year 2030. Projections were also carried out for year 2050 for sensitivity analysis. In the IMPACT model, regional commodity prices are endogenously determined by market-clearing conditions that take into account changes in world prices, trade policies and costs, and producer and consumer support measures in national markets. Commodity prices in the base year were based on data from the Agricultural Market Access Database of the Organisation for Economic Co-operation and Development,[76,77] and estimates of export and import tariffs were adopted from the Global Trade Analysis Project (GTAP).[78]

The four alternative healthy diet patterns were developed by the EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems, based on a comprehensive review of the literature on healthy eating and food system sustainability:[79] a **flexitarian diet (FLX)**, which contains small to moderate amounts of all animal source foods; a **pescatarian diet (PSC),** which contains moderate amounts of fish but no other meat; a **vegetarian diet (VEG),** which contains moderate amounts of dairy and eggs, but no fish or other meat; and a **vegan diet (VGN)**, which is completely plant-based consisting of a variety of fruits and vegetables, whole grains and plant-based protein sources, such as legumes and nuts. These diets are in line with observed dietary patterns.[80,81,82] See **Annex 7** for full description of these diets.

METHODS TO ESTIMATE HEALTH COSTS

For estimating the health costs, the proportions of mortality and disease cases attributable to dietary and weight-related risk factors were first calculated, with a focus on NCDs. These are the proportions that would be avoided if the risk exposure changed from current food consumption patterns to any of the four alternative healthy diet patterns. Changes in mortality at the regional level were calculated by multiplying these proportions by region, disease- and age-specific death rates and population numbers. For measuring the health burden of diets, methods developed by the Global Burden of Disease (GBD) project were followed, using a comparative risk assessment framework of dietary and weight-related risks.[83] The assessment included four disease endpoints: coronary heart disease, stroke, type 2 diabetes mellitus and cancer (both in aggregate and as site-specific cases, such as colon and rectal cancer)[80] in line with available cost-of-illness estimates.[84] The risk factors included seven dietary risks: low intake of fruits, vegetables, legumes, nuts and whole grains, as well as high intake of red meat and processed meat. The risk factors included also three weight-related risks: being underweight, overweight or obese. Note that high intake of sodium is not included in this analysis as a risk factor. Although, ideally, cost estimates would also include the costs related to

BOX 14
(CONTINUED)

the health impact of undernutrition, both in terms of deaths and lost productivity, such estimates have not been included because data for these estimations do not exist. For this reason the estimated costs are likely to be underestimated.

To quantify the cost of health impacts, the cost-of-illness approach was used. For estimating the health costs of diets, the estimates of cause-specific attributable deaths obtained from the comparative risk assessment were paired with cost-of-illness estimates. The latter capture both the direct (i.e. medical and healthcare costs) and indirect (costs of informal care and lost working days) costs associated with a specific disease.[1]

METHODS TO ESTIMATE CLIMATE-CHANGE COSTS

For estimating the climate-change costs of diets, the GHG emissions associated with food consumption were calculated and then paired with cost estimates of climate damages. For the former, a set of emissions factors derived from life-cycle assessments were adopted, including a global life-cycle assessment with regional detail covering livestock products, which was undertaken by FAO,[85] and a comprehensive meta-analysis of life-cycle assessments of other food products.[86] The assessments included all main emissions (carbon dioxide, methane, nitrous oxide) and sources along the food supply chain from the farm gate to the retail point: production, processing, transport, including international trade, and, for livestock products, land use and feed production. For fish and seafood, wild-caught and farmed fish production were differentiated[87] and paired with the associated emissions footprints.[88,89] Improvements in the emissions intensities of foods over time were accounted for by incorporating the mitigation potential of bottom-up changes in management practices and technologies from marginal abatement cost curves, in line with previous assessments. Finally, for monetizing the GHG emissions, estimates of the social cost of carbon (SCC) were used, which represent the economic cost caused by an additional tonne of GHG emissions. In particular, estimates come from a fully revised version of the Dynamic Integrated model of Climate and the Economy (DICE) for a scenario that constrains a future temperature rise to 2.5 degrees (with the temperature limit averaged over 100 years) in line with policy goals.[73,90,91]

For future years, this report accounted for improvements in the emissions intensities of foods over time by incorporating the mitigation potential of bottom-up changes in management practices and technologies from marginal abatement cost curves[90] in line with previous assessments.[80] The mitigation options included changes in irrigation, cropping and fertilization that reduce methane and nitrous oxide emissions for rice and other crops, as well as changes in manure management, feed conversion and feed additives that reduce enteric fermentation in livestock. In line with commitments made as part of the SDGs, this report also included a halving of food loss and waste by 2030 in development pathway. For monetizing the GHG emissions, this report used estimates of the SCC, which represents the economic cost caused by an additional tonne of GHG emissions.

For a complete list of references and further details on methodology and data sources, see **Annex 7**.

* Veganism in free-living populations tends to be associated with religious reasons or particular health consciousness; furthermore, non-biased intervention trials involving direct comparison of vegan diets with various other dietary patterns and examination of long-term health effects are essentially non-existent.[92] Although the vegan diet may result in positive health outcomes in countries with ample food choice, access to supplements or an abundance of highly fortified foods, it is not likely to be applicable for many countries, and is not an acceptable diet for young children and pregnant or lactating women in many contexts. Vegetarian diets are also likely to have similar (albeit smaller) issues relating to meeting nutrient adequacy, and in pregnancy require careful monitoring to ensure essential nutrients are met.

» as the "benchmark diet" in the analysis presented below, is estimated based on a harmonized data set of food availability estimates by FAO. Future food demand is estimated considering expected changes in income, population and dietary preferences.[74] The food demand projections are comparable with other estimates.[75]

Four alternative healthy diet patterns are analysed: a predominantly plant-based flexitarian diet which contains small to moderate amounts of animal source foods; a pescatarian diet that is based on sustainable aquaculture and which contains moderate amounts of fish but no other meat; a vegetarian diet that includes moderate amounts of dairy and eggs, but no fish or other meat; and a completely plant-based, vegan diet that is based on a variety of fruits and vegetables, whole grains and plant-based protein sources, such as legumes and nuts. These diets conform to the general recommendations of the EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems and take into account regional preferences for specific staple crops, fruits, vegetables and other food categories, as well as population-specific energy requirements (Box 14).

The purpose of identifying the four alternative diet patterns is to examine the hidden costs for different healthy diets that include aspects of environmental sustainability, rather than to endorse any particular dietary pattern. The four alternative diet scenarios are only examples, and other variations could be developed for a similar analysis of hidden costs. While there is a range of healthy diets, based in global guidelines, that can be designed to include sustainability considerations, not all are the most healthy and appropriate diets for all population groups. The purely plant-based diets in particular can carry large risks of nutrient inadequacies.[ab]

This can be the case in settings where overall diet quality is low: e.g. where micronutrients cannot easily be supplied or managed through an abundance of nutrient-rich plant-based foods; in the case of young children and pregnant or lactating women who have higher nutrient requirements; or where populations are already suffering nutrient deficiencies.[93,94]

Hidden health costs

As highlighted in Section 1.3 of this report, a healthy diet ensures adequate calories and nutrients, and includes a balanced, diverse intake of foods from several different food groups eaten over a period of time. It is intended to meet all requirements of nutrient adequacy and to help prevent malnutrition in all its forms, as well as NCDs. Diets of poor quality are a principal contributor to the multiple burdens of malnutrition, like stunting, wasting, micronutrient deficiencies, overweight and obesity. Both undernutrition early in life and overweight and obesity are significant risk factors for NCDs.[95]

Estimating the health costs related to poor quality diets, including the multiple burdens of malnutrition and related NCDs, is fraught with challenges related to data availability and the sheer complexity of the interrelated outcomes. One of the biggest challenges is that there is a lack of data on the costs related to the health impacts of undernutrition, both in terms of deaths and lost productivity. There are a few case studies of cost estimates for undernutrition.[96,97] For example, it is projected that undernutrition will reduce gross domestic product (GDP) by up to 11 percent in Africa and Asia by 2050.[98] Yet global estimates are few. The lack of comprehensive comparable data, however, prevents global modelling efforts from capturing the full effect of diets on undernutrition, including on children and adolescents.[ac]

ab Veganism in free-living populations tends to be associated with particular health consciousness; furthermore, intervention trials of vegan diets that are related to direct comparison of vegan diets with various other dietary patterns, that are defended from bias, and that examine long-term health effects are essentially non-existent.[92] Although the vegan diet may result in positive health outcomes in countries with ample food choice, access to supplements or an abundance of highly fortified foods, it is not likely to be applicable for many countries, and is not an acceptable diet for young children and pregnant or lactating women in many contexts. Vegetarian diets are also likely to have similar (albeit smaller) issues relating to meeting nutrient adequacy, and in pregnancy require careful monitoring to ensure essential nutrients are met.

ac Although there is a lack of global comparable data, there are some case studies. For example, the economic impact of undernutrition resulting from productivity losses as a consequence of higher death rates and lower levels of education can be considerable, and have been shown to range between 1.7 percent and 11.4 percent of GDP in countries of Central America and the Dominican Republic and four South American countries (see ECLAC and WFP [2007][349] and [2009][350]). In addition to these economic considerations, the problems associated with child undernutrition are not limited to the life cycle of each individual, but can affect that person's children, who will also be more vulnerable (see ECLAC and WFP [2007][349]).

Even considering only obesity, estimated economic costs from existing studies vary considerably due to the different methodologies used to estimate indirect and direct costs.[95,99] For example, estimates from the United States of America range from USD 89 billion to USD 212 billion in total costs per year; those from China are estimated at 3.6 and 8.7 percent of gross national product (GNP) in 2020 and 2025, respectively; and for Brazil, it is projected that there could be a doubling of the obesity-related healthcare costs from USD 5.8 billion in 2010 to USD 10.1 billion in 2050.

There are also data limitations on the healthcare costs and the effect of obesity and overweight on productivity and disabilities, as these have rarely been studied in low- and middle-income countries, despite the fact that more than 70 percent of all obese or overweight people in the world live in these contexts. The most widely quoted, for 2014, reports that obesity is projected to cost USD 2 trillion annually by 2050, largely driven by the value placed on lost economic productivity plus direct healthcare costs.[100]

In valuing the economic impacts of poor quality diets, it is not only linked to mortality and the direct medical and healthcare costs associated with treating a specific disease, but also involves indirect costs. The indirect costs can be significant, accounting for up to 60 percent of the total costs of being overweight or obese.[101] They include, for example, reduced educational attainment, lower lifetime earnings, costs of informal care, loss of productivity, increased disabilities and loss of working days.

Despite these challenges, valuating the health impacts of diet-related diseases, specifically NCDs, provides a useful indication of the level of impacts. This report provides a comparative analysis of the health benefits of global dietary changes for all major regions in the world and by country income group. The analysis of hidden costs or externalities related to the health impact of diets combines two parameters: the estimated number of deaths due to four specific NCDs (coronary heart disease, stroke, cancer, type 2 diabetes mellitus), and the estimated health costs associated with those NCDs. Due to data limitations, the indirect costs included in the analysis presented in this report only relate to the loss of productivity/working days, and the costs of informal care.

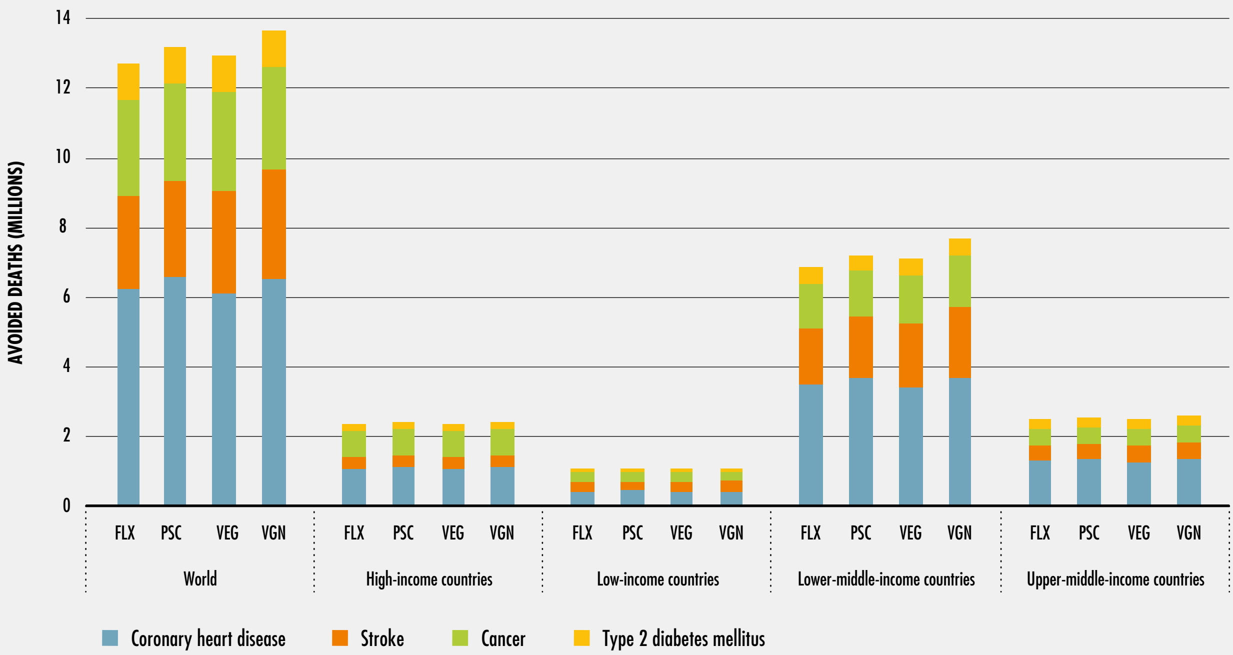
As mentioned above, ideally cost estimates should include the costs related to the health impact of undernutrition, both in terms of deaths and lost productivity due to diets that are not sufficiently nutritious. However, data for these estimations do not exist. The health costs presented here, therefore, are likely to be underestimated. Despite these data limitations, the current analysis provides important insights on the costs and health benefits of consuming healthy diets.

Results

Shifting to healthy diets, including not only cutting out energy-dense foods of minimal nutritional value, but also increasing the diversity of nutritious foods, is associated with significant reductions in mortality. This finding is seen across all four healthy diet scenarios, looking at average estimates of avoided deaths in 2030 compared with the benchmark scenario of national average current food consumption patterns (Figure 32). At the global level, for example, the adoption of the flexitarian diet would result on average in 12.7 million avoided deaths, ranging between a minimum of 7 and a maximum of 18.3 million avoided deaths. For the other three diet patterns, avoided deaths are projected to be even higher: an average of 13.2 million (7.5–18.9) for the pescatarian, 12.9 million (7.3–18.6) for the vegetarian and 13.7 million (7.9–19.4) for the vegan diet (Figure 32).

Moving away from the global averages, important differences in health benefits emerge across regions and country income groups. Middle-income countries, which represent 69 percent of the world population in 2030, have the most to gain in terms of reduced mortality by switching to any of the four alternative diet scenarios. Between 73 and 75 percent of avoided deaths in the world, across the four diets, occur in middle-income countries. Specifically, the highest percentage of deaths avoided (range 54–56 percent) would be seen in lower-middle-income countries, followed by upper-middle-income countries (range 19–20 percent), high-income countries

FIGURE 32
COMPARED WITH CURRENT CONSUMPTION PATTERNS, ADOPTING ANY OF THE FOUR ALTERNATIVE HEALTHY DIET PATTERNS IS PROJECTED TO LEAD TO SIGNIFICANT REDUCTIONS IN MORTALITY BY 2030



NOTES: The figure shows reductions in mortality for the world and by country income group in 2030, related to four non-communicable diseases: coronary heart disease, stroke, cancer and type-2 diabetes mellitus. The y-axis shows the number of deaths avoided in 2030 by moving from the benchmark diet of national average food consumption to the four healthy and sustainable dietary patterns. The four alternative healthy diet patterns for the analysis include the flexitarian (FLX), the pescatarian (PSC), the vegetarian (VEG) and the vegan (VGN) diet (see footnote y for more information). See Box 14 for the definition of the five diets and a summary of the methods and data sources. For the full methodological notes, see Annex 7.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets.* Background paper for *The State of Food Security and Nutrition in the World 2020.* Rome, FAO.

(17–19 percent) and low-income countries (8 percent), whose reduced mortality is the same across the four diets. The low percentages in low-income countries are explained by the fact that mortality is only measured in terms of NCDs, which are major causes of mortality in higher-income countries. In low-income countries, major causes of mortality are more related to the multiple forms of communicable, maternal, neonatal conditions and undernutrition. Of the low- and middle-income countries, the largest proportion of health benefits in terms of avoided deaths from adopting any of the four diet scenarios, 22–23 percent, is found in South-eastern Asian countries.

On a per capita basis, taking account of the total population in each country income group, 36 percent of per capita avoided deaths are projected to occur in upper-middle-income countries. This is followed by 30 percent in high-income countries, 23 percent in lower-middle-income countries and 11 percent in low-income countries.

Further insight is gained by examining the contribution of the weight-related risk factors (obesity, overweight and underweight) and diet-related risk factors (by food group) to the total avoided death. This shows that for the four diet scenarios, the majority of avoidable deaths (on average 68 percent) are due to imbalances in dietary composition. The remaining 32 percent of the avoided deaths are due to imbalanced weight levels (see **Annex 8**, Table A8.1).

Assuming that current food consumption patterns accommodate expected changes in income and population, as per in the benchmark scenario (BMK), health costs are projected to amount to an average of USD 1.3 trillion in 2030 (Figure 33). More than half (57 percent) of these are direct healthcare costs as they are associated with expenses related to treating the different diet-related diseases. The other part (43 percent) accounts for indirect costs, including losses in labour productivity (11 percent) and informal care (32 percent).

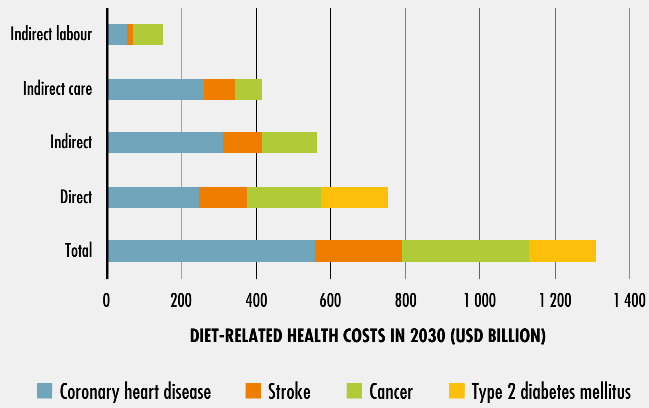
Across country income groups (**Annex 8,** Figure A8.1), the level of total costs is influenced by the general level of healthcare spending (healthcare costs are highest in high-income countries) and by population numbers (middle-income countries have the largest share of world population, estimated at 76 percent). Hence, the greatest costs are seen in high-income countries (USD 637 billion), followed by lower-middle-income countries (USD 415 billion), upper-middle-income countries (USD 252 billion) and low-income countries (USD 17 billion).

If, instead, any of the four alternative diet patterns used for the analyses are adopted (FLX, PSC, VEG, VGN), diet-related health costs dramatically decrease by USD 1.2–1.3 trillion, representing an average reduction of 95 percent of the diet-related health expenditures worldwide compared to the benchmark scenario in 2030 (Figure 34).

Although most avoidable deaths would be found in middle-income countries (more than twice as many as in high-income countries), on average, 49 percent of all cost savings would occur in high-income countries due to their higher health expenditure.

Lower-middle-income countries not only stand to benefit from the highest number of avoided deaths, but their cost saving is also significant, second only to high-income countries. More important, this cost saving in lower-middle-income countries derives mostly from savings on indirect costs, which include avoided productivity losses and days not worked, potentially leading to positive second-round effects for livelihoods and growth in the economy overall.

FIGURE 33
UNDER CURRENT FOOD CONSUMPTION PATTERNS, DIET-RELATED HEALTH COSTS ARE PROJECTED TO REACH USD 1.3 TRILLION PER YEAR IN 2030

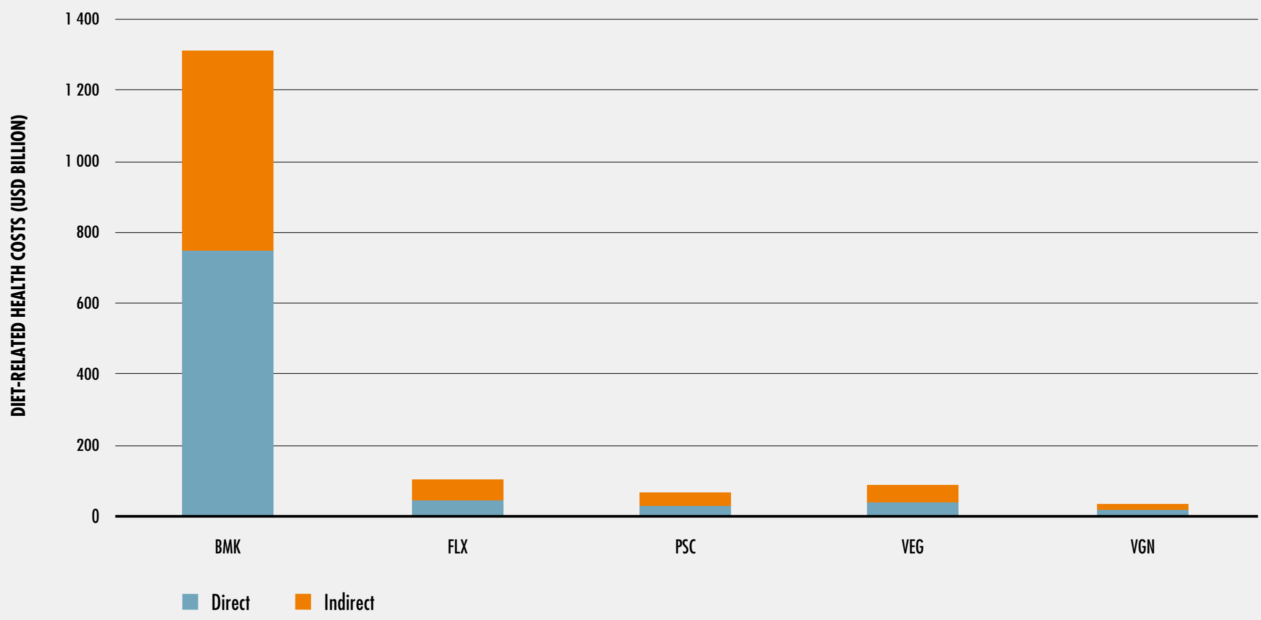


NOTES: The figure shows projected diet-related health costs in 2030 (USD billion) if current food consumption patterns (BMK) remain unchanged. The figure shows direct costs (direct medical and healthcare costs associated with treating a specific disease) and indirect costs (indirect loss of productivity per working days and the costs of informal care associated with specific disease). The diet-related diseases included in the analysis include coronary heart disease, stroke, cancer and type 2 diabetes mellitus. See Box 14 for the definition of the diet (BMK) and a summary of the methods and data sources. For the full methodological notes, see Annex 7.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets.* Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

Hidden climate-change costs

What people eat, and how that food is produced, not only affects their health, but also has major ramifications for the state of the environment and for climate change. Most global and cross-country valuations of environmental impacts focus on GHG emissions, because data limitations hamper global cross-country comparisons of other important environmental impacts related to land use, energy and water use.

FIGURE 34
ADOPTION OF ANY OF THE FOUR ALTERNATIVE HEALTHY DIET PATTERNS WOULD DRAMATICALLY DECREASE DIET-RELATED HEALTH COSTS BY 2030



NOTES: The figure shows diet-related health costs in 2030 (USD billion) by direct and indirect cost component, under current consumption patterns (BMK) and four alternative healthy diet patterns: flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN) (see footnote y for more information). Costs are shown for 157 countries. Direct costs include direct medical and healthcare costs associated with treating a specific disease. Indirect costs include loss of productivity per working days and the costs of informal care associated with a specific disease. Health costs refer to four diet-related diseases included in the analysis: coronary heart disease, stroke, cancer and type-2 diabetes mellitus. See Box 14 for the definition of the five diets and a summary of the methods and data sources. For the full methodological notes, see Annex 7.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

During the 2007–2016 period, the food system underpinning the world's current food consumption patterns was responsible for 21–37 percent of total anthropogenic GHG emissions (meaning originating in human activity), which presents it as a major driver of climate change, even without considering other environmental effects.[102,ad] This estimate includes emissions of 10–12 percent from crop and livestock activities at the farm gate; 8–10 percent from land use and land-use change, including deforestation and peatland degradation; and 5–10 percent from supply chain activities, including GHG emissions from food loss and waste.

Increases in GHG emissions and other environmental impacts are set to continue to rise under current food consumption patterns and food systems. FAO estimates that the world will need to produce about 50 percent more food by 2050 to feed the growing world population, assuming no changes occur in food loss and waste.[103] If current dietary patterns and food systems remain, this would engender significant increases in GHG emissions and

ad Food system emissions include CO_2 and non-CO_2 gases, specifically those generated from: i) crop and livestock activities at the farm gate; ii) land use and land-use change dynamics associated with agriculture; and iii) food processing, retail and consumption patterns, including upstream and downstream processes such as manufacture of chemical fertilizers and fuel. In addition, food systems are a major driver of land conversion, deforestation and loss of biodiversity. Agriculture alone accounts for approximately 70 percent of global freshwater withdrawals and is a major contributor to water pollution.

other environmental impacts, including loss of biodiversity, soil degradation, pollution and water use.

Many studies indicate that dietary shifts can significantly reduce GHG emissions. Setting dietary and nutritional goals with no consideration for the environment could in some cases increase GHG emissions.[136] For instance, several studies highlight that if current dietary trends are maintained, this could lead to a significant climate-change emissions from agriculture of approximately 20 $GtCO_2$-eq per year by 2050.[73,84,104,105,106,107,108] A few studies show contrasting results, but they focus on one or more dietary components of self-selected healthy diets (diets freely chosen by consumers). One study found that the lowest emission diets analysed were lower in meat but higher in oil, refined grains and added sugar.[109]

Recent analyses have highlighted that reductions in consumption of meat and dairy in many diets would not only have health benefits in many countries but would have significant environmental benefits. The analyses have shown that reductions in global meat consumption and other dietary changes, for instance, would ease pressure on land use[84,86,110] and reduce GHG emissions.[86,106,110,111] Other studies have found that rebalancing consumption towards healthy diets could help significantly cut emissions from the food systems[111] and may be essential to avoid negative environmental impacts, such as major agricultural expansion[105] and global warming of more than 2 degrees,[106] while ensuring access to safe and affordable food for an increasing global population.[112]

The latest Intergovernmental Panel on Climate Change (IPCC) Special report on Climate Change provides an in-depth examination of GHG emissions in relation to climate mitigation and food security and concludes there are significant opportunities to achieve both objectives simultaneously[102] by adopting diets in line with health-based dietary recommendations. National food-based dietary guidelines (FBDGs) for healthy eating are based on global guidelines[46] and are broadly similar across most countries. They are typically capped by number of calories and higher in plant-based foods, such as vegetables, fruits, whole grains, legumes, nuts and seeds, and lower in trans and saturated fats, free of sugars and salt. Such diets have the potential to be both healthy and include sustainability considerations, but this requires both climate change and health being considered together.

Healthy diets present important opportunities for reducing GHG emissions in some contexts, because they are rich in plant-based foods that emit lower GHG levels compared with diets that are heavy in red meat consumption. However, this may not be the best option in order to pursue a reduction in GHG emissions, especially in contexts where consumption of red meat and dairy can provide valuable sources of essential nutrients to vulnerable populations, particularly to prevent undernutrition. There is no exact make-up of a healthy diet that includes sustainability considerations, but the guiding principles for a healthy diet are the same (see Section 1.3, Box 5). One of these guiding principles is that a healthy diet can contain animal source foods in moderate to small amounts. Specifically, a healthy diet can include moderate amounts of eggs, dairy, poultry, fish and small amounts of red meat. This principle based on health considerations, also presents an opportunity for countries to make the shift to healthy diets and simultaneously contribute to reductions in GHG emissions.

Not all healthy diets include aspects of sustainability because there is no "unique" healthy diet. For example, most of the national FBDGs that define a national healthy diet are highly variable in their recommendations and generally do not include aspects of sustainability. While some FBDGs are associated with reductions in GHG emissions, these reductions are generally estimated to be moderate. Most FBDGs are not compatible with a set of global environmental targets related to climate change and environmental resources. The policy measures that shift production and consumption to healthy diets are not explicitly designed to address the climate change problems of the world. But healthy diets that include aspects of sustainability present important opportunities for synergies for reducing GHG emissions. The four diet scenarios analysed are only four out of many possible diet scenarios that could be simulated to achieve results in terms of GHG emissions reductions.

Simply put, not all healthy diets are sustainable and not all diets designed for sustainability are always healthy or adequate for all population groups. This important nuance is not well understood and is often missing from ongoing discussions and debates on the potential contribution of healthy diets to environmental sustainability.

Dietary shifts that include sustainability considerations can play an important role as part of a broader strategy, for increasing the environmental sustainability of food systems. These include limiting the impacts of diets on the environment through technological and productivity advancements, sustainable and integrated land and natural resource use, and enhanced efficiencies and innovations along the food supply chain, including those aimed at reducing food loss and waste. Limiting the impacts of diets on the environment in this way may help create a virtuous circle, or a recurring cycle of events, each having a beneficial effect on the next, as all the enhancements contribute to reducing the environmental cost of producing nutritious food. This is further explained in the next section.

Though beyond the scope of this report, there is an abundance of technological knowledge and practices that can inform a combination of approaches for increasing the environmental sustainability of food systems.[113] One example is sustainable land management practices which do not require land use change and do not create demand for more land conversion, including sustainable management of cropland and grazing lands, livestock, forest, fisheries and aquaculture production.[102] Another example is integrated agricultural production systems that use efficient climate-smart agricultural practices, such as integrated rice and fish farming and integrated crop-livestock systems.[114] Addressing the contribution of livestock production to GHG emissions is critical, but there are numerous sustainable efficiency enhancements that can be adapted and applied across the diverse livestock production systems (e.g. promoting the use of by-products and waste as livestock feed and recycling manure for energy and nutrients).[115,116,117,118] Land-use regulation, combating desertification and halting biodiversity loss are also important.[102] These approaches can also contribute to reducing the cost of healthy diets.

As stated previously, data limitations hamper global cross-country comparisons of other important environmental impacts related to land, energy and water use. This has of course limited this report's own global analysis, which looks at the hidden climate-change costs by focusing exclusively on GHG emissions and their climate impacts. Nonetheless, Table 9 summarizes additional evidence from the literature on the impact of current dietary patterns on these other environmental impacts, and the estimations of potential impacts from shifting to healthy diet patterns that include sustainability considerations. Another environmental impact to consider is food biodiversity, which is essential for guaranteeing diverse diets around the world.[119] One of the main factors influencing biodiversity loss is land-use change and diets. Animal source foods, in particular, have been one of the main contributors to biodiversity loss.[120]

Results

Due to data availability constraints to conduct a global and regional analysis, this report presents estimates on the environmental costs of diets focusing only on GHG emissions. For this reason, this report makes more reference to climate-change costs rather than all environmental costs. A two-step approach is adopted. In the first step, GHG emissions associated with food consumption are calculated. In the second step, these emissions are paired with cost estimates of climate damages to gauge the climate-change costs of each dietary pattern (see **Annex 7** for the methodology and data sources and **Annex 8** for additional figures and tables). Both steps present important results with policy implications.

GHG emissions associated with different dietary patterns

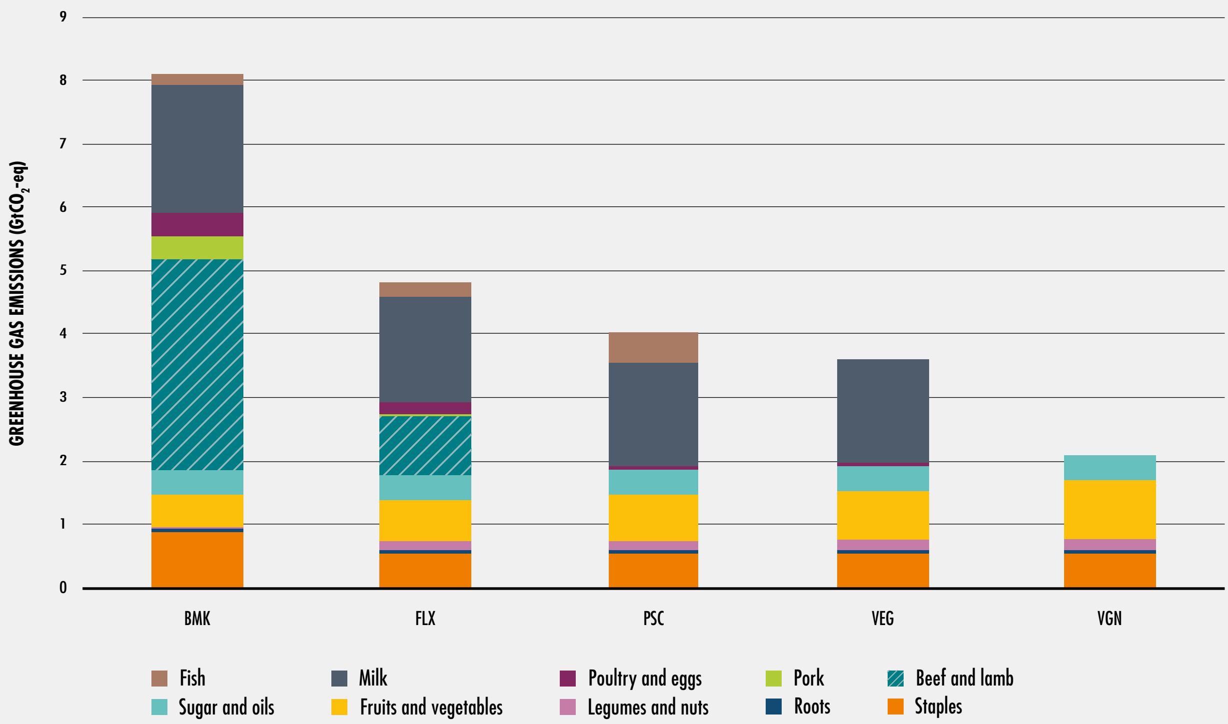
In the benchmark diet scenario (BMK), which assumes that current food consumption patterns remain unchanged, the projected diet-related GHG emissions amounted to 8.1 $GtCO_2$-eq in 2030 (adjusted for income and population »

TABLE 9
SHIFTING TO HEALTHY DIETS THAT INCLUDE SUSTAINABILITY CONSIDERATIONS CAN CONTRIBUTE TO REDUCTIONS IN ENVIRONMENTAL IMPACTS ON LAND, ENERGY AND WATER USE

	Current diet*	Shifting to healthy diets that include sustainability considerations**	Shifting to the most effective diet in reducing specific environmental impacts***
Land use	It has been estimated that 50% of habitable land is used for agriculture. Of this, 77% is used for livestock production (including grazing land and land used for animal feed production) and 23% for crops.[121]	Moving towards healthy diets that include sustainability considerations would reduce land use by food production with median of 28%, measured in m²/capita/year.[122] Another study estimated that healthy diets that include sustainability considerations would incur in an increase land use in 2050 compared to a 2009 baseline from -16 to 130 million hectares.[86] Still another study estimated a range of reduction between 8% to 11% measured as million km² by year, depending of the dietary scenario.[80]	A systematic review found that the "vegan diet" showed the largest reductions in land use (m²/capita/year) with median of 55%.[122] Another study estimated that a "vegetarian" dietary scenario would reduce land use in 16 million hectares compared to a 2009 baseline.[86] Still another study found the largest reduction on land use was associated with the "pescatarian" dietary scenario, with reduction of 11% (million km²/year).[80]
Energy use	Global estimates are not available. For the United States of America, it has been estimated that the average American diet accounts for 19% of the total energy consumption in the country.[123]	Only related to the use of fossil fuel, it has been estimated that shifting to healthy diets that include sustainability considerations would reduce by 3% the fuel consumption related to the food system in the United States of America.[124]	Shifting to an "energy-use efficient" diet would reduce by 74% the fuel use of the United States food system.[124]
Water footprint	The use of freshwater in our current dietary patterns is estimated to be 1 506 km³,[80] while a systematic study found that the total water footprint for different country dietary patterns around the world ranged from 688 to 8 341 litres per capita per day.[125]	A systematic study found that moving towards healthy diets that include sustainability considerations would reduce the water footprint of diets with median of 18% (l/capita/day).[122] In another study, moving towards healthy diets that include sustainability considerations would reduce the water footprint of diets between 2% and 11% compared with the current scenario.[80]	A systematic review estimated a median reduction of 37% in the total water footprint (l/capita/day) by the adoption of a "vegetarian" diet scenario.[122] Another study estimated a reduction of 25% of the total water footprint by the adoption of a dietary scenario with no animal source foods (l/capita/day).[125] Still another study, the largest reductions in freshwater use would result from a shift to a flexitarian diet (11%), while shifting to a vegan diet shows the lowest reduction rate in freshwater use (2%).[80]

NOTES: The table shows estimates from published studies about the impact of current dietary patterns on land, energy and water use, and the hypothetical reductions due shifts towards different healthy diets that include sustainability considerations. * refers to the baseline of each study. ** refers to the median or the range of reduction in a specific environmental impact of all dietary scenarios presented in each study. In the case of energy use, it refers to a dietary scenario based mostly on the 2010 Dietary Guidelines for Americans. *** refers to the dietary scenario that shows the largest impact reduction compared with the baseline in the use of land, energy and water as described in each study of the reviewed literature.
SOURCE: FAO, based on information of the cited literature (see endnotes for details).

FIGURE 35
ADOPTION OF ANY OF THE FOUR ALTERNATIVE HEALTHY DIET PATTERNS COULD SIGNIFICANTLY REDUCE PROJECTED DIET-RELATED GHG EMISSIONS IN 2030



NOTES: The figure shows the amount of diet-related GHG emissions in 2030 by dietary pattern and food group. Dietary patterns include benchmark current food consumption patterns (BMK) and four alternative healthy diet patterns: flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN) (see footnote y for more information). See Box 14 for the definition of the five diets and a summary of the methods and data sources. For the full methodological notes, see Annex 7.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» changes). This represents 13 percent of estimated total GHG emissions in that year. Adoption of any of the four alternative healthy diet patterns[ae] worldwide would reduce projected diet-related GHG emission by 41–74 percent (Figure 35).

Under current food consumption patterns (BMK), more than three-quarters of the diet-related GHG emissions (77 percent) were associated with animal source foods consumed worldwide, including beef and lamb (41 percent),[af] and milk and dairy (25 percent), which were the greatest contributors at the global level. These global findings echo those of other studies on the climate implications of rising meat and dairy intake. They also reiterate the importance of reducing animal-product intake in high consumption countries and providing plant-forward strategies – promoting diets where whole grains, fruits, vegetables, nuts and legumes constitute a greater proportion of foods consumed – for transitioning countries.[44,79,84,105]

More than half of all emissions under current food consumption patterns (4.2 $GtCO_2$-eq or 52 percent) are associated with food demand from lower-middle-income countries (**Annex 8**, Table A8.2). Looking at per capita emissions, however, these are largest in upper-middle-income countries

ae See footnote y.

af This is in line with other studies, for example, Kim *et al.* (2019), who find that whether by serving, energy content, protein, or mass, ruminant meats (i.e. bovine, sheep and goat) are by far the most GHG-intensive items. Per serving, bovine meat (weighted average 6.54 kg CO_2e/serving) was 316, 115 and 40 times more GHG-intensive than pulses, nuts and seeds, and soy.

(1.6 $MtCO_2$-eq), followed by high-income countries (1.0 $MtCO_2$-eq). The lowest emissions were associated with low-income countries (0.7 $MtCO_2$-eq).

Important differences in climate benefits emerge when viewing the results by region and country income group under the four alternative diet patterns (Figure 35). The reduction in emissions as a result of the adoption of any of the four alternative healthy dietary patterns[ag] ranges between 45 and 78 percent in middle-income countries (MICs), which represent 69 percent of the world population in 2030. The highest percentage of reduction of emissions (range 60–86 percent) would occur in upper-middle-income countries, followed by high-income countries (range 60–77 percent), lower-middle-income countries (31–70 percent) and low-income countries (27–68 percent). Of the low- and middle-income countries, the greatest reduction of GHG emissions would be 65–88 percent as seen in Latin America and the Caribbean.

The global and country income group aggregates hide important variations across subregions and countries. These, in turn, indicate that there are potential trade-offs that need to be managed as countries transform food systems towards healthy diets that include sustainability considerations. For example, countries with high burdens of undernourishment and multiple forms of malnutrition might see their consumption-related emissions rise as growing shares of their population consume healthy and nutrient adequate diets. In these cases, fighting hunger and malnutrition by increasing the diversity of nutritious foods available for infants and young children outweighs the negative effects deriving from higher national GHG emissions.

A study of 140 countries that quantifies the GHG emissions of nine increasingly plant-forward diets[ah] found that several countries would need to increase their per capita GHG footprint to meet energy needs and the recommended protein intake (12 percent of energy). For example, in Figure 36, Uganda's GHG footprint (solid curve) is below the dashed line, meaning the country would need to increase its per capita GHG footprint to meet energy needs and recommended protein intake. In contrast, the GHG footprint of the United States of America is above the line, meaning the country exceeds energy needs and that just by decreasing energy and maintaining at least 12 percent of energy from protein, some reduction in GHG emissions can be achieved. Moreover, by shifting dietary patterns to be more plant-forward, GHG emissions in countries towards the left of the curve could be cut even further.

Climate-change costs associated with different dietary patterns

To estimate the climate-change costs associated with alternative diets, GHG emissions were monetized using estimates of the social cost of carbon, which represents the economic cost resulting from each additional tonne of GHG emissions. This builds on a previous study[84] but uses estimates from a fully revised version of the Dynamic Integrated model of Climate and the Economy (DICE) for a scenario that constrains future global temperature rise (with the temperature limit averaged over 100 years) to a limit of 2.5 degrees, in line with stated policy goals.[91] This scenario is referred to as the "DICE 2016 T2.5". The social cost of carbon values in that scenario was USD/tCO_2-eq 107, 204 and 543 for the years 2015, 2030 and 2050.[ai]

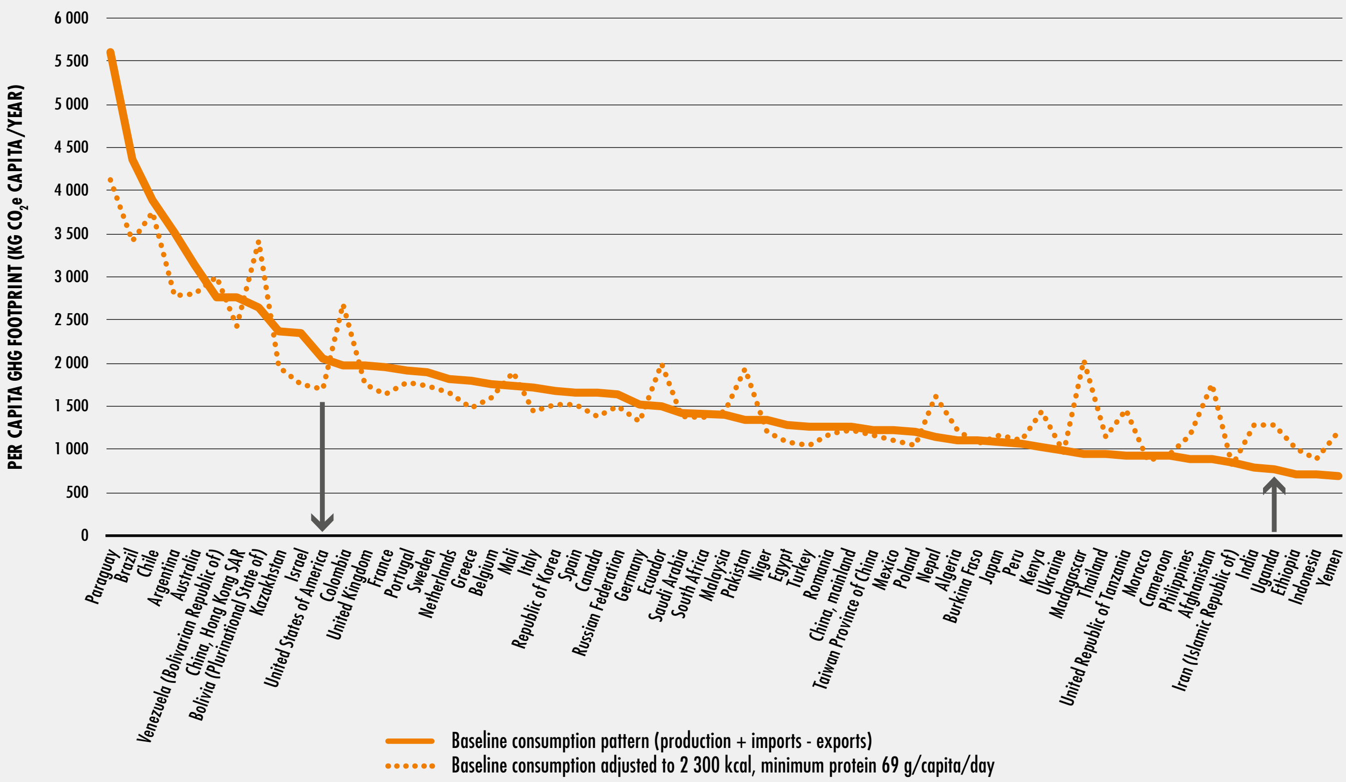
Current food consumption patterns pose significant social cost in terms of GHG emissions and climate change. The diet-related social cost of GHG emissions related to current food consumption patterns is estimated to be around USD 1.7 trillion in 2030 for an emissions-stabilization scenario (i.e. the "Dice 2016 T2.5" scenario) that keeps global temperature limited to a 2.5-degree increase (averaged over 100 years). It is estimated to

ag See footnote y.

ah The nine plant-forward healthy diets included meatless day, low red meat, no dairy, no red meat, pescatarian, lacto-ovo vegetarian, 2/3 vegan, low food chain and vegan.

ai An alternative would have been to adopt social cost of carbon values obtained for different discount rates (by which future damages are converted to present values) for a reference path with current policies, or to adopt social cost of carbon values for an "optimal control" path, but neither of these options fulfilled stated policy objectives with respect to limiting climate change.

FIGURE 36
INCREASES IN GHG EMISSIONS WILL BE NECESSARY FOR SOME COUNTRIES TO MEET DIETARY ENERGY AND PROTEIN NEEDS



NOTES: The figure shows per capita GHG footprint by country and consumption pattern (according to FAO Food Balance Sheets) in years 2011–2013. The "baseline adjusted" has energy intake adjusted to 2 300 kcal per capita per day and at least 12 percent of energy from protein (69 g/capita/day). Those countries for which the dotted line is above the solid line, would need to increase their per capita GHG footprint to meet energy needs and recommended protein intake. Those below the solid line have room to decrease their per capita GHG footprint, while still maintaining the target for energy and protein intake of at least 69 g/capita/day.
SOURCE: Kim, B.F., Santo, R.E., Scatterday, A.P., Fry, J.P., Synk, C.M., Cebron, S.R., Mekonnen, M.M., Hoekstra, A.Y., de Pee, S., Bloem, M.W., Neff, R.A. & Nachman, K.E. 2019. Country-specific dietary shifts to mitigate climate and water crises. *Global Environmental Change*, 62. https://doi.org/10.1016/j.gloenvcha.2019.05.010

be around USD 0.9 trillion in 2030 for an unconstrained scenario, in which future climate damages are discounted or converted to present values at a rate of 3 percent (**Annex 8**, Figure A8.3).[aj]

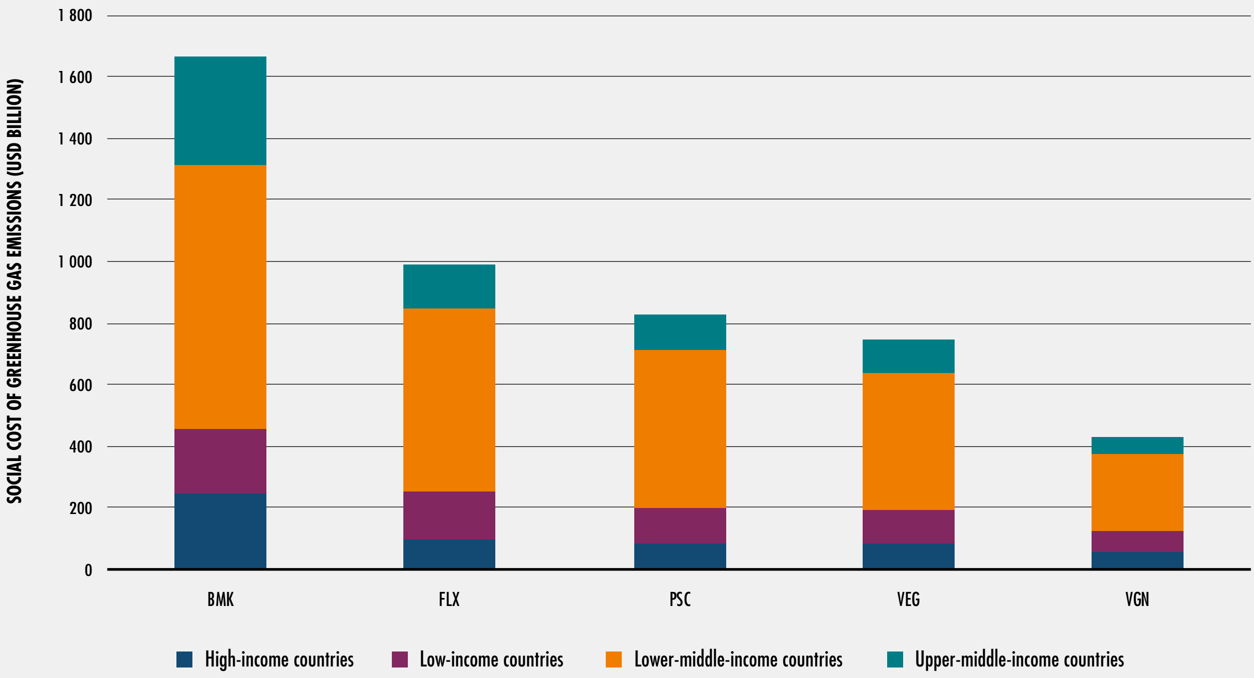
Regional distribution of the social cost of GHG emissions shows that, in the group of lower-middle-income countries, South-eastern Asia and the Western Pacific regions would have the highest social cost of GHG emissions in 2030, amounting to an average of USD 339 billion, while lower-middle-income countries in Europe would have the lowest social cost of GHG emission (USD 75 billion). In line with the regional distribution of emissions estimated, lower-middle-income countries would account for half of the social costs (52 percent), upper-middle-income countries for a fifth (21 percent) and high- and low-income countries for 15 to 12 percent each, respectively.

The analysis shows that the adoption of any of the four alternative healthy diet patterns (FLX, PSC, VEG and VGN)[ak] could potentially

aj Using previous estimates from the Intergovernmental Working Group (IWG) that included three integrated assessment models resulted in social costs of USD 0.1–0.6 trillion.

ak See footnote y.

FIGURE 37
ADOPTION OF PLANT-BASED DIETARY PATTERNS WOULD REDUCE THE SOCIAL COST OF GHG EMISSIONS BY 41–74 PERCENT IN 2030



NOTES: The figure shows diet-related social cost of GHG emissions in 2030 (USD billion) under current food consumption patterns (BMK) and four alternative healthy diet patterns: flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN) (see footnote y for more information). Costs are shown for 157 countries. See Box 14 for the definition of the five diets and a summary of the methods and data sources. For the full methodological notes, see Annex 7.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

contribute to significant reductions of the social cost of GHG emissions, ranging from USD 0.7 to 1.3 trillion (41–74 percent) in 2030 (Figure 37).

About 75 percent of the social cost of GHG emissions from current food consumption patterns come from meat and dairy products. The largest share is from beef (36 percent), followed by milk (25 percent). Cereals account for 11 percent of the total cost. The adoption of any one of four alternative heathy dietary patterns could potentially lead to significant reductions in social cost of GHG emissions, even by means of the flexitarian diet that includes moderate amounts of animal source foods and small amounts of red meat (**Annex 8**, Figure A8.4).

Health and climate-change costs: putting them into context

To put the health and climate-change costs into context, it is useful to compare the hidden costs with the wholesale costs of the diets, estimated at the consumption level and valued based on estimates of commodity prices by region. On the aggregate level, the wholesale costs of diets mirror those assessed at the consumption level, and hidden costs are not included (see **Annex 7** for the methodology for estimating the wholesale costs of the diets).

Combining the total cost of diets measured at current wholesale prices and estimates of the hidden health and climate-change costs allows a more complete estimate of the full cost of these diets. These full cost estimates can help inform food policy to incentivize shifts towards healthy diets that include sustainability considerations (see Section 1.3).

Total wholesale cost of each of the four alternative healthy diet patterns[al] is found to be above the wholesale cost of current diets in low-income and some lower-middle-income countries but not in high-income and many upper-middle-income countries (Figure 38).

If the diet-related health and climate-change costs were added to the total wholesale cost of the benchmark diet representing the current consumption pattern, then the full cost of this benchmark diet would increase by 50 percent globally, from USD 6.0 to USD 8.9 trillion by 2030. This increase ranges from 35 percent in lower-middle-income countries to 87 percent in high-income countries.

On the other hand, if the diet-related health and climate-change costs were added to the total wholesale cost of the four alternative diet patterns (FLX, PSC, VEG and VGN), then the full cost of these diets globally would only increase between 8 and 19 percent. Overall, this translates into a significant cost savings, compared with the benchmark diet. Considering the full costs (wholesale cost and diet-related health and climate-change costs), the adoption of any of the four alternative dietary patterns would lead to reductions in the full cost of diets between 22 and 29 percent globally, ranging from 11–21 percent in low-income countries to 52–58 percent in high-income countries (Figure 38).

Recognizing the externalities that result from current food consumption patterns is therefore important. The analysis shows that for every USD 1 spent on food, health and climate change externalities create an additional cost of USD 0.5. Put differently, considering all the costs (monetary and external), the external cost of food makes up one-third of the total cost. However, there is some variation across regions. In sub-Saharan African countries, for instance, for every USD 1 spent on food, health and environmental externalities represent a cost of USD 0.35, or 26 percent of the total cost.

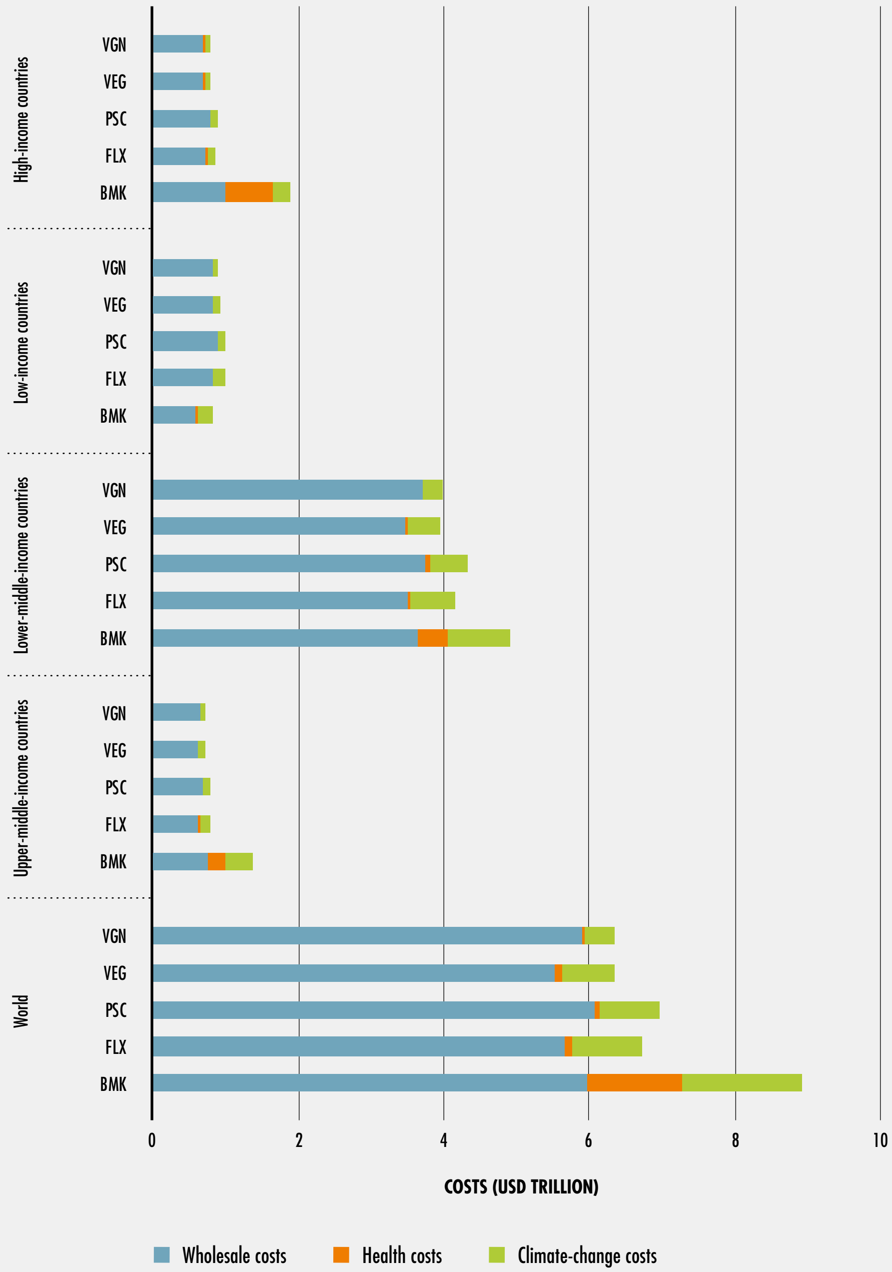
Under the benchmark diet, the highest cost of health and climate change externalities are found in high- and upper-middle-income countries: for USD 1 spent on food, these external costs amount to an additional USD 0.87 and USD 0.79, respectively. This represents 47 and 44 percent of the full cost (wholesale value, plus hidden cost) for high- and upper-middle-income countries, respectively. On the contrary, the cost of health and climate-change externalities are much lower for low-income and lower-middle-income countries, amounting to only USD 0.37 and USD 0.35, respectively.

Of course, the estimated hidden costs or externalities would be much higher than USD 0.5 for every USD 1 spent on food, if data were available to factor in the full range of health impacts of malnutrition in all its forms, including undernutrition, as well as all of the current dietary patterns' environmental impacts related to land use, energy and water use.

Ignoring the hidden costs of current dietary patterns would result in a serious underestimation of the true cost of achieving food security and nutrition and environmental sustainability. Bringing to light the previously unaccounted for health and climate-change costs can help inform concrete policies that target such externalities, including fiscal policies that incentivize a shift towards healthy diets. As shown above, a shift to healthy diets would bring about significant reductions in both individual health costs and global carbon footprint by 2030, compared with current dietary patterns. However, given that not all healthy diets are sustainable and not all diets designed for sustainability are always healthy for everyone, the nature of this shift needs to be decided carefully, as we explore further below.

al See footnote y.

FIGURE 38
THE ADOPTION OF ANY OF THE FOUR ALTERNATIVE HEALTHY DIET PATTERNS COULD POTENTIALLY LEAD TO 22–29 PERCENT REDUCTION IN THE FULL COST OF DIETS ON AVERAGE BY 2030



NOTES: The figure shows the total costs of various diets (USD trillion) in 2030 by cost component, dietary pattern and country income group. The totals show cost components related to wholesale costs, health-related costs and climate-change-related costs in 2030 by country income group. Total costs are shown under the benchmark scenario of current food consumption patterns and four alternative healthy diet patterns including the flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN) scenario (see footnote y for more information). See Box 14 for the definition of the five diets and a summary of the methods and data sources. For the full methodological notes, see Annex 7.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

Managing trade-offs and exploiting synergies in the transition towards healthy diets that include sustainability considerations

A shift towards healthy diets that also include sustainability considerations is essential, if we are to end hunger and all forms of malnutrition, and ensure the sustainability of agriculture and food production systems – in short, achieve SDG 2. The challenge is huge, as most countries do not meet or are unlikely to meet dietary recommendations for healthy diets by 2030 based on current trends.

This dietary shift will require large transformative changes in food systems at all levels. Given the large diversity of current food systems and wide discrepancies in food security and nutrition status across and within countries, there is no one-size-fits-all solution for countries to shift towards healthy diets and create synergies to reduce their environmental footprints.[44,73,80,84] Raising awareness and influencing policy concerning healthy diets is complicated because of persistently high levels of hunger and undernutrition in many countries, and low levels of understanding about the multiple burdens of malnutrition and how they are interconnected.

As noted previously, to address hunger and malnutrition in all its forms, many countries may need to increase their carbon footprint in order to ensure that certain food items are available to their population, particularly to the most vulnerable groups. This is illustrated well in a country analysis covering Indonesia (Box 15). Most Indonesians' diets do not meet minimum dietary recommendations, but exceed recommended levels of dietary energy intake due to high consumption of rice, sugar and fats. To increase dietary diversity, some increases in food consumption-related GHG emissions would therefore be necessary. To lower the excess energy intake levels, a substantial reduction in rice consumption would also be needed, even though rice has been at the forefront of the country's food security policy. This would require major changes in current dietary practices and food production, whose impacts would reverberate across the entire food supply chain, with impacts on domestic and international trade as well. The analysis also shows that affordability of healthy diets is a major barrier for the majority of Indonesians, as the cost of healthy diets is higher than the current average food expenditure in the country. Similar conclusions could be drawn for countries where large parts of the population do not meet minimum dietary recommendations.

Clearly, the process of food systems transformation will not be easy, and therefore countries must carefully assess their own context-specific barriers and manage the potential trade-offs and synergies. For example, where the food system not only provides food, but also drives the rural economy, a shift towards healthy diets could mean the loss of livelihoods or incomes for small farmers and the rural poor as well. In these cases, care must be taken to mitigate the negative impact on incomes and livelihoods as food systems transform to deliver affordable healthy diets. Many lower-income countries whose populations suffer nutrient deficiencies may also need to increase their national GHG emissions in order to first meet nutrition targets. Conversely, in upper-middle-income countries and high-income countries, where diet patterns exceed optimal energy requirements and people consume more animal source foods than required, major changes in dietary practices and system-wide changes in food production patterns will be needed to reduce their environmental impact.

Conclusion

Section 2.1 of this report highlighted that the cost of a healthy diet must fall to an affordable level for all, to enable people to consume a healthy diet. But the matter of cost has another, broader dimension to consider. Section 2.2 has further shown that diets have hidden costs, whose consideration is not only critical for meeting the SDG 2 targets to end hunger and food insecurity and all forms of malnutrition by 2030, but also other SDGs. Specifically, this section has brought to light the health (SDG 3) and climate-related (SDG 13) consequences of our dietary patterns and food systems that support these.

Using different variants of healthy diets as a reference, this section has shown that a shift towards healthy diets can result in savings »

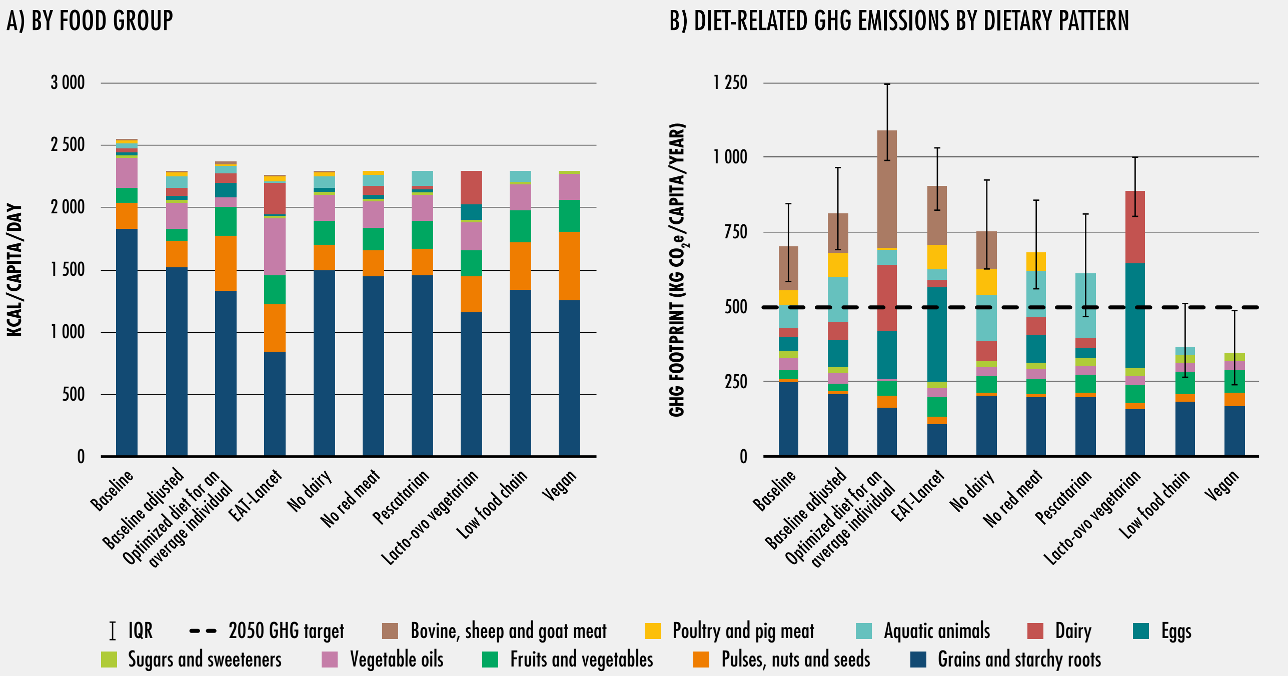
BOX 15
MOVING FROM CURRENT DIETARY PATTERNS TO HEALTHY DIETS THAT INCLUDE SUSTAINABILITY CONSIDERATIONS: BALANCING GOALS AND TRADE-OFFS IN INDONESIA

Indonesia is an emerging lower-middle-income country that has made enormous gains in poverty reduction and whose prevalence of undernourishment (PoU), currently at around 8 percent, is well below the average for lower-middle-income countries. Nevertheless, the country faces a triple burden of malnutrition: more than one-third of children under 5 years of age are stunted, indicating a large undernutrition problem; a quarter of all adults are overweight or obese; micronutrient deficiencies are widespread.

The current diets are dominated by staple foods, mainly rice, which provides 70 percent of dietary energy needs (see "baseline" diet, Figure a). Energy intake is higher while protein intake is lower than recommended by the Indonesian FBDGs. Low dietary diversity in the country leads to an inadequate intake of essential micronutrients, which affects people's short- and long-term health and development; moreover, the current intake of nutritious foods is too low to prevent NCDs. Furthermore, the disproportionately high level of energy intake from rice and foods high in fat and sugar increases the prevalence of overweight and obesity, while micronutrient deficiencies persist.

According to a recent analysis[44,126] comparing current consumption with a number of different healthy diets that include sustainability considerations

DIETARY PATTERNS IN INDONESIA, CURRENT AND MODELLED



NOTES: The left panel shows kilocalorie intake per capita per day for the baseline and different plant-forward diets, and the contribution of different food group categories. The right panel shows GHG footprint related to the consumption of different diets and the contribution by food category. IQR denotes the interquartile range, and the dashed line shows the 2050 target of GHG emissions. The baseline diet refers to current consumption as measured by FAO Food Balance Sheet (FBS); other diets are different plant-forward diets according to food group. See Annex 8 for a description of these diets.
SOURCE: de Pee, S., Hardinsyah, J.F., Kim, B.F., Semba, R.D., Deptfort, A. & Fanzo, J.C. forthcoming. *Balancing nutrition, health, affordability and climate goals – the case of Indonesia.*

BOX 15
(CONTINUED)

(i.e. diets that help reduce climate-change costs), some increases in food consumption-related GHG emissions would be necessary for Indonesia to achieve global dietary recommendations[44,127,128,129,130,131,132,133] (Figure b). The results show that current food consumption patterns ("baseline")[127] provide 2 607 kcal and 56 g of protein per capita per day. Reducing energy to an amount that is more in line with estimated needs for a healthy diet (i.e. 2 300 kcal/capita/day, and ensuring that 12 percent of energy comes from protein (69 g/capita/day), while maintaining relative contributions of current dietary protein sources) would result in a 15 percent increase in Indonesia's GHG emissions ("baseline adjusted", see Figure b).

The recommended reduction in rice consumption is substantial and would require major changes in dietary practices and food production patterns. Compared with current food consumption patterns, the "no red meat", "pescatarian", "low food chain" and "vegan" diets have lower GHG emissions (Figure b). But only the latter two have GHG emissions below the target for sustainable food systems.[44,126] In terms of nutrient adequacy, the optimized diet has the best score, but that diet also has the highest GHG emissions.

In summary, Indonesians need to consume more diversified diets in order to meet nutrient needs, prevent undernutrition and its consequences for human capital development, prevent the risks of NCDs later in life, and promote healthy lives in general. The challenge is that a more diversified diet with less rice costs more and has higher GHG emissions than diets consumed today, even when limiting the increase of animal source foods consumption and focusing on non-ruminants and seafood as animal sources of proteins and micronutrients. Two exceptions to this are the low food chain and vegan diets, but these do not meet nutrient needs.

Policies to improve access to and affordability of more diversified, healthy diets that meet nutrient needs while possibly contributing to reductions of GHG emissions would need to focus on reducing the cost of nutritious foods, adding nutritional value and promoting the use of sustainable agricultural practices. This could be done through food production, food value chain optimization, food fortification and creation of healthy food environments. This would also require policies to provide better access to nutritious foods to lower-income consumers through social protection instruments, including school feeding programmes and healthy public procurement policies. More policy recommendations along these lines are presented later.

» projected to exceed USD 1.3 trillion per year by 2030 as direct and indirect health costs associated with diet-related non-communicable diseases are avoided. Furthermore, dietary shifts to healthy diets can play an important role in increasing the environmental sustainability of food systems. For example, the diet-related social cost of GHG emissions associated with current dietary patterns is estimated to be more than USD 1.7 trillion per year by 2030, which could be reduced significantly through a shift towards healthy diets.

However, there is no one healthy diet, let alone one that includes sustainability considerations for every context. Furthermore, there could be other technological and productivity advancements that may be more cost effective in addressing sustainability concerns and mitigating climate change. Every country will have to consider the potential trade-offs and synergies arising from the transformations needed in its transition towards healthy diets that include sustainability considerations.

As seen from the full cost analysis in this section, high- and upper-middle-income countries stand to benefit the most from shifts to healthy diets, as in those countries the two hidden costs considered constitute almost half of the full cost of their current food consumption patterns (i.e. 47 to 44 percent of the full cost, respectively). Indeed, looking at per capita emissions under current food consumption patterns, these are projected to be the largest in upper-middle- and high-income countries. Therefore, importantly, the bigger change towards healthy diets that include sustainability considerations will have to happen in upper-income and high-income countries.

On the other hand, an seen from the above regional and country-income distribution of the social cost of GHG emissions, a real difference can be made in lower-middle-income countries given that by 2030 they would account for more than half or 52 percent of the social cost of GHG emissions under current food consumption patterns, because they house the majority of the world's population. Small changes in these countries can make a significant difference, and the change that they need to make in terms of change of diet is much smaller than the changes needed in upper-middle-income and high-income countries.

The shift towards healthy diets that help mitigate the effects from climate change, no doubt, can also create a virtuous circle. This can happen, for example, by limiting the impacts of diets on the environment through technological and productivity advancements, and through sustainable and integrated land and natural resource use. Enhanced efficiencies and innovations along the food supply chain, including those aimed at reducing food loss and waste and accompanied with concrete policy measures such as fiscal policies are other examples. Moving towards healthy diets through these enhancements will contribute to reducing the cost of producing and consuming nutritious food because, as shall be seen in the next section, it simultaneously addresses some of the factors driving the cost of food. The remaining years of the UN Decade of Action on Nutrition, for which creation of sustainable, resilient food systems for healthy diets is a priority, present an opportunity to accelerate country level action in this area. ■

2.3 WHAT IS DRIVING THE COST OF NUTRITIOUS FOODS?

KEY MESSAGES

➔ Factors driving the cost of nutritious foods are found throughout food systems, in the realms of food production, food supply chains, food environments, as well as consumer demand and the political economy of food.

➔ Food production: Low levels of productivity, high production risks and insufficient diversification towards the production of more nutritious foods are key drivers of the cost of healthy diets, especially in low-income countries.

➔ Food supply chains: Inadequate food storage, poor road infrastructure and limited food preservation capacity, especially for highly perishable foods, lead to food losses and inefficiencies along the food supply chain that drive up the cost of nutritious foods.

➔ Food environments: In both urban and rural areas, the lack of physical access to food markets, especially to fresh fruit and vegetable markets, represents a formidable barrier to accessing a healthy diet, especially for the poor.

➔ Consumer demand: Rapid rates of urbanization have resulted in more work-away and eat-away-from-home habits, with a direct impact on the demand for easy-to-prepare, highly processed foods or convenience foods that are often energy dense and high in fats, sugars and/or salt and do not necessarily contribute to healthy diets.

➔ Political economy: Trade policies, mainly protectionary trade measures and input subsidy programmes, tend to protect and incentivize the domestic production of staple foods, such as rice and maize, often at the detriment of nutritious foods, like fruits and vegetables. Non-tariff trade measures can help improve food safety, quality standards and the nutritional value of food, but they can also drive up the costs of trade and hence food prices, negatively affecting affordability of healthy diets.

➔ Addressing some of these drivers to reduce the cost of nutritious foods implies the need to also tackle environmental externalities associated with current food systems and the hidden cost they create, particularly at the food production level, but also at the consumption level.

As shown in the cost and affordability analysis, even the most conservative cost estimate of a healthy diet is unaffordable for more than 3 billion people in the world. To understand what is driving the high cost of healthy diets relative to people's incomes, we need to look at their most costly food groups. As was shown previously, the highest-cost food groups in a healthy diet are those that are more nutritious: dairy, fruits, vegetables, protein-rich foods (plant-based and animal source), with some variations by region (Figure 27). Therefore, to increase the affordability of healthy diets, the cost of these nutritious foods must come down.

Global food price developments represent an important indicator of changes in the cost of food at country levels.[am] Following a long period of decline during the twentieth century, food prices of major commodities, including meat, dairy, cereals, vegetable oils and sugar, rose sharply during the first decade of the twenty-first century. By 2011, price indices for these commodity groups more than doubled (even tripled for some). Since reaching a peak in 2011–2013, global prices of these major commodities have dropped by about 29 percent, although meat and dairy prices declined less by about 15–19 percent from their highest levels.[134]

Recently food markets have been confronted with significant uncertainties that affect the price of foods, ranging from a fast-changing trade environment to the rapid spread of African Swine Fever over several continents, Desert Locust outbreaks in Eastern Africa and Southern Asia, and the devastating impacts of the COVID-19 pandemic on economies and markets of so many countries around the world (Box 16). These major events place upward pressure on food prices, thus affecting the cost and affordability of healthy diets. The full impact of COVID-19 on food prices remains to be seen.

Affordability of diets is determined by the cost of food relative to people's incomes. The 2019 edition of this report addressed the relationship between food security, nutrition and poverty. It showed that poverty and inequality reduction is critical to improving people's capacity to access sufficient and nutritious food, pointing to concrete policy recommendations, some of which are revisited in the last section of this part of the report. While the broader issue of how to increase people's incomes is at the core of economic development,[144] this topic is beyond the scope of this year's report. On the other hand, increasing affordability through food price reductions is not as widely studied, hence the drivers of the cost of foods, rather than the drivers of people's incomes, are the focus of this section.

Many factors determine the consumer price of nutritious foods, from the point of production throughout the food supply chain and also within the food environment, where consumers engage with the food system to make decisions about acquiring, preparing and consuming foods. As food systems have become more globalized, industrialized and dominated by large actors capable of economies of scale and of maintaining long supply chains,[145] this has had different effects on food prices and the affordability of various diets across countries. Other drivers, including rising incomes, increasing urbanization and changing consumer demands, have led to food markets becoming outlets for mass-produced and highly processed foods, often energy-dense foods of minimal nutritional value that are high in fats, sugars and/or salt.[145] This has resulted in vegetables, fruits and animal source foods often being too expensive or inaccessible to many households, leading to low nutritional quality diets.

Within the broad context of these global trends, the unique structure and performance of a multitude of food systems (and their supply chains) at national, subnational and municipal (or community) levels imply different cost structures for nutritious foods in different locations. Some of the cost drivers, such as »

am Price trends reported here stem from the FAO Food Price Index, which is a measure of the monthly change in international prices of a basket of food commodities. It consists of the average of five commodity group price indices, weighted with the average export shares of each of the groups for 2002–2004.[134]

BOX 16
HOW COULD THE COVID-19 PANDEMIC AFFECT FOOD PRICES AND AFFORDABILITY OF HEALTHY DIETS?

Healthy diets are further out of reach for more than 3 billion people. As the tragic human impact of the COVID-19 pandemic is engulfing the world, it is also wreaking havoc on the world economy* with multiple effects on people's reduced capacity to access healthy diets. Record levels of unemployment, lost livelihoods** and rising poverty levels*** will cause healthy diets to become even more unaffordable for the more than 3 billion people estimated in this report. This number is likely to rise during the course of 2020.

There is sufficient food, but millions risk not having access to diverse and nutritious foods. Globally, enough food is being produced or in stock to meet dietary energy needs. But border closures, quarantines, market, supply chain and trade disruptions are restricting people's physical access to sufficient, diverse and nutritious sources of food, especially in countries hit hard by the pandemic or already affected by high levels of food insecurity.[135] High value perishable commodities are going to waste, as essential workers in food and agriculture are barred from crossing borders and food supply chains are being disrupted.[136] Closure of informal markets may exacerbate unaffordability healthy diets. Estimates based on scenarios modelling the potential impacts of the COVID-19 pandemic on the number of undernourished people in the world are presented in Part 1 (see Box 3), while the possible impacts on malnutrition are presented in Box 4.

Currently, in low- and middle-income countries, the lives and livelihoods of an estimated 265 million people are under severe threat unless swift action is taken to address the impact of COVID-19.[137]

Food losses are increasing as food supply chains are under strain. In spite of major efforts to keep open food production, processing, trade and transportation networks, and access to food markets and retail outlets, there are reports of significant food losses, especially of fruits and vegetables, fish, meat and dairy products.[138] Furthermore, travel restrictions are causing severe labour shortages in food and agriculture production and processing industries, leading to production and supply disruptions. Middle- and high-income countries have been most affected by increased levels of food losses as producers cannot market their produce putting upward pressures on food prices, especially of perishable commodities.[136]

Food prices may rise in the absence of urgent and coordinated policy measures and corrective action. How the extreme economic conditions affect food prices varies tremendously across and within countries, between urban and rural areas and across different food groups. The depth and length of the economic crisis, and to what extent corrective policy measures are taken and implemented in a coordinated manner will determine if rises in food prices can be avoided. Most importantly, trade channels must stay open to prevent food price rises. Both exporters and importers of foods should agree not to impose trade barriers in response to the pandemic. Countries should eliminate existing export restrictions, including export taxes and export bans, while also reducing tariffs to facilitate imports.[139]

Evidence of impact on food prices. At the time of writing, few countries had reported significant rises in food prices, except for a number of local markets because of temporary food shortages. In Western Africa, countries like the Central African Republic, Gambia, Liberia, Mauritania, Niger, Senegal and Sierra Leone, where the market situation was already fragile, may face further deterioration. In several of these countries non-seasonal price increases of 10–20 percent have already been recorded in monthly variations for food products. In countries hardest hit by the pandemic, there has been a reduction in the demand for fruits, horticultural and other perishable products, such as aquatic products, leading to a decline in food prices. The poultry and egg food production chains have also faced strong downward price pressures.[138]

Impact on some of the most vulnerable populations. Migrant workers have been affected by lockdowns, trade disruptions, layoffs and illness, while their capacity to send remittances to their home countries has dropped significantly. This will affect families especially in Bangladesh, Ethiopia, Indonesia, Kenya, Nepal, Nigeria, Somalia, Tajikistan and many others, where remittances make up a large proportion of the income of poor households.

Policies to counter the negative effects of the COVID-19 pandemic on food systems worldwide should prevent significant increases in the cost of nutritious food and support affordability of healthy diets. Recommendations are presented in Box 21.

* The IMF expects the world economy to contract by 3 percent in 2020, much worse than during the 2008–2009 financial crisis.[140]

** ILO estimates that 1.6 billion workers in the informal economy (nearly half the global workforce) risk losing their livelihoods and the equivalent of 305 million full-time jobs will be lost during the second quarter of 2020 (10.5 percent lower than end 2019).[141]

*** The World Bank estimates 40–60 million people will fall into extreme poverty (< USD 1.90/day, half of which in SSA) and 90–100 million will fall below the USD 3.20/day poverty line (half of which in Southern Asia). Other estimates from UNU-WIDER place the figures much higher and suggest that about half a billion people worldwide could be pushed into poverty due to COVID-19.[142,143]

» food losses and waste, cut across food systems, whereas others vary by food group or are specific to the country context, such as domestic policies aimed at increasing the availability of staple foods. International trade and related government policies and the aspects of the political economy of food also represent major drivers of the cost of nutritious foods. Finally, climatic shocks (as highlighted in the 2018 edition of this report) and other unexpected shocks, including those caused by infestations and diseases at the regional level (e.g. African Swine Fever or Desert Locust outbreaks) or at the global level (COVID-19) are becoming more frequent and severe, often disrupting the world's food supply chains.

Hence, food systems today are facing huge challenges in adapting to a multitude of developments. They simultaneously face demands to ensure that healthy diets are affordable not only to a growing urbanized world population but especially also to the majority of the poorest living in rural areas. While production and processing advances have made food more convenient, widely available and affordable for large portions of the world,[146] these same food systems are a dominant driver of the increased availability of energy-dense foods of minimal nutritional value that are high in fats, sugars and/or salt. They are also a driver of health threats like NCDs and many environmental threats, including climate change, biodiversity loss, and degradation of land, soil and freshwater.

This section focuses on four main sets of drivers determining the cost of food. The following drivers are specifically covered:

1. Cost drivers that relate to the **production of diverse nutritious foods that contribute to healthy diets** (insufficient diversification and low productivity; low levels of technology; pre-harvest and post-harvest losses; seasonality and other climate risk factors; insufficient investment in R&D, limited access to knowledge and information).
2. Cost drivers that relate to the **food supply chain** beyond food production (inadequate food storage, handling and preservation, especially of perishable foods; food losses beyond pre-harvest and post-harvest losses; poor road networks and limited transport capacity).
3. Cost drivers that relate to the **food environment** as well as **consumer demand and behaviour** (population growth, urbanization, access to markets; food preferences and culture; consumer knowledge and behaviour).
4. Cost drivers that relate to the **political economy** of food (including the unique impact of food and agricultural policies on the cost of nutritious foods; trade measures and government policies that favour energy-dense foods of minimal nutritional value over nutritious foods; public expenditure; unfavourable trade mechanisms and the impact of food and agriculture industry lobbying on the cost of nutritious foods).

Cost drivers in the production of diverse nutritious foods

Low levels of technology, innovation and investment in food production

Addressing low productivity in food production can be an effective way of raising the overall supply of food including nutritious foods, reducing food prices and raising incomes, especially for the poorer family farmers and smallholder food producers in low-income and lower-middle-income countries, like farmers, pastoralists and fisherfolk. Sustained productivity growth in food and agriculture, without depleting natural resources, depends on food producers having the capacities to innovate (enabling them to raise yields), manage inputs more efficiently, adopt new crops or breeds and improve quality, while also conserving natural resources.[147]

Productivity growth at every stage of the food supply chain requires technological and institutional innovations, which allow food production, handling and processing to remain profitable at a lower per-unit cost for consumers,[103] while at the same time being sustainable. In recent decades, the expansion of agricultural areas has played only a marginal role in increasing production. Hence, technological innovation in many forms (e.g. mechanization, increased access to irrigation, plant and animal breeding, improved management practices, along with increased access to global and locally specific information) is urgently needed for substantial and sustained growth in yields and productivity in most of the world, especially in sub-Saharan Africa. Furthermore, reducing pre-harvest and post-harvest losses at the production level should be an integral part of efforts to increase productivity.

In addition to low productivity, insufficient diversification towards the production of horticultural products, legumes, small-scale fisheries, aquaculture, livestock and other nutritious food products also limits the supply of diverse and nutritious foods in markets, resulting in higher food prices. Diversified and well-integrated production systems not only increase the availability of nutritious foods, but also help vulnerable populations to increase their resilience to climate and price shocks and reduce seasonal variation in food production.[148] It is also critical to increase the variety of foods produced and move into higher-value products, such as from staple foods to also producing fruits and vegetables and exportable food products.[149]

Over the past number of decades, increases in agricultural productivity across countries and regions has been highly uneven with the fastest rate of growth (measured as the gross output of crops and livestock per hectare of farmland) registered in the developed countries of Eastern Asia (Japan and the Republic of Korea). In contrast, growth in agricultural productivity has regrettably been slowest in sub-Saharan Africa and Southern Asia.[149] Insufficient investment in nutritious foods, especially in low-income countries with a high prevalence of undernutrition, has led to a relatively high cost of these foods. For instance, vegetable productivity varies widely across countries, with tremendous potential for improvements. In Nigeria, for example, average yields in tomato production reached only 4 tonnes per hectare, compared with China's 51 tonnes per hectare.[an] Such large productivity gaps could be successfully reduced with stepped-up public and private sector investment in agricultural research, technology transfer and technical assistance for fruit and vegetable producers. In Indonesia, the implementation of Farmer Field Schools aimed specifically at vegetable producers resulted in yields of tomatoes and chilies increasing by 20 percent and 12 percent, respectively, compared with a control group.[150] And in the United Republic of Tanzania, a technology transfer project resulted in important yield increases in four varieties of vegetables, with increases of more than 20 percent in tomato production.[151]

Of course, productivity is only one of several drivers that determine the ultimate consumer prices, but it is still an important one. A global analysis based on the IMPACT model[ao] has shown that increasing the productivity of fruits, vegetables, pulses and poultry by 25 percent could result in the reduction of the average world prices of these commodities by 20–25 percent. Different scenarios produced similar results. For example, the doubling of agricultural productivity in these commodities could also lead to a 50 percent reduction in prices.[152]

Further efforts to improve diet quality, especially for the growing populations in low-income countries, may require increased consumption of animal source foods (ASFs), including dairy products, as well as fisheries and aquaculture products, to meet protein intake requirements for those populations. Increasing livestock production can lead to lower prices of livestock products and, therefore, increased access to such products by the poor, especially poor urban consumers.[153] However, the perishable nature of ASFs, especially of fresh milk, fish and eggs, could also lead to supply constraints and consequently higher prices. Even given the option of low-cost imports, these only offer limited scope to bring down prices.[7]

Indeed, high prices are already seen in many countries due to poor productivity in the dairy and poultry sectors. Dairy production, for its part, has some specific constraints: for example, it is poorly suited to tropical climates. In many parts of Africa, keeping dairy animals is severely constrained by tsetse flies. The high price of eggs in many parts of the world is paradoxical, given that poultry are the most

an In 2012–2013, China's tomato production accounted for 35 percent of the global-traded value for tomatoes.[160]

ao The IFPRI International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) web tool is a fully interactive online policy analysis tool.[351]

widely owned livestock in low-income countries. Unfortunately, homestead poultry production is often hindered by diseases like Newcastle's and lack of inputs. Countries like India that have achieved larger-scale commercial production with the use of improved breeds, feed, housing and vaccinations have seen marked declines in the prices of eggs and poultry products, even in the face of rising demand.[7]

In South-eastern Asia, innovative "climate-smart" agricultural techniques consisting of low-cost and environmentally friendly farming practices have led to higher incomes for poor households, especially in rural and remote areas, while also increasing the diversity of food items available on local markets. For example, in Lao People's Democratic Republic, "rice-fish farming" practices combining aquatic products and rice as the main staple have increased household incomes through diversification and more efficient use of inputs.[154] Aquatic animals and plants raised in rice fields have increased dietary diversity in food consumption and represent important and affordable sources of protein and micronutrients to the population.[155]

A large body of evidence confirms that there are high returns to public investments in agricultural R&D. When agricultural technologies and new practices are introduced simultaneously, they can significantly raise productivity and reduce food prices in low-income countries. For staple foods, such combined efforts could reduce food prices by up to 49 percent for maize, 43 percent for rice and 45 percent for wheat.[156] A wide range of technologies, including no-till farming, heat-tolerant crops, artificial insemination in livestock and DNA-based approaches to identify and monitor disease-causing agents, can benefit smallholders in low-income countries.[157,158]

In spite of the high potential for technological advances, in many low- and middle-income countries, investment in agricultural sector R&D is currently insufficient.[159] For example, in a sample of 70 LMICs, the average number of public sector researchers per million in the country's population is 4–5 in cereal research, with only 1 researcher each in the cultivation of fruits and vegetables.[160] The focus on staples is a reason for continued high prices, in particular for more perishable food commodities like fruits and vegetables and livestock and fisheries products.

In Ethiopia, rapid economic progress over the past two decades went hand-in-hand with substantial increases in agricultural productivity, spurred by government policies and investment. However, this involved much higher levels of investment towards increased productivity of starchy staples, eventually resulting in a reduction of staple food prices with relatively higher prices for nutritious foods (see Box 17).

However, increasing productivity may not accrue gains on its own. Without access to markets to absorb excess local supply, there is little incentive to increase production as this will only lead to lowering farm-gate prices.[161] These lower prices in turn act as a disincentive to increased food production and technological innovation in the sector,[161] ultimately leading to higher food prices.

Managing risks in food and agricultural production

Engaging in the food and agriculture sector can be an intrinsically risky endeavour, be it in crop or livestock production, fisheries and aquaculture or forestry. This is particularly the case for poorer family farmers and smallholder producers on marginal lands or those with limited access to technology, capital or other productive resources. In crop production, traditional staple foods generally carry a lower risk compared with the production of higher value and more nutritious foods. For many low-income smallholders, it might be a rational choice to stick with low-productivity, low-risk technological options – but the consequence is that poor households may never produce enough to enable them to provide sufficient diverse nutritious food for their families. This is in stark contrast to the food and agriculture sectors in high-income countries, where producers can purchase insurance to protect their incomes.

Managing risk is an important aspect of food production in all food and agriculture sectors, one that greatly influences what a producer decides to grow, raise or capture. This indirectly affects prices, and thus the cost of diets and how affordable they may or may not be for

BOX 17
THE IMPACT OF GOVERNMENT POLICIES AND INVESTMENT IN AGRICULTURE ON THE COST OF NUTRIENT ADEQUATE DIETS IN ETHIOPIA

During 2004–2010, Ethiopia was one of the fastest growing economies in the world as it experienced an average annual GDP growth of 11 percent, and just under 10 percent during 2011–2017. Among the several factors behind this economic success was a rapid agricultural sector modernization that notably increased the productivity of cereals.[162]

This economic transformation was accompanied by rapidly rising food inflation and increases in nominal wages from 2002 to 2016. In particular, the cost of animal source foods, fruits, vegetables and pulses, increased far more rapidly than the cost of starchy staples and oils and fats, partly reflecting government commitment to increase productivity of traditional crop varieties such as teff, wheat and maize.[163]

The agricultural transformation, however, did not take into consideration diet quality and health consequences of diets of low nutritional quality. It helped alleviate poverty through a reduction in cereal prices, but insufficient investment in the production of high-value crops, such as fruits and vegetables, and animal source foods contributed to higher relative prices of these foods compared with starchy staples, thus limiting the affordability of these nutritious foods, especially for the poorest households.

During the transformation, nominal wages increased faster than the cost of a nutrient adequate diet, thus making this diet (as described in Box 10) more affordable over time, as it came to represent 22 percent of the average nominal wage in 2016 from 32 percent in 2008. Nevertheless, this improvement was driven by wage increases rather than a decline in food prices.[164]

Generally, even if wage increases are positive for the real affordability of diets as it occurred in Ethiopia, the higher increase in the cost of healthy diets poses important challenges. As the demand for nutritious foods is highly elastic (i.e. a small change in prices corresponds to a high change in demand), there tends to be a consumer reluctance to turn wage gains into purchases of these foods. To bring down prices of high-quality commodities, the economic transformation of the country should, therefore, focus not only on the traditional staple crops but also on improving the production systems of noncereal sectors.[49]

the consumer. Vegetable production is often identified as a profitable but more risky option for smallholders. The risk factors include: higher levels of capital outlay, like irrigation equipment; potential for harvest losses due to extreme weather conditions; the highly perishable nature of vegetables; changing levels of consumer demand; and volatile producer prices. Other sectors, such as livestock rearing, fisheries or aquaculture also call for substantial levels of capital investment and hence require a good understanding of risk factors before engaging in production.

In Ethiopia, a qualitative study on the smallholder perceptions about the risks of producing vegetables found that the major risks observed by farmers are market price fluctuations, followed by drought and pests.[165] In Malawi and Mozambique, traditional vegetable value chains are exposed to risks not only at the production level, but also in the other stages of the value chain due to poor infrastructure and lack of processing or packaging facilities.[166]

In the absence of access to knowledge, information and credit, all of the above are risks that influence food producers' decisions on whether to invest in crop production, livestock or aquaculture, which ultimately influences the overall availability of nutritious foods and their prices. Many producers will continue growing what they know best, largely staple foods, rather than venture into more risk-prone products or other commodities of higher nutritional content.[167]

BOX 18
SEASONALITY RELATED TO CLIMATE AND REMITTANCES AFFECTS FOOD PRICES AND AFFORDABILITY OF NUTRIENT ADEQUATE DIETS IN TAJIKISTAN

Tajikistan is a landlocked lower-middle-income country that largely depends on agriculture and remittances. The country's long winters, high exposure to natural shocks and seasonality in food production limit its access to markets and nutritious foods.[172] In addition, many households are highly dependent on remittances from seasonal, mostly construction-related labour in Russian Federation. The dual effect of climate-related shocks and seasonality and irregular remittances have caused both seasonal and year-on-year increases of food prices, raising the cost of nutrient adequate diets while affordability levels have decreased. Households already spend 50–60 percent of their expenditure on food and are therefore unable to absorb much of a change in food prices.

A WFP-supported Fill the Nutrient Gap analysis helped identify key barriers faced by the most vulnerable across four regions in Tajikistan in accessing nutritious foods.[173] The analysis found that 29–42 percent of households could not afford a nutrient adequate diet. When factoring in the habitual high consumption of vegetable oil and fat, this proportion increased to 41–56 percent.

As a result of the year-on-year increase of prices of food and non-food items and variations in income-earning opportunities during 2014–2017 – i.e. a lower proportion of households reported "having worked over the previous week" – a downward trend in affordability was observed. The analysis showed a decrease in affordability from 55 percent in May 2015 to 45 percent in June 2016, while WFP monitoring data showed that the proportion of rural households that reported spending more than 65 percent of expenditure on food grew from 33 percent in December 2014 to 60 percent in December 2017.[174]

Those smallholders who have successfully engaged in vegetable production have had several factors in common: access to markets, enhanced access to credit, irrigation infrastructure, technology and knowledge.[168] For many, contract farming is an instrument that can provide certainty in expected returns on production. In India, for instance, contract farming in onions has led to increased yields and overall production levels.[169]

Seasonality and climate factors

Prices for most food and agricultural products exhibit significant seasonality, typically peaking just before the harvest, when food supplies are scarce, and dropping thereafter. The seasonality of prices of fruits and vegetables is typically more extreme, with different peaks according to the timing of the harvest. Even as people substitute between foods according to price fluctuations, the lowest possible expenditure needed to meet all nutrient intake requirements still varies significantly due to seasonality, while the cost of calories (largely derived from less perishable staple foods) usually fluctuates less[170] (see Box 18).

When food prices show high seasonality, this may have particular consequences for dietary intake and nutritional outcomes and may also cause even further food price volatility,[171] further challenging food security and nutrition. A study of 13 commodities across 193 markets in seven countries pointed to high levels of food price seasonality in African food markets, as measured by the "seasonal gap". The seasonal gap, defined as the difference between the high price immediately prior to the harvest and the low price following the harvest averaged across years, was highest for fruits and vegetables and lowest for commodities produced throughout the year, such as eggs (Table 10). In some countries, food price seasonality was quite high even for staples such as maize.[171]

Climate change is expected to further aggravate seasonality through increased drought frequency, disruption of food production by floods and tropical storms, increasing and more variable temperatures, and more erratic rainfall. Small Island Developing States (SIDS)

TABLE 10
FRUITS AND VEGETABLES SHOW THE HIGHEST LEVELS OF FOOD PRICE SEASONALITY IN SEVEN SELECTED COUNTRIES IN AFRICA (2000–2012)

Food crop	Seasonal gap in food prices (%)
Tomatoes	60.8
Plantain/matoke	49.1
Oranges	39.8
Maize	33.1
Bananas	28.4
Teff	24.0
Beans	22.9
Sorghum	22.0
Millet	20.1
Cassava	18.8
Rice	16.6
Cowpeas	17.6
Eggs	14.1
Average (all 13 crops)	28.3

NOTES: The table shows the average estimated seasonal gap in food prices by food crop in seven selected countries in Africa (2000–2012). The seasonal gap is the difference between the high price immediately prior to the harvest and the low price following the harvest averaged across years. For above crops, there are between 6 and 13 years of monthly price data over the 2000–2012 period depending on the country, market place and commodity. Countries covered: Burkina Faso, Ethiopia, Ghana, Malawi, Niger, United Republic of Tanzania and Uganda.
SOURCE: Gilbert, C.L., Christiaensen, L. & Kaminski, J. 2017. Food price seasonality in Africa: Measurement and extent. *Food Policy*, 67: 119–132.

in particular suffer from these effects of climate change, including as the result of cyclones and hurricanes, rising sea levels and eroding coastlines. These changes exacerbate their already fragile natural environments making it more difficult to produce sufficient food at reasonable cost to meet their dietary needs.[175]

Climate change will lead to a general decline in agricultural production over the next two to three decades, turning into a major cost driver of food in the near future. Overall degradation of soil quality and agro-ecosystem conditions is furthermore leading to a general decrease in agricultural production.[176,177] In sub-Saharan Africa, it has been predicted that as climate change affects food production, particularly through average temperature and changing rainfall patterns, the average consumer price of maize and other coarse grains could rise by 150–200 percent over a 20-year period (2010–2030) with the highest price rises to be seen in Southern Africa.[178] Elsewhere, a climate impact study conducted on the five largest countries in Southern Asia suggests that there is likely to be a significant negative impact on food production and agricultural productivity, while food prices are expected to rise. This has important implications for food security and nutrition.[179] Similarly, a long-term study in Malaysia (1980–2017) shows a negative effect of climate change on fruit and vegetable production[180] that might prompt shifts in eating patterns towards even lower fruit and vegetable intakes and increased consumption of highly processed food and beverages that are high in saturated fats, trans fats, sugars and/or salt.[145]

Current food consumption patterns and the food systems that support them are both major drivers of negative environmental impacts and climate change, creating a vicious circle. As shown in Section 2.2, these patterns and systems have major ramifications for the state of the environment and climate change. Current food demand patterns create significant hidden social costs in terms of GHG emissions and climate change, estimated to reach USD 1.7 trillion per year by 2030 (Figure 37). However, there is also strong evidence of global climate change leading to increasing climate variability and extremes and unpredictable seasonality, as highlighted in the in-depth climate analysis presented in the 2018 edition of this report. Climate variability and extremes and unpredictable seasonality are exacerbated because these hidden environmental and climate-change costs are left unaddressed. This, in turn, negatively impacts productivity in the food and agricultural sectors, ultimately increasing the cost of nutritious foods and healthy diets.

Cost drivers along the food supply chain

In addition to the challenges of diversifying food production and increasing the productivity of nutritious foods, there are a host of bottlenecks along the food supply chain that must be addressed to deliver a variety of nutritious and safe foods at a lower cost to consumers.

Food losses and waste

Reducing pre-harvest and post-harvest losses in quantity and quality at the production level in the agriculture, fisheries and forestry sectors is an important starting point to reduce the cost of nutritious foods along the food supply chain. This is because losses decrease the overall availability of these foods, while also possibly undermining environmental sustainability. In lower-income countries, where food insecurity is often severe, increasing access to a greater amount and variety of foods is critical.

The effect of a reduction of food losses on access to food will be different for each actor of the food supply chain, depending on the overall price effect. For example, a fall in prices can improve consumers' access to food, but if not proportionally supported by productivity gains at the production level, it may diminish the food security status of commercial farming households, as they will then receive lower prices for their products.[181] This highlights the importance of combining pre-harvest and post-harvest loss reduction at the production level with other investments for productivity gains (as outlined above) as part of comprehensive efforts to increase productivity. Such combined efforts can contribute not only to lower consumer prices, but also to increased profit margins for food producers.

Recent estimates show that around 14 percent of the world's food is lost during the post-harvest production stage and before reaching the retail level. Global revised estimates of percentages of food wasted every year occurring at the retail and consumer levels, are being compiled by UN Environment Programme.[181]

All along the supply chain, from production to wholesale and retail, food losses and waste are generally highest for more perishable nutritious foods, including fruits, vegetables and animal products. A recent analysis finds that the losses and waste are higher for fruits and vegetables than for cereals and pulses at all stages in the food supply chain, with the exception of on-farm losses and those incurred during transportation in Eastern and South-eastern Asia.[181] For example, looking at only one supply chain stage, fruit and vegetable loss and waste at the retail level are as high as 35 percent in sub-Saharan Africa.

Important causes of losses at the production level include exposure to adverse weather conditions, harvest and handling practices, as well as marketing challenges. Inadequate storage conditions and decisions made at earlier stages of the supply chain (e.g. lack of proper plant health management, inadequate crating or packing of foods) lead to products with a shorter shelf life. Adequate cold storage, in particular, can be crucial to prevent quantitative and qualitative losses of perishable foods. Moreover, during transportation, good physical infrastructure and efficient trade logistics of key importance to prevent food losses.

Generally, reducing food loss and waste entails certain costs. Producers and consumers will only undertake the necessary efforts if the benefits outweigh these costs. For producers, the benefits of reducing food losses by investing in technology or improved practices may be too small in relation to the investment cost. For consumers, the value of their time may be too high to justify efforts to curb waste, such as planning food purchases, meal preparation and managing food stocks.[181] Again, the impact of reduction in food loss and waste depends on how their effect on prices is transmitted throughout the food supply chain; some actors may benefit, others may lose out. Public policy needs to create the right incentives for producers to cut food losses and for consumers to reduce food waste in order to maximize social benefits and reduce the cost of nutritious foods.

Technology and infrastructure

Fruits and vegetables and animal source foods are highly perishable, especially fish, fresh milk, meat and eggs. Lack of adequate market infrastructure and limited processing technology can result in food losses and higher food prices, especially for highly perishable foods like milk. As stated above, improved technology and infrastructure in handling, storage and processing (cool storage systems, cold chains, drying techniques, improved packaging) offers opportunities to reduce losses and lower consumer food prices. Certain processing techniques can increase the nutrient content of food and raise the bioavailability of nutrients, including through fermentation, germination and roasting.[182,248]

Some of these preservation techniques rely on low levels of technology (e.g. open air or solar drying, or smoking of fish); however, a stable supply of electricity becomes important for cold storage of perishable commodities requiring refrigeration. In sub-Saharan Africa, refrigeration facilities remain inaccessible to most smallholders. In the United Republic of Tanzania, it has been estimated that 25 percent of milk deteriorates because lack of refrigeration facilities; 97 percent of red meat sold in the country has been never been refrigerated.[183] Highly perishable foods require storage facilities with controlled temperature and humidity conditions. In the absence of these facilities, many producers have little option but to sell their produce immediately regardless of the market price, or face the risk of heavy losses.[183] Hence, the lack of adequate storage facilities negatively affects smallholders' incomes, and the availability and cost of fresh foods produced locally.

Another important component of market infrastructure is the overall quality and efficiency of the national road and transportation network, which is critical in getting produce from the farm gate to markets at reasonable cost. Investment in all-weather rural roads is particularly important. This reduces the time it takes to reach rural and urban markets, thus helping to reduce pre-harvest and post-harvest losses, including of perishable fruits and vegetables. In many countries, transport costs are a barrier to increasing the affordability of healthy diets, particularly for lower-income consumers (Box 19). Therefore, investing in road infrastructure would have significant returns in getting nutritious food to the market at lower costs.

Overall, small- and medium-sized producers have seen their capacity to engage with markets increase, both at the local and international levels. This trend has been essentially driven by their improved access to local infrastructure (e.g. power grid, roads) and to local supermarkets,[184] along with their proximity to marketplaces in growing urban centres. However, this benefit is often offset by the difficulties that smaller producers face in complying with increasingly standardized procurement processes that accompany trends in systematic "super-marketization" and internationalization of markets.[185] Moreover, poor road networks continue to constrain the existence of well-functioning markets.

As for the food processing industry, there is concern that food policies and the private sector have promoted "inexpensive calories and expensive nutrients",[186] leading to increased prevalence of overweight and micronutrient deficiencies. This is of particular concern in high-income countries and rapidly growing low- and middle-income countries, where the agricultural sector has become or is rapidly becoming a supplier of raw materials for the food processing industry, rather than a provider of food for direct human consumption.[186] These developments have underscored the need for policy interventions that promote nutrition-sensitive food systems from the production level throughout the food value chain, as discussed in the next section.

The food environment and consumer demand as a cost driver

The food environment is the "physical, economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food".[35] It is the marketplace where food prices are determined based on supply and demand, where food marketing shapes food preferences, and where consumers form their understanding and expectations of food safety and quality (e.g. through nutrition labelling). Consumer decisions are also important in regard to how much of their household budget is spent on food and on what food items in particular.

Consumption decisions, on the one hand, are based on relative prices and consumer income (or cost and affordability) and consumer preferences. This part of the report focuses on cost and affordability, but, as shall be seen in Section 2.4, the effectiveness of policies to reduce the cost of nutritious food and increase the affordability of healthy diets will also depend »

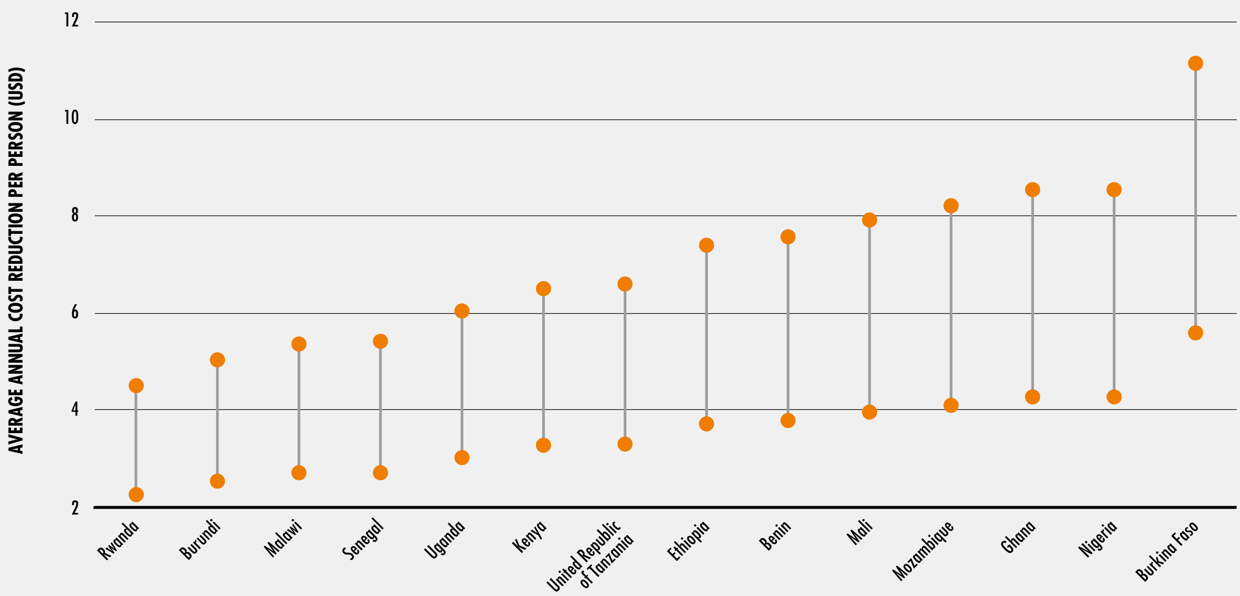
BOX 19
PUBLIC INVESTMENTS IN ROAD NETWORKS OF SELECTED AFRICAN COUNTRIES INCREASE AFFORDABILITY OF NUTRIENT ADEQUATE DIETS

Public investments in the road networks of 14 African countries could help raise the affordability of nutrient adequate diets,* especially for the poorest, by means of reducing transport costs by up to USD 50 per household on an annual basis. A simulation of the impact of improvements in road infrastructure on price reductions of key food commodities helped derive increased levels of affordability for country-specific nutrient adequate diets.**

The estimation of the potential cost savings for such a diet, as shown in the figure below, is built on two assumptions. First, an improvement of the road network will decrease average transport costs for a given food commodity relative to the transport cost for the same product in South Africa, the country considered to have the most efficient transportation network in the region.*** Second, the cost reduction is transmitted to the final retail price of the food commodity analysed.

Results. If transportation were more efficient as a result of a better road network, potential savings would amount to USD 7 per capita per year, on average, across the countries analysed. Assuming an average household size of five members[187] in the analysed countries, these savings could amount to USD 35 per household on an annual basis. Given that the composition and cost structure of a nutrient diet is different in each country, the savings effect of the reduced transport costs differ

IN AFRICA PUBLIC INVESTMENTS TO IMPROVE ROAD NETWORKS CAN LEAD TO SIGNIFICANT ANNUAL REDUCTIONS IN THE COST OF A NUTRIENT ADEQUATE DIET (2014–2017)



NOTES: The figure shows simulated lower- and upper-bound annual average reduction in the cost of a nutrient adequate diet, following a reduction in transport costs associated with improved road networks for selected countries in Africa (2014–2017). Upper bound reflects the scenario of transport cost shock applied to half the retail price, while in the lower bound, the shock is applied to a quarter of the retail price. Retail food price data from 2017 are obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). See Box 10 for the definition of the nutrient adequate diet, Box 11 for a brief description of the cost methodology, and Annex 3 for a full description of the simulation methodology and data sources.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

BOX 19
(CONTINUED)

by country. For example, in Burkina Faso, savings per household could be as much as USD 55 per year. In Burkina Faso, Burundi and Mozambique, per capita savings in the diet are close to 1 percent of the annual per capita GDP. In Malawi, Rwanda and Senegal, the effect is less pronounced, with a nutrient adequate diet costing just USD 25 less per household on an annual basis. Given that lower transportation costs could change the relative price of different products, they could also lead to gradual changes in the composition of the diet. For example, in Benin, consumers could start to consume more potatoes as these become more affordable compared with maize.

These results highlight the importance of public investments in infrastructure in support of raising the affordability of a nutrient adequate diet. Different from trade policies, which often generate opposing incentives to producers and consumers, as further explained below (see Box 24 on trade policy in Central America), policies and investments in support of the provision of public goods, like roads, railroads and transport services, may have a positive effect for all actors along the food supply chain.

* The nutrient adequate diet analysed here is defined as in Box 10.

** The estimated potential decrease in transportation costs is derived from the database on price incentive indicators developed by the Monitoring and Analysing Food and Agricultural Policies (MAFAP) Programme of FAO.

*** Transport costs are adjusted downward using the World Bank Logistics Performance Index (Dimension Infrastructure, on quality of trade and transport related infrastructure) of each country expressed with respect to the ratio for South Africa, the most efficient country in the region in terms of transport networks. According to the index (average 2010–2012), the analysed sub-Saharan African countries were about 30 to 50 percent less efficient than South Africa, in terms of trade and transport infrastructure.

» on measures shaping of the food environment and other policies that help shift consumer preferences towards healthy diets.

The distance to food marketplaces and the time required to prepare a healthy meal are among the key barriers that prevent many consumers from having access to, and hence deciding to pay a higher cost for healthy diets. These barriers can be seen as cost drivers because people who try to overcome them would have to accept an additional cost on top of the cost of food itself. The concept of "opportunity cost", which put simply means the loss of other alternatives when one alternative is chosen, can be applied in this context as explained as follows.

Access to markets

In many parts of the world, in both urban and rural areas, physical access by consumers to food markets, especially to fresh fruit and vegetable markets, represents a formidable challenge to eating a healthy diet. This is particularly true among poorer country income groups, who may not be able to access these markets, because of the distance and high transport costs involved. For these country income groups, the opportunity cost of eating healthy is too high, because of the time and the transport cost that they would have to incur, and they end up eating unhealthy food that is available closer to home at a much lower cost.

In such instances, homestead food production can be a good source of fresh foods, add diversity to the diet and lower the cost of a nutrient adequate diet. For example, the Philippines national nutrition survey found that more than half of the green, leafy and yellow vegetables and more than one-quarter of other vegetables consumed were produced by the households consuming them.[188] A simulation of different levels of homestead food production, sales and consumption of vegetables showed that, at optimal levels of sales and own consumption, the proportion of rural households that otherwise would not be able to afford a nutrient adequate diet could decrease from 37 percent to none.[189]

Poor road networks or long distances between production and consumption areas are also barriers to domestic trade that prevent well-functioning markets from existing. These constraints often translate into wide-ranging degrees of accessibility to food commodities, and price differences within countries, as seen in countries like the United Republic of Tanzania (Box 20).

In Kenya, as elsewhere, fluctuations in consumer prices of fruits, vegetables and staples are mainly determined by harvest performance, production cycles and transportation costs from the farm gate to the food markets. In Kenya's vast Arid Lands, food must be transported over large distances, and this becomes more difficult during the rainy seasons when roads deteriorate. Apart from seasonal volatility, food prices increase by about 1.3 percent for every additional hour of delivery time from the market hubs in central parts of the country to the more distant district headquarters, and by 1.8 percent for each hour between the district headquarters and remote markets off the regular transport corridors.[190] These price increases are ultimately passed on to the consumer.

Urban settings and food prices

Population growth, increases in income and urbanization are fundamental drivers of the rising demand for food and changes in people's diets with effects on food prices. The urban population, in particular, will continue to rapidly rise, with most of the increase seen in small- and medium-sized cities in Africa and Asia. Notably, by 2030, it is expected that the youth (under the age of 18) will make up 60 percent of urban populations,[197] which presents both challenges (e.g. in terms of high youth unemployment in urban areas) and opportunities (e.g. youth engaging in urban agriculture) in regard to providing sufficient access to nutritious foods to rapidly growing urban populations.

A large portion of the world's urban population lives in informal settlements on the urban periphery, ranging from 20 percent in Latin America to 55 percent in sub-Saharan Africa, and as much as 65 percent for all low-income countries.[198] In low- and middle-income countries in particular, easy access to traditional produce markets remains key to lowering the cost of nutritious foods and providing a wider variety of choices for these foods than in more modern supermarkets. Conversely, in a growing number of megacities worldwide, urban food prices have risen, as it has become more and more difficult and time-consuming to transport fresh produce to market.

The rapid growth of supermarkets in urban settings presents challenges and opportunities for providing access to affordable healthy diets. Supermarkets' modern and efficient food supply model offers significant opportunities to distribute fresh fruits and vegetables, and animal source and fortified foods widely, to stabilize food prices and to ensure food safety. On the other hand, supermarkets also offer a wide variety of non-perishable energy-dense foods of minimal nutritional value, often high in unhealthy fats, sugars and/or salt, at lower prices than nutritious foods. While governments could put in place measures to stimulate adequate availability of affordable nutritious foods in supermarkets, in large part the development of supermarket chains is stimulated by technological change and consumer demand, which are beyond the control of governments.[199]

A promising solution can be seen in the area of urban and peri-urban agriculture, which has gained in prominence as a means for urban dwellers to access fresh and nutritious food items, including fruits and vegetables at reasonable cost, either through own production or through short value chains. For urban farmers, the proximity to markets allows them to reduce pre-harvest and post-harvest losses in vegetables by as much as 30 percent. Twelve case studies across different cities and countries have documented that 80 to 100 percent of the supply of leafy vegetables in these cities is produced through urban agriculture.[200] In Ghana, for instance, almost all of the supply of fresh milk, spring onions and lettuce in the city of Kumasi is produced through urban agriculture, while most of poultry, eggs and tomatoes come from peri-urban areas of the city.[201]

BOX 20
POOR ROAD INFRASTRUCTURE AND LONG DISTANCES CAUSE LARGE DIFFERENCES IN THE COST OF HEALTHY DIETS ACROSS VARIOUS REGIONS OF THE UNITED REPUBLIC OF TANZANIA

The United Republic of Tanzania is characterized by long distances between rural agricultural areas and urban centres and ports. Poor road conditions cause food losses en route to markets, especially for perishable goods. Paved roads represent only 31 percent of the total classified road network, with the country's rural roads remaining largely unpaved, of which 90 percent are in poor or very poor condition.[191] The poor infrastructure and resulting high transportation costs are an important driver of food prices not only for net-buyers of food in urban centres, but also for rural farmers with small marketable surpluses who sell most of their produce at the farm gate, rather than incur high transportation costs to move their products to distant markets.

Nearly two-thirds of Tanzanian smallholder farmers sell their produce at the farm gate with very low profit margins, while final consumers face high food prices largely due to the high transaction and transportation costs.[192] These domestic factors contribute to remarkable cross-regional variability in the cost of the different diets (as defined in Box 10). The average daily cost of an energy sufficient diet in the United Republic of Tanzania is estimated at USD 0.53, representing about 30 percent of the average national food expenditure.[49] Hence, the majority of the population has access to a starchy diet but cannot afford diets that include more nutritious foods.

In 2011, approximately 68 percent of the Tanzanian population (31 million people) could not afford a healthy diet (as defined in Box 10).[49] Differences in the cost of diets across the country's regions are driven by high local cost variability, given that specific food components contribute differently to the cost of a healthy diet in each region. More specifically, the cost of a healthy diet is highest in the south-eastern regions of Lindi, Mtwara and Pwani, which include the largest city of Dar es Salaam, and also in the east-coast region of Kilimanjaro.[49]

The cost of a healthy diet ranges between USD 2.54 and USD 2.83 in these regions, which is above the national average of USD 2.33.[49] Out of the six components of a healthy diet (i.e. starchy staples, dairy, proteins, fruits, vegetables and oils), the prices of starchy staples and vegetables are the main drivers behind the high cost. For instance, in the city of Dar es Salaam, which is the main market but located far from the producing regions, starchy staples are the most expensive food component of a healthy diet at a cost 26 percent higher than the national average.[49]

The most important staple food marketing corridor in the country leads to Dar es Salaam from the four surplus producing regions Iringa, Mbeya, Ruvuma and Rukwa – the so-called "Big Four regions", located in the south-western part of the country.[193] The Big Four are more than 500 kilometres from Dar es Salaam and do not have convenient access to a port or to the main export market to the north: Nairobi in Kenya.[194] The long distances between markets and producers, combined with poor road conditions and limited market information, hinder the efficient flow of staple foods from surplus-producing areas, where prices are lowest, to urban and deficit markets, where prices are highest.

Similarly, as an important component of a healthy diet, vegetables contribute to the high costs of this diet in regions that do not produce a high variety of horticultural products and are far away from producing regions. Vegetables are the most expensive in Lindi, Mtwara and Pwani regions. In these regions, the average cost of vegetables in a healthy diet is USD 0.76, which is 72 percent higher than the national average of USD 0.44.[49] In Lindi and Mtwara, for instance, the production of cashew nuts and sesame as cash crops are the main source of livelihood, while frequent drought conditions further contribute to the higher cost of vegetables.[195,196] This also applies to the cost of protein-rich foods and dairy products, which is highest in the urban and deficit markets of Lindi, Dodoma and Dar es Salaam. For protein-rich foods other than dairy, the cost is lowest in the major producing regions of Ruvuma and Kagera; for dairy production, the cost is lowest in Mara, Tanga and Mbeya.[193]

Consumer demand as a cost driver

The rapid rate of urbanization, combined with changing lifestyles and increasing involvement of women in economic activities, is leading to structural changes in consumer behaviour and food culture. As such consumer demand is also an important cost driver to consider. These changes are making it more difficult, especially for women with jobs, to be able to afford the time that it takes to prepare a healthy meal, and prior to that, to buy the needed nutritious ingredients. The opportunity cost of eating healthy in the face of these changes is too high, because of the availability of cheap energy-dense fast foods of minimal nutritional value and easy-to-prepare, highly processed foods, already half cooked to reduce the time spent on preparation.[152]

A study for high-income countries suggests that lack of time was the leading barrier to adopting dietary guidance. As cited by adults and in analyses of United States consumer expenditure data, spending at quick-service outlets was strongly and positively associated with hours spent in paid employment. Likewise, low- and middle-income working parents in Europe cope with time pressures by relying more on take-outs and restaurant meals and basing family meals on prepared entrees and other quick options.[202]

Time constraints include shopping for food, preparing it and cleaning up afterwards – all time burdens that often fall disproportionately on women. Fruits and vegetables, for example, tend to have shorter shelf lives and require frequent purchases, and need more time for preparation; beans also take a long time to cook. None of these time constraints are trivial. It has been estimated that the labour costs of a healthy diet for a single-headed household recipient of the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program) in the United States of America would represent 60 percent of the total cost of food (defined as the sum of the cost of food items and preparation time). Time constraints help explain why even those who can afford a healthy diet spend their income on less healthy but more convenient alternatives.[202]

Another structural change in food culture and demand relates to the increase in incomes in low- and middle-income countries. This rise in income leads to a well-documented change in diet composition, including a growing demand for animal source foods in the middle-income classes of those countries in both urban and rural areas.[76, 215] In addition, it is generally accepted that today's consumers increasingly care about the safety and quality of the food they eat, how their food is produced, and the impact that food production and consumption have on the environment and on society.[205] The latter concern is particularly relevant to higher-income consumers. As a result, there is an increased demand by these consumers for "ecological" products that include information about the products' origins, including the harvest methods used in their production. This is seen in high-income countries, where consumer demand has led to increased production and certification of these ecological products, which has significantly reduced their prices. For example, the organic premium for products like coffee or spinach has shrunk significantly in the past decade. In 2004, organic spinach cost 60 percent more than conventional products; today this differential has been reduced to 7 percent.[206]

Even with adequate access to various points of purchase, including fresh markets, neighbourhood stores and supermarkets, several factors influence consumer choices from the large variety of foods offered. These include different types of promotion, including price promotions, product packaging and claims, as well as product positioning in stores, all of which are linked to the cost of food items promoted. In addition, there are still other measures that affect the cost of nutritious foods and the cost of energy-dense foods of minimal nutritional value differently, as described next.

The political economy as a cost driver

Food and agricultural policies – as well as other policies, including in the health and environmental realms – have the power, either directly or indirectly, to affect the cost of food. They are not exclusively based on technical considerations. Rather, they are the outcome of a complex decision-making process that can be influenced by a variety of objectives and interests. In particular, the food and agriculture policy framework, which is the focus of this subsection, encapsulates the difficult balancing act required when choosing between actions in agriculture versus other sectors; among different government objectives and fiscal policies; between benefits for producers, consumers and intermediaries; and even between different agricultural subsectors. Generally, policymakers seek to achieve this balance through a set of policies that either provide incentives to agriculture through subsidies or penalizes the sector or some of its actors in one form or another. In doing so, government policy decisions impact directly or indirectly the cost of nutritious foods of different population groups.

A key indicator that shows to what extent the agricultural sector is either penalized or supported by trade and market policies is the nominal rate of protection (NRP),[ap] which compares farm gate prices with international reference prices. The reference price is the benchmark price adjusted for market access costs associated with bringing the commodity from the border to the farm gate. It is considered the undistorted price that would prevail in absence of policies and under perfect market conditions. As such, it measures the extent to which domestic policies, including trade, marketing or exchange rate measures, distort the prices that farmers receive for their products. Data provided by the International Consortium for Measuring the Policy Environment for Agriculture[aq] show that, overall, agricultural production in low-income countries is penalized as suggested by a negative NRP, while in middle- and high-income countries, it is supported (Table 11).

This means that in low-income countries, agricultural policy depresses prices at the farm gate level, which, in principle, would favour consumers if it were not for the fact that lower prices effectively discourage agricultural production. Lower levels of production lead to higher consumer prices. In middle- and high-income countries, on the other hand, government policy tends to favour agricultural producers.

When the agricultural sector is penalized (or taxed indirectly) by prevailing government policies, as in the case of low-income countries, the resulting decline in prices negatively impacts the affordability of healthy diets also in rural areas. First, the depressed food prices reduce the income of smallholders, thus compromising their ability to afford nutritious foods. Second, the decline in prices discourages farming activities, which negatively affects consumers, as rural populations are increasingly reliant on local food markets for access to nutritious food. There are further negative effects of indirect taxation of agricultural production as well, including reduced demand for farm labour and reduced wages for unskilled workers in both farm and non-farm jobs. Thus, even though poor households stand to benefit from government policies, if indirect taxation contributes to reduced food prices, suppliers of unskilled labour in rural areas will lose earnings.[207] Hence, the net effect on the affordability of healthy diets depends on the relative importance of the agricultural sector. In low-income countries, where the agricultural sector accounts for the majority of employment, it is reasonable to assume that the net impact of agricultural taxation on the affordability of nutritious foods is negative.[208]

The above is one example of the delicate balancing act between producer and consumer interests. On the one hand, higher food prices serve as incentives for farmers, traders and processors to produce. On the other hand, food prices are also a major determinant of the real incomes of poor producers, who devote a large proportion of their revenues on food purchases.

ap The nominal rate of protection (NRP) reflects the extent to which agricultural trade and market policies, coupled with market dynamics, affect commodity prices. When negative, it signals that policies in place have led to farm gate prices lower than the international-equivalent (reference) price, which is considered to be undistorted by national policies and free of influence of domestic market failures. In general, policies depressing farm gate prices are usually export barriers, as well as price interventions to protect consumers. Lack of regulations addressing value chain inefficiencies, which constrain price transmission, can also determine price disincentives at the farm gate. When the NRP is positive, this indicates that trade protection, through import tariffs or quotas, and price support policies have sustained domestic prices, thus subsidizing the agricultural sector.

aq The Ag-Incentives Consortium is a collective effort of international institutions that have assembled a database of agricultural policy indicators with the objective of providing a tool to analyse the policy environment and political economy phenomena of food systems. Partner institutions are the Food and Agriculture Organization of the United Nations (FAO), the Inter-American Development Bank (IDB), the International Food Policy Research Institute (IFPRI), the Organisation for Economic Co-operation and Development (OECD) and the World Bank Group (WB).

TABLE 11
AGRICULTURAL PRODUCTION IN LOW-INCOME COUNTRIES IS PENALIZED, WHILE IN MIDDLE- AND HIGH-INCOME COUNTRIES IT IS SUPPORTED (2005–2016)

	Average weighted nominal rate of protection												
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	AVG
High-income countries	19.6	16.2	11.9	10.6	11.7	9.7	7.6	9.2	8.3	8.3	8.5	9.5	10.9
Middle-income countries	1.3	2.2	-2.8	-6.4	1.8	3.2	-0.3	4.8	4.3	6.2	9.4	7.2	2.6
Low-income countries	-47.9	-41.6	-45.2	-25.4	-37.5	-41.4	-33.6	-21.8	-37.3	-39.1	-40.8	-41.2	-37.7

NOTES: The table shows average weighted nominal rate of protection for agricultural production by country income group, between 2005 and 2016. Nominal rate of protection expressed as the ratio of the price gap (difference between observed and reference prices at farm gate) and the reference price at farm gate.
SOURCE: Ag-Incentives. 2020. Nominal rate of protection. In: *Ag-Incentives* [online]. Washington, DC. [Cited 26 April 2020]. http://ag-incentives.org/indicator/nominal-rate-protection

Impact of trade policies on the cost of food

Trade is a central element to global food security. Agricultural trade has increased substantially over the past decade, resulting in almost 20 percent of all dietary energy supply worldwide being derived from imported food.[209] Much of this expansion in food trade and consumption of food imports is driven by low- and middle-income countries. A large proportion of exports are provided by a small number of net-exporting emerging economies. Five countries (China, Democratic People's Republic of Korea, Japan, Russian Federation and Saudi Arabia) are responsible for about 40 percent of all global food imports. Seven countries (Argentina, Australia, Brazil, Canada, New Zealand, Thailand and the United States of America) account for about 55 percent of total food exports. As a result, the impact of these main players on the international market stability and prices is large.[209]

Trade policy commonly refers to border policies as well as domestic support measures that affect trade flows. The discussion below focuses on the impact of the former, which include measures that directly affect imports, such as tariffs and non-tariff measures (NTMs), and exports, including export taxes or restrictions. Observers point out that challenges related to escalating food prices may be partly due to trade policies.[210] In 2015, members of the World Trade Organization (WTO) agreed to eliminate agricultural export subsidies with the objective of creating a fair trade environment for food producers around the world, particularly for those in low- and middle-income countries, who could not compete against their counterparts in high-income countries that artificially boosted exports through subsidies.[211] Nevertheless, some governments continued to put in place export bans and controls, often on ad-hoc basis, in order to reduce and stabilize domestic prices of staple foods. However, such restrictions have often proven to be ineffective in reducing domestic food prices, and tend to increase price instability.[212,213,214] In addition, when trade policies are used to shield the domestic market from unfavourable developments in the world market, these policies have a multiplier effect. Specifically, high food prices may trigger a series of export restrictions that exacerbate the rise of the world food price that, in turn, feeds into even more restrictive policies. Similarly, low food prices may lead exporting governments to set export promotion measures that in turn lower the world price and lead to further promotion measures.[215] Since the adoption of the "Nairobi Package" by the WTO in 2015, such subsidies are no longer allowed under WTO rules.

Regarding food imports, trade policies affect the cost and affordability of different food items by altering the relative prices between imported and import-competing foods. Trade policies that

TABLE 12
WORLDWIDE, GOVERNMENTS SUPPORT THE PRODUCTION OF SUGAR, RICE AND ANIMAL PRODUCTS THE MOST THROUGH INTERVENTIONS, WHILE PENALIZING THE PRODUCTION OF MORE NUTRIENT-RICH FRUITS AND VEGETABLES (2005–2016)

10 most incentivized products				10 most taxed products			
	# countries	Weighted NRP	Unweighted NRP		# countries	Weighted NRP	Unweighted NRP
Sugar	27	19	29.9	Tomatoes	8	-2.2	0.8
Rice	36	17.6	39.8	Soybeans	13	-3.4	47.9
Poultry meat	35	15.4	64.7	Groundnuts	9	-3.5	1
Grapes	6	12.4	27.1	Cocoa beans	4	-5.4	-6
Pig meat	30	12.2	40.7	Sunflower seed	8	-5.6	-3
Sheep meat	15	11.8	16.8	Palm oil	4	-7.2	-3.8
Bovine Meat	38	11.8	21.6	Cashew nuts	4	-11.8	-6.3
Cassava	8	8.5	20.2	Sorghum	8	-21.3	-3.3
Rapeseed	6	6	23.8	Mango	4	-23.9	-8.7
Apples	6	4.5	15.5	Bananas	12	-32.5	-5.2

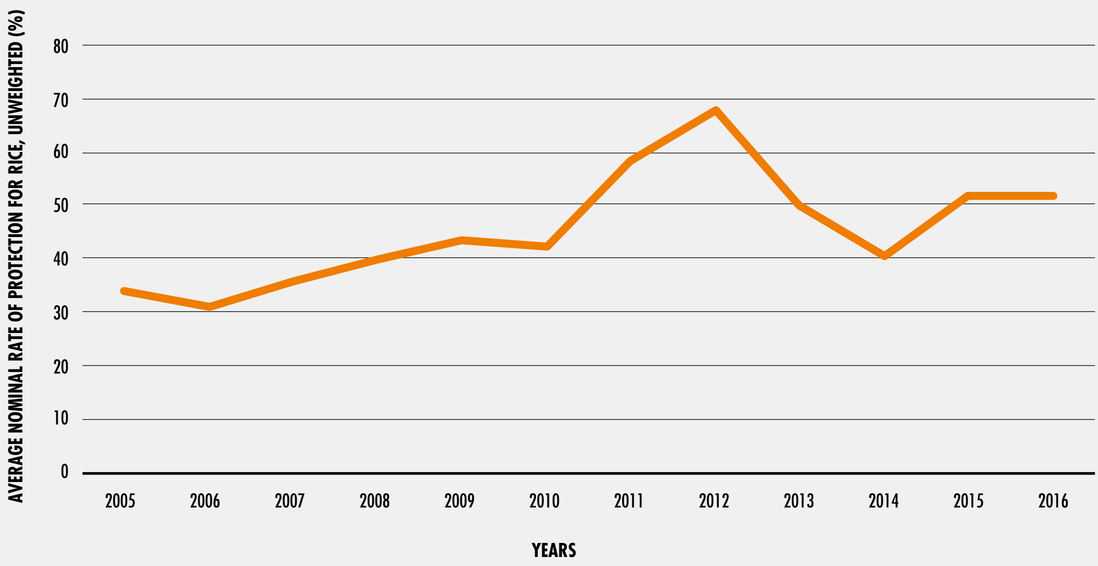
NOTES: The table shows the global average nominal rate of protection (NRP) by product (2005–2016). NRP for each product is the ratio of the price gap (difference between observed and reference price of the specific product at farm gate) and the reference price of the product at farm gate.
SOURCE: Ag-Incentives. 2020. Nominal rate of protection. In: *Ag-Incentives* [online]. Washington, DC. [Cited 26 April 2020]. http://ag-incentives.org/indicator/nominal-rate-protection

discourage imports are among the most used policy instruments to protect domestic producers and food processing industries. Generally, tariff barriers remain higher for agricultural products than any other product group, increasing the cost of food in countries applying those restrictions, and leading to a misallocation of resources that reduces global welfare. Worldwide, governments support the production of sugar, rice and animal products the most through interventions, while penalizing the production of more nutrient-rich fruits and vegetables, such as tomatoes and bananas, the most (Table 12).

Besides tariff barriers, governments also implement non-tariff measures, such as sanitary and phyto-sanitary measures (SPS) and technical barriers to trade (TBT). As trade liberalization has progressed over the past decades, the number of regulatory policies pertaining to product quality, health and safety standards has increased. Animal products and vegetables are the product groups most subjected to non-tariff measures, with over 16 000 measures registered in the WTO database for these products alone.[216] NTMs can negatively affect the affordability of diets. For example, exporters and importers may face additional costs to comply with regulatory requirements, driving up the cost of trade. This in turn would increase food prices and make diets less affordable. On the other hand, NTMs can play an important role in raising food safety and quality levels, and improve the nutritional content of diets. Tariffs and non-tariff measures are a source of concern for food exporting countries that face an uncertain market outlook, which weakens government incentives to prioritize agricultural production as a major source of economic growth and development. A direct consequence of this is the low levels of agricultural investments in infrastructure and innovation.[209]

Protectionary trade measures such as import tariffs and quotas, together with input subsidy programmes, have often been embedded in self-sufficiency and import substitution

FIGURE 39
PROTECTIONARY TRADE POLICIES PROTECT AND INCENTIVIZE DOMESTIC PRODUCTION OF STAPLE FOODS, SUCH AS RICE, BUT OFTEN TO THE DETRIMENT OF NUTRITIOUS FOODS IN LOW-INCOME COUNTRIES



NOTES: The figure shows the average nominal rate of protection (NRP) for rice in low-income countries, between years 2005 and 2016. NRP for rice is the ratio of the price gap (difference between observed and reference prices of rice at farm gate) and the reference price of rice at farm gate.
SOURCE: Ag-Incentives. 2020. Nominal rate of protection. In: *Ag-Incentives* [online]. Washington, DC. [Cited 26 April 2020]. http://ag-incentives.org/indicator/nominal-rate-protection

strategies. In low-income countries, this policy has protected and incentivized the domestic production of staple foods such as rice (Figure 39) and maize but often to the detriment of vitamin- and micronutrient-rich foods (i.e. fruits and vegetables).[ar] This can have an adverse effect on the affordability of more nutritious foods.

As mentioned, trade policy often involves significant trade-offs. For example, across many countries in Latin America and the Caribbean, poultry meat imports are subject to import tariffs, shielding domestic poultry producers from cheaper imports from Brazil and the United States of America. Although these policies have been effective in eliminating imports, they have also driven up the local retail price of chicken, making one of the main sources of animal protein less affordable for consumers.[217]

The case of rice within the Eastern Africa Community (EAC) demonstrates a similar dilemma. In Burundi, Kenya, Rwanda and Uganda, the EAC imposes a Common External Tariff on sensitive products, including rice, of up to 75 percent. Although this protects the EAC's rice farmers and processors from cheaper imports, evidence indicates that this support leaves consumers paying more for rice in the retail market.[217]

ar A graphical representation of the nominal rate of protection for high value commodities (e.g. fruits and vegetables) is challenged by a serious lack of sufficient data for low-income countries. For staple foods such as rice and maize, not only are data available for all low-income countries but the policy environment around these commodities is relatively homogenous in all of these countries, with strong tariff protection, which offers a meaningful interpretation of the very positive nominal rate of protection values.

Other domestic support measures affecting food prices

Beyond the trade and market policies discussed above, there are other measures that national governments may put in place that influence food prices, which represent trade-offs between supporting agricultural producers and consumers. Managed price policies have been adopted by countries throughout the world. High-income countries, including United States of America and those in the European Union, maintained price measures to support their farmers for several decades during the post-war period, even though recently they have largely replaced them with direct payments decoupled from prices and production.[218] In middle- and low-income countries, governments still revert to some of these measures to either protect consumers from high food prices or incentivize domestic agricultural production and prevent profit losses. In the former, interventions usually take the form of food price controls, reduction of consumption taxes, interventions to limit monopoly or oligopoly positions and release of food stocks. In the latter, policymakers stimulate production through price-setting mechanisms that fix minimum and reference prices, or commodity board procurement at supported prices.[219]

No matter what the policy objectives are, there will be winners and losers in the population from each of these interventions, and the affordability of healthy diets will be affected as well. For instance, preventing food price increases through price controls may make healthy diets more affordable for the most vulnerable citizens. Nevertheless, the same intervention can reduce incentives for farmers to produce nutritious foods, as retail prices are controlled, subsequently reducing the overall availability of nutritious foods in the country.

Public expenditure and investments

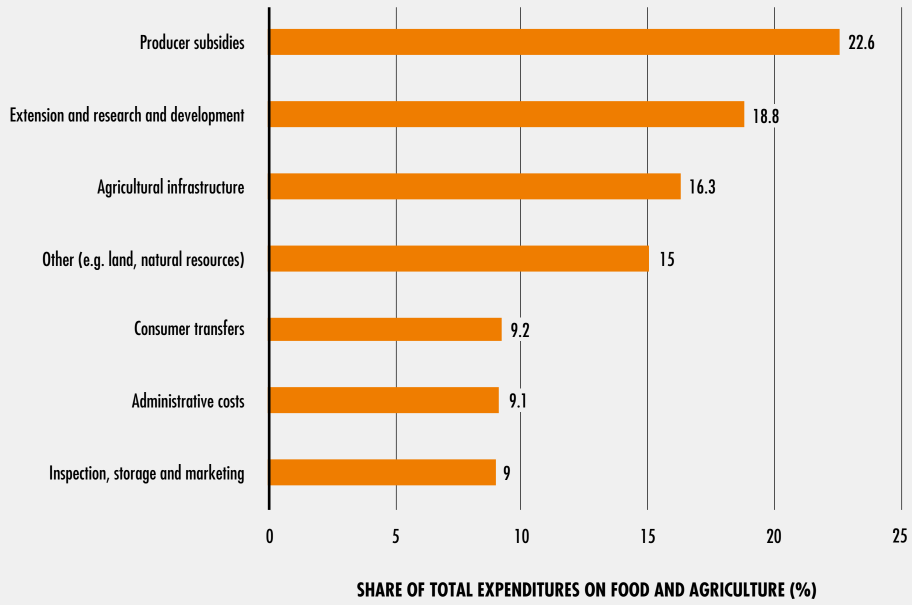
Public expenditure and investments also affect the cost of food. Public expenditure is a powerful instrument by which governments can shape and develop their food systems.[220,221,222] Public spending can be used as an equity tool in reallocating resources in favour of the poorest family farmers and smallholder producers or to address market failures or overcome the under provision of public goods in the food and agriculture sectors.[222]

There is widespread consensus regarding the importance of public spending. It is important to ensure that scarce resources are invested in those areas where returns are higher. Certain types of expenditure that are proven to have high returns, such as agricultural R&D and extension, tend to be sorely underfunded.[223] Conversely, while subsidies can have positive effects in enhancing productivity, their long-term returns have been estimated to be lower than those of public goods.

According to the public expenditure data[224] in selected sub-Saharan African countries, limited resources available to the region's governments are mainly absorbed by investments in food production, which continues to take up the largest share of agricultural investments at the expense of other segments of the food system (Figure 40). As discussed, farmers in low-income countries are largely penalized by trade and market policies that suppress prices. Conversely, they seem to benefit from significant budgetary transfers, mainly in the form of input subsidy programmes and a few other farm income support measures.[225] These expenditures are often preferred by policymakers, as they represent an immediate, liquid and targetable benefit for the rural population, which constitutes a large electoral base in these countries. However, input subsidies are also difficult to phase out, even when costs exceed benefits.[226] Spending a large proportion of the budget on input subsidies may not be the most efficient approach to ensure sectoral growth and affordability of food.[226]

As shown in Figure 40, post-production facilities, like storage and marketing, remain under-supported. Expenditures that benefit consumers (e.g. school feeding and cash transfers) are also limited compared with expenditures targeting producers, although a reversal in this trend is visible in some African countries, more recently. In countries like Ethiopia, Kenya and Mozambique, increasing emphasis has been given to social protection programmes, in particular cash transfers targeting the poorest.[225] Expenditure of this type and marketing and storage expenditures, to a lesser extent, can address constraints faced by the poor in accessing nutritious food. Investments in agricultural R&D have also proven to be highly effective in reducing malnutrition, compared with

FIGURE 40
PUBLIC EXPENDITURE IN FOOD AND AGRICULTURE FAVOURS PRODUCER SUBSIDIES, WITH LESS INVESTMENT TOWARDS EFFICIENCY GAINS ACROSS FOOD SUPPLY CHAINS (SELECTED AFRICAN COUNTRIES, 2005–2017)



NOTES: The figure shows average composite shares of expenditure over total expenditures in food and agriculture (2005–2017) in selected African countries. Countries analysed include: Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Rwanda, Senegal, Uganda and United Republic of Tanzania. Expenditures are derived from budgets and from actual expenditures, both from donors and national sources. Definitions of expenditure categories can be found at: www.fao.org/in-action/mafap/database/glossary-public-expenditure
SOURCE: FAO. 2020. Database. In: *Monitoring and Analysing Food and Agricultural Policies (MAFAP)* [online]. Rome. [Cited 26 April 2020]. www.fao.org/in-action/mafap/data

non-agricultural R&D spending. For example, the introduction of improved seed varieties can lead to a positive supply shock, which decreases prices and increases consumption, leading to an improvement in selected nutritional outcomes.[227,228]

Other investments with great potential to enhance affordability of nutritious foods are those in road infrastructure, as noted earlier. Only 16 percent of expenditure, on average, was allocated to infrastructural projects in the countries analysed (Figure 40). However, several studies confirm that improved roads can reduce prices of local crops, with greater effects in less productive areas and moderate food price volatility.[229,230]

Although the pro-producer bias in public budgets can partially compensate for the negative nominal rate of protection that producers in low-income countries face, a rebalancing of allocations towards more efficient expenditures with longer-term impacts on food security and nutrition is desirable. Investments in public goods, such as roads and storage infrastructure, and in food assistance programmes (food aid, cash transfers and school feeding, captured under "consumer transfers" in Figure 40) are fundamental to ensuring affordability of healthy diets, when nutrition-sensitive components are included.

Globalization and the transformation of food systems

Food systems worldwide experienced major transformations, in particular during the 1990s and 2000s, as a wave of globalization in the food industry marked by urbanization, rising incomes, market liberalization and foreign direct investment reached the developing world.[231] This globalization was accompanied by a massive growth of investments by transnational food corporations and rapidly increasing levels of food sold through supermarkets, referred to as the "supermarket revolution".[232]

These developments represent a key aspect of the political economy that drive food systems transformation and influence the cost and affordability of food. For example, as economic power becomes increasingly concentrated into fewer transnational corporations in the food sector, these corporations engage in policy-making processes and lobby for a reduction in regulations that apply to them, promote regulations that apply to other sectors (e.g. trade and investment agreements that bind governments to protect corporate investment interests), resist or reject taxes that apply to their products and lobby policymakers for subsidies that benefit their businesses. Thus "market power therefore readily translates into political power"[145] and has kept prices of highly processed foods, often high in fats, sugar and/or salt extremely low.

No doubt, when market power and globalization lead to lower prices of energy-dense foods of minimal nutritional value, this can result in major changes in dietary consumption patterns and nutritional status. This is in particular the case for lower-income population groups for whom these energy-dense foods are more affordable.[231]

Similarly, the globalization of food systems and expansion of supermarkets present an economic opportunity but one with an accompanying risk of increased marginalization and deeper levels of poverty for smallholder farmers and labourers in rural areas. In Kenya, for example, the rise of supermarkets has provided income opportunities for the rural poor, as smallholders have engaged in contractual arrangements with supermarkets to deliver fresh produce. However, while many smallholders have benefited, others have found the contractual conditions unfavourable and risky.[233] In these cases, not only can small farmers be left out of business, but traditional local food commercialization routes might also be broken, including for fruits and vegetables. In other parts of the world, contract farming with supermarket chains has brought lower prices, but the prices have also been more stable.[234]

In middle-income countries of Asia, in particular in India and South-eastern Asian countries, the penetration of the modern retail sector in the form of supermarkets has been less pronounced than in other countries, such as in Mexico and South Africa.[198] In India, rural business hubs have facilitated linking smallholder farmers to rapidly growing urban markets. Apart from procuring food products from the farmers, these hubs provide services such as farm inputs and equipment, as well as access to credit. Having food processing, packaging and cooling facilities at the same location allows consumers to benefit from economies of agglomeration and, on the whole, reduce transaction costs throughout the food supply chain. This model in India has given rise to rural supermarkets that provide cheaper staple foods.[232] Consumers have been drawn to supermarkets providing fresh fruits and vegetables, eggs, dairy, meats and fish, because they are without food safety concerns linked to traditional wet markets.

Nevertheless, while modern food retail stores and supermarkets have changed food systems worldwide and have had a large influence on how people access nutritious foods, traditional food markets and small, independent retail stores also remain important sources of affordable nutritious foods in many countries. In India, Indonesia and Viet Nam, for example, traditional food retail outlets still represent more than 80 percent of the food retail share, and about 60–70 percent of the food retail share in upper-middle-income countries like China and Turkey.[198]

Conclusion

This section has shown that the factors driving the cost of nutritious foods are found throughout food systems in the realms of food production, food supply chains, food environments, consumer demand and the political economy of food. This means that in order for policies to reduce the cost of nutritious foods and ensure affordability of healthy diets, they need to feature prominently in the future transformations of food systems. Only then can the world get back on track to meet the SDG 2 targets to end hunger and food insecurity (SDG Target 2.1) and all forms of malnutrition (SDG Target 2.2) by 2030. This review of cost drivers has been important in identifying the specific policies that can help reduce the cost of nutritious foods and improve affordability of healthy diets, which are presented in the next section. However, due to data availability challenges in quantifying cost drivers of nutritious foods, more research is urgently needed to ensure a more solid knowledge base on which to inform policy.

As seen in this section, some of the factors driving the cost of nutritious foods are a result of environmental degradation and climate change challenges. This, along with the hidden environmental costs discussed in the previous section, provides further justification in addressing the environmental externalities associated with current food systems. This can create an important potential synergy to help reduce the cost of nutritious foods and ensure affordability of healthy diets for all, while at the same time transforming food systems to become more sustainable. ■

2.4 POLICIES TO REDUCE THE COST OF NUTRITIOUS FOODS AND ENSURE AFFORDABILITY OF HEALTHY DIETS

KEY MESSAGES

➔ Reducing the costs of nutritious foods and ensuring the affordability of healthy diets for everyone requires significant transformations of existing food systems worldwide, including strengthening their resilience in the face of shocks like the COVID-19 pandemic.

➔ Given the diversity and complexity of food systems, countries will need to implement a set of context-specific policies and strategies, and step up public and private sector investments with significant policy coherence, improved planning and coordination across sectors and actors.

➔ Policy options and investments must enable transformations that will help reduce the cost of nutritious foods and strengthen the purchasing power of the poor.

➔ This starts with an urgent rebalancing of agricultural policies and incentives towards more nutrition-sensitive investment in food and agricultural production, especially fruits and vegetables, protein-rich plant-based and animal source foods, such as legumes, poultry, fish and dairy products.

➔ Policy actions across food supply chains are critical in reducing the costs of nutritious foods. Such actions should enhance efficiencies in food storage, processing, packaging, distribution and marketing, while also reducing food losses.

➔ The efficiency of internal trade and marketing mechanisms are key to reducing the cost of food to consumers and avoiding disincentives to the local production of nutritious foods, are important to improve the affordability of healthy diets for both urban and rural consumers.

➔ Governments should carefully consider the impacts of the rising number of barriers to international trade on the affordability of nutritious foods (including non-tariff measures put in place to ensure food safety), as restrictive trade policies tend to raise the cost of food, which can be particularly harmful to net food-importing countries.

➔ Raising the affordability of healthy diets requires policies that enhance employment and income-generating activities, reduce income inequality and ensure that no one is left behind. Nutrition-sensitive social protection programmes will be particularly necessary to support the poor and those living through humanitarian crises, without basic access to sufficient nutritious food to meet dietary requirements.

➔ Additional policy measures that are beyond the scope of this report, but are designed to promote healthy diets, need to be put in place as well. These include the promotion of healthy food environments, taxation of energy-dense foods, food industry and marketing regulation, and policies supporting nutrition education, sustainable food consumption and food waste reduction.

➔ There are significant opportunities to address both the health and environmental challenges through changes in dietary patterns that have a lower impact on human health and the environment.

Results from the analyses in earlier sections of this report highlight the many challenges in providing the world's populations with access to healthy diets to meet their nutrient requirements and lead an active and healthy life. The sobering statistics call for the urgent transformation of food systems towards diets that are affordable, predominantly plant-based and sustainable. To summarize the key results:

- Estimates of the cost and affordability of diets around the world suggest that at more than 3 billion people cannot afford a healthy diet; more than 1.5 billion cannot afford a diet that meets required levels of essential nutrients; 185 million cannot even access a diet with sufficient dietary energy.
- By 2030, diet-related health costs linked to NCDs, largely as a result of rapidly rising overweight and obesity levels, could amount to USD 1.3 trillion.
- Current food consumption patterns pose significant costs to society in terms of GHG emissions, estimated at USD 1.7 trillion per year by 2030.

These estimates, together with the most recent data on food security and nutritional status presented in Part 1 of this report, demonstrate the tremendous challenges policymakers face in transforming their countries' food systems by 2030. COVID-19 will exacerbate these challenges as it negatively affects food supply chains and people's access to nutritious foods. In spite of great uncertainty and the likelihood of a deep global recession, countries can take action to soften the impact of the pandemic on food and nutrition security.

This section provides guidance on policy instruments and strategies to prioritize actions and investments. The emphasis is on reducing the cost of nutritious foods and ensuring affordability of healthy diets in the broader context of food systems transformation. Some of the policies and strategies discussed in this section can form a critical part of broader efforts towards strengthening the resilience of food systems against shocks the size of the COVID-19 pandemic. More specific policy recommendations for governments are presented in Box 21.

As elaborated in Section 2.2 of this report, healthy diets can play an important role in an overall strategy towards reducing diet-related health costs and environmental costs. Addressing these "hidden costs" to society requires a range of policy measures and investments beyond the immediate focus of this report.

Setting the stage for effective food systems transformation

Ten years remain to achieve the ambitious SDG targets within the current economic, social and political environment – an environment vulnerable to climate shocks and unexpected consequences of the COVID-19

BOX 21
IMPACT OF COVID-19: POLICY RECOMMENDATIONS TO PREVENT COST INCREASES OF NUTRITIOUS FOODS AND ENSURE ACCESS TO AFFORDABLE HEALTHY DIETS

The following recommendations for governments can help ensure that food systems provide sufficient, diverse and nutritious foods to enable access to healthy diets for all.

- Expand and improve emergency food assistance and social protection programmes to ensure access to nutritious food for the poor and vulnerable, as they have been hardest hit by the pandemic.[235]
- Coordinate action to provide life-saving humanitarian assistance and avoid widespread famine, especially for millions of civilians living in conflict situations, including many women and children.[236]
- Enact trade and tax policies to keep global trade open;[237] restrictions on movement of goods will cause food losses and disrupt production, processing, distribution and sales of diverse, safe and nutritious foods.
- Focus on key logistics bottlenecks in the food value chains to avoid unnecessary spikes in the cost of food,[237] in particular the affordability of diversified safe and nutritious food for all.
- Step up direct support to smallholders to enhance their productivity, reduce pre-harvest and post-harvest losses, and ensure access to food markets, also through e-commerce channels.[235]
- Scale up "double-duty actions" in the COVID-19 response to reduce negative impacts on food security and nutrition (e.g. exclusive breastfeeding promotion, maternal nutrition and antenatal care programmes, adapted school feeding programmes, food and agriculture policies that support healthy diets, universal healthcare).[238]
- Consider initiating and/or maintaining food fortification programmes in line with international guidance to counteract worsening diet quality during the pandemic, as the consumption of unfortified food or non-perishable foods with lower levels of micronutrient content could rise.[239]
- Put in place economic stimulus measures for proper recovery and with strengthened food access, as the pandemic widely lowers people's purchasing power, especially for the increasing numbers of unemployed.[240]
- The food industry should ensure that Food Safety Management Systems (FSMS) are installed based on the Hazard Analysis and Critical Control Point (HACCP) principles to manage food safety risks and prevent food contamination.[241]

crisis. With this short timeline, countries must identify and implement policy and investment changes that will transform their current food systems to ensure everybody can afford healthy diets that include sustainability considerations. Urgent action is needed, especially for the poorest in society, who face the greatest challenges.

Key policy challenges must be overcome, including: (i) very high levels of unaffordability of healthy diets; (ii) often deeply entrenched government policies that favour the production, trade and consumption of staple foods over other nutritious foods; (iii) globalized and local food value chains driven almost exclusively by profit motives rather than the provision of foods that contribute to healthy diets and support sustainability; (iv) increased availability of energy-dense foods, often containing a high amount of fats, sugars and/or salt, which has contributed to the rapid rise of obesity and diet-related NCDs; and (v) changes in consumer behaviour and preferences, often influenced by intensive marketing of energy-dense foods, that have increasingly led to unhealthy eating habits, a higher prevalence of NCDs and a high carbon footprint of the diets consumed.

BOX 22
A ROADMAP TOWARDS ENSURING THE AFFORDABILITY OF HEALTHY DIETS – KEY STEPS IN FOOD SYSTEMS TRANSFORMATION

STEP 1	**Comprehensive situation analysis.** Governments must have a thorough understanding of the food security and nutrition situation, in addition to the capacity of food systems to deliver nutritious foods and at what level of affordability, to all segments of the population.
STEP 2	**Cost drivers of healthy diets.** Identify cost drivers of nutritious foods along the food supply chains, and to what extent the food environments facilitate or hinder people's physical, economic and social access to healthy diets. Ensure cross-sectoral consultation, including representatives from public and private sectors, and civil society, while ensuring robust safeguards to manage conflicts of interest.
STEP 3	**Address urgent needs of the most vulnerable.** While preparing for food systems transformation, ensure that adequate social protection mechanisms and emergency support are in place to help reduce the still unacceptably high levels of hunger and malnutrition in all its forms.
STEP 4	**Identify policies and investments to leverage food systems transformation.** Agree upon a set of well-designed policies and investment opportunities across social and economic sectors towards more nutrition-sensitive food systems that provide greater access to affordable healthy diets for the entire population.
STEP 5	**Implement policy recommendations and monitor adherence and impact.** Ensure policy measures and investment are implemented in accordance with agreed priorities, backed by appropriate legislation, regulation and investment plans from all actors in the public and private sectors; establish an evidence-based monitoring system to monitor progress towards SDG targets.

Box 22 provides a roadmap towards rapid and effective transformation of food systems at municipal, national, regional and global levels, including several key high-level policy consultations, analyses and actions.

During the food systems transformation process recommended in Box 22, the following are important principles to follow.

Ensure context-specific policy instruments and investment strategies

Given the wide diversity and complexity of food systems from municipal to national and global levels, and the interaction between different food systems, each situation will require a context-specific set of coordinated policy instruments and strategies, as well as public and private sector investments for food systems to be transformed. To be effective, proposed policy measures must first recognize the current state of food security and nutrition of any one country or community, as well as the specific food systems context within which the policy recommendations are made.

This includes the identification of country-specific cost drivers of nutritious foods as reviewed in Section 2.3, in addition to a thorough understanding of the critical role food systems play in driving the rural economy, in particular. Equally important, given rapid rates of urbanization and the increasingly complex web of food supply chains expected to deliver safe and nutritious foods to rising numbers of urban consumers, strong rural-urban linkages are critical.

Following an improved understanding of the overall challenges, governments, regional and global institutions in consultation with all concerned actors should work towards putting in place a comprehensive set of policy measures that will enable a rapid and efficient transformation of food systems. This should include a full understanding of the extent to which the political economy and potential trade-offs will either promote or hinder affordability of healthy diets that include sustainability considerations.

Strengthen policy alignment through improved planning and coordination

Given the complexity and diversity of existing food systems, and the political economy that has shaped them in often undesirable ways, concerted efforts are needed across many different sectors of the economy: health, agriculture, environment, forestry, fisheries and aquaculture, the food industry, trade and marketing, finance and development, infrastructure, retail and education. All actors, including government, private sector, research and academia, civil society, the media, and the food producers and consumers themselves, have to work together. This includes actors of the global value chains with monopolistic and oligopolistic power that exert influence on the domestic food systems of countries.

Certain policy measures or investments will have a greater impact on the transformation of food systems than others, prompting some sector representatives to advocate for these measures only. However, given the inter-connectivity of different actions in a food systems context, only concerted efforts across sectors will be helpful. While most investments in food systems are made by the private sector, the public sector holds primary responsibility for providing public goods and enhancing social values by filling gaps (e.g. investment in road networks and social protection mechanisms) and addressing market failures.[242] Strengthened governance for food security and nutrition is a priority of the UN Decade of Action on Nutrition and this includes an emphasis on cross-government, inter-sectoral and multisectoral coordination. Most countries (80 percent) report that coordination mechanisms for their national nutrition policies are in place.[243]

Consider temporal dimensions of transformation

There is a temporal dimension that must be considered when devising policies towards successful food systems transformation. Policy effectiveness towards achieving development objectives will depend on the identification of which challenges are to be tackled more boldly at the beginning of the transformation process, where there is more room for rapid progress. This is an important aspect because public expenditures and investments towards transformative policies may face increasing marginal returns in addressing hunger, food insecurity and all forms of malnutrition only during a certain period of time.[as] Public expenditures in particular are a key instrument to achieve systemic change.

As short-term interventions aim to meet the immediate needs of the poorest and most food insecure, it is important not to lose sight of the nutritional needs of these most vulnerable during the transformation process, even if it means increasing the country's environmental footprint. Not meeting nutrient requirements during critical phases of the life cycle, as in infancy, early childhood and adolescence, or during pregnancy and lactation, will have lifelong and intergenerational consequences. Hence the importance of immediate food consumption and nutrition needs being addressed adequately at the beginning of the food systems transformation process, even if it entails certain trade-offs (environmental, in this case).

as Empirical evidence and analysis emanating from a number of country studies for Latin America and the Caribbean[352] and for Africa, Asia and the Middle East[353] recognizes the importance of considering decreasing marginal returns in the effectiveness of social spending over time. Sánchez and Cicowiez[354] have added analysis to demonstrate that, in the very long run, the payoff of past policies will depend on labour market changes and the efficiency of service delivery.

The public sector has primary responsibility for longer-term investments towards food systems transformation, such as infrastructure for water and roads, and other measures that create the enabling environment for cost efficiencies to be realized along the value chains. Governments can also deploy investment decisions through co-investing, taxing, subsidizing or regulating to encourage private sector investments in food systems for healthy diets, while accounting for their environmental footprint. These investments should be complemented by regulatory and voluntary measures, consumer education and other incentives.[242]

Strategies and policies that include both short- and longer-term perspectives are needed to help prioritize investments and interventions, while avoiding unfavourable trade-offs as countries transform their food systems. In spite of the many challenges in ensuring that appropriate policy decisions are made at the right time, many opportunities exist for strengthening food value chains that deliver fresh, nutritious foods at affordable prices in markets around the world. Below, various policy instruments, interventions and investments are suggested that could transform existing food systems towards more affordable healthy diets.

Policy options to reduce the cost and enhance affordability of healthy diets

A rising and ever more urbanized world population, combined with increasing levels of income, is placing tremendous pressure on the food and agriculture sectors to increase production to keep food prices from rising.[103] In order to offset this upward pressure on prices and increase affordability of healthy diets, food and agricultural policies and incentives must help accelerate productivity and production of vegetables and fruits, and protein-rich foods. Importantly, some estimates suggest that increased agricultural productivity alone will help raise incomes of nearly 80 percent of the world's extreme poor who live in rural areas, most of whom rely on farming for their livelihoods.[149] The impacts of climate change and natural resource constraints, however, will further challenge the need for expansion in agricultural production. The above trends call for substantial policy changes in food and agriculture, and along the entire food supply chain, in order to meet rising food demand.

While drawing on key messages from earlier sections in this report, a summary of policy options and investments to be considered to transform food systems worldwide towards greater affordability of healthy diets is presented in Figure 41**.** The remainder of this section elaborates on each of the policy recommendations presented.

Policies and investments to reduce the cost of nutritious foods

Policies focusing on agricultural production. Reducing the cost of nutritious foods and increasing the affordability of healthy diets must start with a reorientation of agricultural priorities towards more nutrition-sensitive food and agricultural production. Public expenditures will need to be stepped up to enable many of the policy decisions and investments needed to raise productivity, encourage diversification in food production and ensure that nutritious foods are made abundantly available. In some cases, this will require expenditure reallocations for a better prioritization and strengthened effectiveness of public expenditures as part of an overall food and agriculture sector strategy. In this regard, it is also essential that governments carefully consider trade-offs in their policy decisions and assess the impact of alternative policy measures towards the ultimate objective of eradicating hunger and all forms of malnutrition. Such a shift should consider the overarching aspects of food and agriculture policy and investments outlined below.

Investment in nutrition-sensitive agricultural productivity increases and diversification. Policy options and incentives to improve access to healthy diets must start at the producer level. Investments that support homestead food production of vegetables, legumes, dairy, poultry, fish and fruit are important to provide greater access to healthy diets in poor rural settings. Access to knowledge in improved and more sustainable farming techniques, including climate-smart production methods, are key to increasing productivity »

FIGURE 41
POLICY OPTIONS TO REDUCE THE COST OF NUTRITIOUS FOODS AND ENHANCE AFFORDABILITY OF HEALTHY DIETS WITH COMPLEMENTARY POLICIES TO PROMOTE HEALTHY DIETS

POLICIES AND INVESTMENTS TO REDUCE THE COST OF NUTRITIOUS FOODS

- Investment in nutrition-sensitive agricultural productivity increases and diversification
- Promotion of urban and peri-urban agriculture
- Avoiding taxation of nutritious foods
- Investment in research, innovation and extension
- Policies and investment in nutrition-sensitive value chains
- Policies and investment to reduce food losses
- Policies and investment in nutrition-sensitive handling and processing
- Food fortification
- Investment in road networks, transport, market infrastructure
- Ensuring trade and marketing policies balance producer and consumer interests
- Strengthening food supply chains under humanitarian conditions

CONSUMER-ORIENTED POLICIES TO ENHANCE AFFORDABILITY OF HEALTHY DIETS

- Policies to reduce poverty and income inequality
- Strengthening nutrition-sensitive social protection mechanisms, including:
  - cash transfer programmes
  - in-kind transfers/food distribution
  - school feeding programmes
- Subsidization of nutritious foods

COMPLEMENTARY POLICIES THAT PROMOTE HEALTHY DIETS

- Promotion of healthy food environments
- Taxation of energy-dense foods and beverages of minimal nutritional value
- Food industry regulations
- Regulation of food marketing
- Promote breastfeeding, regulate marketing of breastmilk substitutes, ensure access to nutritious foods by infants
- Policies supporting nutrition education
- Policies in support of sustainable food consumption and food waste reduction

SOURCE: FAO.

» and maintaining profitability, and producing marketable surpluses at reduced costs, while increasing the resilience of food systems.

Policies and investments must also focus on improving nutrition outcomes among the population.[182,244] These include policies that facilitate diversified and integrated food and agricultural production systems, empower women and youth in food and agriculture, and provide incentives for increased production of fruits and vegetables, as well as small-scale livestock, agroforestry, aquaculture and fisheries products.

Agricultural policies that encourage a move away from monoculture towards more integrated production techniques, such as agroforestry and rice-fish farming, should be considered as this helps reduce the cost of production, increase food producers' incomes and resilience, provide ecosystem services, and increase dietary diversity. In recognition of the positive impact of integrated approaches on food security and nutrition, the inclusion of nutrition objectives in food and agriculture policies and ensuring access for all to safe and sustainable healthy diets are emphasized under the action area on "sustainable, resilient food systems for healthy diets" under the United Nations Decade of Action on Nutrition 2016–2025.[245]

Promotion of urban and peri-urban agriculture. Production of diverse, nutritious foods should also be expanded in peri-urban and urban settings through investment in horticultural crop production to provide easier access to fruits and vegetables, while reducing the risk of food losses along the shortened food supply chains. The wide variety of urban agriculture production systems, and a general lack of understanding of the relative importance, nature and food security implications of urban agriculture[246] make it difficult to provide specific policy recommendations. Meanwhile, in order to ensure that the potential of urban agriculture in supporting food security and nutrition can be fully exploited, appropriate mechanisms of governance and institutional support for urban agriculture, including supportive legislation, need to be developed.[247]

Avoiding taxation of nutritious foods. In low-income countries, where growth in food production is most needed, the agricultural sectors are often penalized as a result of, for example, exchange rate fluctuations, price controls or weak bargaining power of farmers. Policy interventions that tend to depress prices of agricultural commodities not only reduce farmers' incomes and incentives to produce, but also reduce the affordability of healthy diets for some of the most marginalized populations (the rural poor). Therefore, policies that penalize food and agricultural production (through direct or indirect taxation) should be avoided, as they tend to have adverse effects on the production of nutritious foods.

Subsidy levels in the food and agriculture sectors should also be revisited, especially in low-income countries, to avoid taxation of nutritious foods. A FAO analysis shows that across a group of 68 countries, subsidies are highest for sugar, followed by subsidies for animal products and staple foods (mainly rice). Among the same group of countries, fruits and vegetables are among the most penalized (through various policy measures that disincentivize production). Governments should conduct an objective review of current agricultural policies to ensure the production of nutritious foods is supported rather than taxed.

Other policy and structural impediments, including a weak private sector in many low-income countries, have limited the supply responsiveness of vegetables and other non-staple foods. In India, policies that promote staple crop production, such as fertilizer and credit subsidies, price supports and irrigation infrastructure (particularly for rice), have tended to discourage the production of traditional non-staple crops, such as pulses and legumes.[248] A bias in irrigation infrastructure development in favour of staple crops has been maintained in many other regions. Instead, policies should promote investment in irrigation infrastructure specifically targeting strengthened capacity for all-season vegetable production, and other high-value commodities to increase availability of nutritious foods.

Investment in research, innovation and extension to raise productivity of nutritious foods in the food and agriculture sectors. National food and agricultural strategies and programmes should step up investment in R&D to raise productivity of nutritious foods and help reduce their cost, while enhancing access to improved technologies, especially for smallholders, to maintain adequate levels of profitability. This should be accompanied by research and extension services that make it possible for producers to adopt more sustainable production methods that conserve natural resources, in particular soil and water,[249] as well as biodiversity.[250] Furthermore, collaboration with regional and international research and extension organizations and networks is important to strengthen capacities of national agricultural research and extension systems, and to facilitate sharing of knowledge and best practices and innovations for increased production and productivity.

Public investment in demand-driven research and extension should be complemented by investment in rural electrification programmes, irrigation infrastructure and increased mechanization to further raise productivity. In parallel with R&D in food and agriculture, low-income countries need to enable and promote inclusive agricultural innovations to meet the rising food demand. Agricultural innovation takes place most effectively in a system where research organizations, extension and advisory services and other key institutions interact with each other and are strongly connected to family farmers, enabling them to raise productivity, strengthen resilience to shocks and enhance sustainable natural resource management.[251]

Innovation in agriculture takes on many possible forms, including *inter alia* labour-saving mechanization; crop and animal breeding; the use of biological control agents and the management of soil biodiversity to improve soil fertility, in addition to hydroponics to produce food in water-limited areas; the development of vaccines against livestock and aquatic animal diseases; the increased use of information and communication technologies (ICTs); the use of drones for aerial surveys in combating deserts locusts; and novel ways for farmers to access markets.

Policy options along the food value chain. Designing and implementing the aforementioned policy directions, aimed at raising productivity of nutritious foods, also requires taking into consideration the critical aspects of the supply chain (or value chain) of each product. In this regard, the value chain approach is useful for navigating the complexity of food systems and identifying opportunities for enhanced nutrition at different stages.[252] For any one food product, all actions along the food value chain ultimately affect the consumer price, and hence the affordability of food (depending on the consumer's income or purchasing power). Key policy actions and both public and private sector investments can increase agricultural productivity, reduce food losses and enhance efficiencies in food storage, processing, packaging, distribution and marketing across the food value chains, all of which translate into lower food prices. In many countries, larger public and private sector investments in food value chains are needed as food systems are becoming increasingly more complex and intertwined, especially in rapidly growing metropolitan areas.

Modern food supply chains, with increasingly diverse and differentiated food products, have brought tremendous opportunities to "add value" to food items. At the same time, they have increased costs to the consumer. As this report presents various policy options below, it is important to recognize that policies that intervene directly in agricultural production to promote healthy eating habits are unlikely to be effective or efficient if they do not take into account how foods are processed, distributed and marketed throughout the *entire* food supply chain,[253] and how the intervention will affect each stage. Policy actions and investments that specifically help increase the affordability of healthy diets – as well as healthy diets that also include sustainability considerations – within a food systems context and across the food value chains are discussed below.

Policies and investment for nutrition-sensitive value chains. Globally, there has been a growing interest among governments and development institutions in using nutrition-sensitive value chains as a means to improve nutrition.[254]

Examples include investments in improved storage, processing and preservation to retain the nutritional value of food products. As discussed above, at the production level, broadening the mix of crops produced and diversifying into agroforestry, livestock and/or fisheries products is also important to raise incomes, as well as nutritional outcomes of small-scale producers.[255]

The need for stronger policies towards more nutrition-sensitive value chains has been advocated especially for high- and middle-income and rapidly growing low-income countries, where the agricultural sector has become a supplier of raw materials for the food processing industry, and where the food system policies promote inexpensive calories and expensive nutrients.[186] It has also been observed that highly processed energy-dense foods are increasingly marketed and made available in low- and middle-income countries, demanding increased production of ingredients for these foods (primarily refined starches, oil and sugars) while at the same time the supply of nutritious, minimally processed foods is being constrained.[256] Among others, these developments have underscored the need for policy interventions that promote nutrition-sensitive food systems from the production level throughout the food value chain.[186]

For example, given the unique challenges faced by SIDS, the Global Action Programme on Food Security and Nutrition in Small Island Developing States highlights the importance of developing more resilient and nutrition-sensitive food systems and their value chains. Among others, the nutrition-sensitive approach aims to address growing malnutrition and health costs due to the emergence of and preference for more energy dense and highly processed foods; significant levels of food loss and waste; increased incidence of food safety issues and trans-boundary diseases, as well as environmental and natural resource degradation.[175] In another example, the Smallholder Livelihood Development Project in eastern Indonesia has adopted a nutrition-sensitive value chain approach to address a "nutrition gap" found to be particularly severe for adolescent girls. Under the project, food commodities that could address nutrition gaps of these girls, as well as other family members, were identified – and included bananas, cassava, maize, spinach, sweet potatoes and fish – which also presented a profitable business opportunity for smallholders. The applied nutrition-sensitive approach helped empower women and generate increased income, laying foundations for a local food system that sustainably delivers nutritious foods that contribute to healthy eating habits. Thus investments spanning across multiple value chains helped diversify diets and sources of income.[257]

Policies and investments to reduce food losses. These policies and investments can increase affordability of nutritious foods in two ways. First, by focusing on the earlier (production) stages of the food supply chain, as this tends to boost supplies and hence reduce food prices at the farm gate.[181] This is particularly important for the reduction of losses in perishable commodities, such as fruits and vegetables, dairy, fish and meat. Second, by targeting the parts of the food supply chain where food losses are greatest, as this will more likely have a greater impact on reducing the cost of the targeted food item. The overall price effect will differ from one commodity to the next and also across countries.[181] In many low- and middle-income countries, food losses of perishable commodities are greatest where markets are absent, road infrastructure is poor and cold storage facilities are poorly developed. Investment in improved storage facilities, as well as post-harvest preservation and conservation techniques, will not only reduce food losses, but also help maintain the nutrient content of food and improve food safety.

Policies and investment in nutrition-sensitive handling and processing. In addition to food storage, appropriate food handling and processing facilities are central to increasing efficiencies along the value chain. If passed on to the consumer (in the form of cost savings), these efficiency gains contribute towards increasing the affordability of healthy diets. Improved storage, processing and preservation may also increase incomes of food producers, in addition to reducing the negative effects of seasonality on food insecurity and malnutrition.[182] In Indonesia, supporting fishery

BOX 23
INVESTING IN THE FISHERIES AND AQUACULTURE VALUE CHAINS RESULTS IN MORE EQUITABLE INCOMES AND HEALTHY DIETS IN INDONESIA

There is tremendous potential for fisheries and aquaculture to raise incomes and dietary diversity, especially among the poor and malnourished,[258] as demonstrated by a project supporting fishing communities in Indonesia. Over the past few decades, fish consumption worldwide has grown at a rate twice as fast as global population growth,[259] and in 2015 it accounted for 17 percent of total animal protein consumed,[260] demonstrating its potential to provide greater availability and access to nutritious food.

Indonesia is the world's second largest fish producer after China, producing 6.1 million tonnes in 2016 (accounting for about 8 percent of the world's total). Small-scale fishers raise and/or harvest most of the fish produced in the country.[259] However, unsustainable production practices, in particular in aquaculture, have undermined the sector's performance[261] as it only contributed to approximately 3 percent of the country's gross domestic product. Further, only 28 percent of the country's total fish production is processed after harvesting, due to lack of post-harvest processing facilities and infrastructures. The sector is also increasingly affected by overexploitation, pollution and climate change.

Addressing these challenges, the Government of Indonesia and development partners implemented the Coastal Community Development Project (CCDP) between 2013 and 2017 in coastal and small island communities of Indonesia. The project aimed at reducing poverty and promoting sustainable economic growth by providing fishery and aquaculture inputs (e.g. fish feed, fishing gear and motorized engines for fishing boats) and training, while establishing processing and marketing facilities (e.g. through investment in fish smokehouses, processing warehouses, cooler boxes, marketing facilities and information centres) that engage primarily women. Furthermore, protection of marine areas, rotational fishing activity plans, awareness raising campaigns and community-based integrated coastal management plans helped to support policies that promote local ownership and sustainable management of natural resources.

The CCDP was successful in increasing fish production and productivity without inducing overfishing, increasing incomes from fisheries through value addition and reduced post-harvest losses, while also improving dietary diversity of fishers in targeted areas. Results from an impact assessment indicate that fisheries productivity increased by 78 percent, post-harvest losses fell by 5 percent and total income increased by 33 percent among fishers. Dietary diversity expanded by 6 percent, mainly driven by increased consumption of fish, seafood, dairy and fruits. Furthermore, it was observed that women's empowerment was improved, among others through an increase of the engagement of women in fisheries processing by 27 percent.[262] A key factor driving CCDP's success has been strengthened linkages between fishers and processors, in addition to strengthened local ownership and capacities of fisheries management processes.

and aquaculture production, and processing and marketing in coastal and small island communities has led to increased productivity, incomes, dietary diversity, as well as women's empowerment, as illustrated in Box 23.

Food fortification. More than 2 billion people in the world today suffer from micronutrient deficiencies caused largely by a dietary deficiency of vitamins and minerals. Food fortification of regularly consumed foods (such as iodization of salt), and fortification of staple foods (through biofortification at the production level or through post-harvest fortification) is recommended as a cost-effective measure to reduce these deficiencies.[263] For example, biofortified crops are those which have been nutritionally enhanced using agronomic practices, conventional plant breeding, or modern biotechnology to increase the density of micronutrients, thus ensuring the staple crop component of a diet is as nutritious as possible.[264] This is particularly important for the rural poor and small farming families in low- and middle-income countries whose diets continue to be dominated by staple foods and are not yet able to access a diversified healthy diet. Given that fortified foods provide a higher micronutrient content at marginally increased prices, it allows households to reduce the overall cost of a healthy diet. National standards, with quality assurance and quality control systems, as well as regulatory and public health monitoring, are needed to ensure quality fortification in line with international guidelines.[265,266,267,268]

Investment in road networks, transport and market infrastructure. Improving the national road network, as well as transport and market infrastructure, requires large amounts of public and private sector investment, but this can go a long way towards ensuring greater affordability of healthy diets. Transport costs are a bottleneck to increasing the affordability of healthy diets in many countries, particularly in the lower income brackets. Beyond the farm gate, investment in an array of physical infrastructure can help reduce the cost of bringing farm produce to market, especially of perishable nutritious foods. In addition, improvements of all-weather rural roads and the national road network can facilitate farmers' access to markets and reduce pre-harvest and post-harvest losses, all of which eventually contribute to reducing consumer prices (see Section 2.3, Box 19).

Furthermore, improvements in physical rural and urban market infrastructure increase access for agricultural producers to markets where they can sell their wares in a competitive and clean environment. It raises competitiveness in price formation and strengthens the food environment where consumers access food, including a variety of fresh produce and other nutritious foods. The potential of these improvements is substantial if one considers the growth of urban markets. For example, in Asia, currently about 60–70 percent of the food supply passes through urban markets,[269] while urban food markets in Africa have grown rapidly and now provide half or more of overall food for consumption. In Kenya, more than 95 percent of the fresh fruits and vegetables consumed is grown domestically, mainly by smallholders, and is supplied to rural and urban markets by small and medium-sized enterprises (SMEs) through informal supply chains.[270] Policies, as well as public and private sector investments aimed at strengthening road networks and transport and market infrastructure enhances a country's capacity to raise the variety of food available on rural and urban markets and reduce the cost of nutritious foods.

As was observed in Bangladesh, for example, public investments increased access to markets in strengthening community markets and market-connecting roads, all of which improved food security and nutrition outcomes of targeted beneficiaries.[271] In Nepal, strengthening linkages between producer organizations of high value crops and local traders also improved food security outcomes of targeted producers.[272] And in the United States of America, government incentives to encourage weekly farmers' markets and regulating local supermarkets to stock fresh produce helped raise access to nutritious food options in "food deserts" – often identified in low-income neighbourhoods where affordable nutritious foods are out of reach.[273]

Ensuring trade and marketing policies balance producer and consumer interests. Trade and marketing policies aimed at decreasing the cost of food to consumers, while avoiding disincentives to the local production of nutritious foods, are often difficult to balance. Nevertheless, the efficiency of internal trade and marketing mechanisms are possibly just as important as measures to support international trade – if not more – in determining the cost of healthy diets for both urban and rural consumers, while also ensuring that food safety standards are met. This is particularly relevant given rapid rates of urbanization, the lengthening of food value chains, and generally, increased demands placed on local food systems, in terms of consumer demand for greater diversity in the choice of food commodities available, and for adequate food safety standards and sustainability issues to be addressed.

International trade policies typically affect the affordability of healthy diets by either lowering or raising the relative prices between

BOX 24
TRADE LIBERALIZATION HELPS TO REDUCE THE COST OF NUTRIENT ADEQUATE DIETS IN CENTRAL AMERICA

Trade liberalization can play a key role in making diets more affordable. Evidence from Central America shows that tariff removal has had a positive impact on the affordability of nutrient adequate diets and helped improve nutrition in a region that is characterized by the coexistence of undernutrition and obesity.[274] Governments in this region have traditionally used trade policy to protect domestic producers and processors from imports. Across the region, tariffs are applied to several strategic products, resulting in higher farm-gate prices for those products. According to estimates from the Inter-American Development Bank (IDB), the total value of this protection amounted to USD 13.53 billion during the 2014–2017 period. By comparison, in the same period, the total budget expenditure in support of the food and agricultural sectors amounted to USD 4.03 billion.[275]

The products that benefit most from trade protection in the region include poultry, meat, sugar, milk, maize, beans and rice. These reflect the range of policy objectives and political economy factors that influence trade policy: achieving food self-sufficiency (maize), maintaining on-farm rural employment and powerful processing industries (sugar) and protecting farmers from more competitive, low-cost imports (poultry and milk). However, these tariffs also drive up food prices. In El Salvador, prices of maize are on average 30 percent higher than those on the international market; in Honduras, milk prices are 19 percent higher, and poultry and meat prices are 56 percent higher. In Costa Rica, the disparity is even greater, with milk prices 35 percent higher and poultry prices 75 percent higher than international market prices.[276]

Currently, Central American countries are approaching the end of the trade liberalization process that was initiated under the 2006 free trade agreement between the United States of America, the Dominican Republic and Central America (DR-CAFTA). Under the DR-CAFTA agreement, trade in agricultural products is to be fully liberalized (i.e. tariffs removed). However, there is a separate schedule for products considered sensitive to the local economies, including for milk, maize, poultry, sugar and meat, under which a gradual reduction of tariffs for each product group was agreed upon. Except for milk, tariff protection for most other products will end in 2021 (15 years after the agreement's entry into force). Evidence shows that the agreement has led to an average annual growth of 8.5 percent of agricultural exports from Central American countries.[277]

Based on recent data, it is estimated that removing trade protection across Central America (excluding Belize), observed during the 2008–2014 period, would reduce the cost of a nutrient adequate diet* by USD 0.12 (lower bound) to USD 0.24 (upper bound) per day, or between USD 44 and USD 88 annually. This would represent an average reduction of 4.4 to 8.7 percent of the total cost of a nutrient adequate diet in the region.** The gains from removing tariffs would be highest in the countries that have the lowest incomes. In Nicaragua and Honduras, the cost of diets would reduce by USD 0.16–0.32 and USD 0.14–0.28 per day, respectively.

* The nutrient adequate diet analysed here is defined as in Box 10. See Box 11 for a brief description of the cost methodology, and Annex 3 for a full description of the simulation methodology and data sources.

** The estimated potential decrease in the cost of a nutrient adequate diet due to the removal of trade protection policies is derived from the database on price incentive indicators developed by the Monitoring and Analysing Food and Agricultural Policies (MAFAP) Programme of FAO. See Annex 3 for a full description of the simulation methodology and data sources.

imported and import-competing foods (Box 24). As discussed in Section 2.3, protectionary trade policies (i.e. import tariffs, non-tariff measures and quotas), as well as input subsidy programmes tend to protect and incentivize domestic production of staple foods, such as rice and maize that mainly provide calories, often to the detriment of nutritious products, such as fruits and vegetables that provide vitamins and minerals. Furthermore, non-tariff measures that impose excessive food safety standards may unduly affect the cost of nutritious foods. This can therefore also have significant adverse effects on the affordability of healthy diets. Hence, it is essential that governments carefully consider the impacts of non-tariff measures on the affordability of nutritious foods, and avoid creating regulatory barriers to trade that negatively affect poor households' access to a healthy diet. In general, but also at times of food crises in particular, such as during the unfolding of the COVID-19 pandemic, protectionism is likely to increase the costs of healthy diets, and agricultural trade restrictions should therefore not be imposed.

Strengthening food supply chains under humanitarian conditions. Many of the above recommendations can be very challenging in certain contexts when, for example, established food supply chains are disrupted because of major natural or man-made disasters (e.g. large-scale floods, earthquakes, armed conflict or civil strife). Under such circumstances, food supply chains may initially break down, until local marketplaces and strained supply chains start delivering food supplies again to reach vulnerable populations, including displaced populations living under humanitarian conditions. The often limited production capacity of local communities, poor market infrastructure, bottlenecks in supply chains and limited market competition will most likely result in high food prices for some of these most vulnerable population groups with little or no source of income. Limited availability of nutritious foods, such as fresh produce, fish and meat, apart from staple foods provided as food aid, pose further challenges to increasing affordability of nutrient adequate, let alone healthy diets under such conditions. Under these contexts, it is important that key actors across the food value chain help provide better access to nutritious foods at affordable prices to the most vulnerable, as demonstrated with the example of the Kakuma refugee camp in Kenya (Box 25).

Consumer-oriented policies to ensure affordability of healthy diets

Policies to reduce poverty and income inequality. Policies aimed at reducing poverty and income inequality, while enhancing employment and income-generating activities, are also key to raising people's incomes and hence the affordability of healthy diets. Today, more than 700 million people, or 10 percent of the world's population, still live in extreme poverty.[280] Approximately 80 percent of the extreme poor live in rural areas.[281] Moreover, according to the analysis presented in Section 2.1, none of these 700 million people can afford nutrient adequate nor healthy diets. "Ending poverty in all its forms everywhere" under SDG 1 remains a major task requiring substantial policy interventions, as well as public and private sector investments across the socio-economic sectors of many countries, in close coordination with in-country efforts addressing SDG 2 and most other SDGs. This is particularly true nowadays, as the impact of the COVID-19 pandemic risks reversing the steady decline in the prevalence of poverty achieved in most countries over the past number of decades,[142] threatening also people's capacity to access healthy diets.

While there are important synergies between policies enhancing employment and reducing income inequality for increased food security and better nutrition, including social protection, these have been addressed in depth in the 2019 edition of this report. Moreover, that edition comprehensively addressed the challenges in safeguarding food security and nutrition as they relate to measures for also protecting incomes in the context of economic slowdowns and downturns, such as the global economic downturn caused by COVID-19.

This year's edition of the report also highlights the importance of social protection policies, although exclusively those that are nutrition-sensitive. These types of policies are most appropriate to provide better access to nutritious foods to lower-income consumers and thus raise their affordability of healthy diets. They can be particularly important in the face of adversity, as we are seeing today during the COVID-19 pandemic. »

BOX 25
MORE EFFICIENT FOOD SUPPLY CHAINS STRENGTHEN ACCESS TO MORE AFFORDABLE HEALTHY DIETS FOR SOME OF THE MOST VULNERABLE POPULATIONS IN A REFUGEE CAMP IN KENYA

Humanitarian conditions and protracted crisis situations present particular challenges to many of the most vulnerable populations to access healthy diets. While some of their most urgent needs may be covered by humanitarian assistance, many people rely on poorly functioning food supply chains to access some of the food they most urgently need. Actions towards supporting more efficient food value chains under humanitarian conditions help ensure improved nutrition among these most vulnerable populations.

Kakuma Camp in Northern Kenya is the largest refugee camp in the world with 191 500 refugees and asylum-seekers. Because of its size and remoteness, this camp faces significant challenges in accessing food. Poor market infrastructure, bottlenecks in supply chains, high rents and high energy costs for traders, limited competition and limited local production capacity often result in high food prices, decreasing the purchasing power of the cash assistance provided to refugees. Other consequences include a limited and unreliable assortment of foods in shops, and low quality and availability of fresh produce and meat. Hence, interventions that increase efficiency of value chains in such context can have significant payoffs.

In 2015, a retail engagement programme was begun with local government aimed at optimizing existing camp markets and improving "value for money" for refugees shopping with cash-based assistance, and for all consumers in Kakuma. By working with local retailers and encouraging more transparent and collaborative market practices, business improved for actors along the food supply chain, while consumers gained better access to affordable healthy diets. Through retail engagement activities, the following lessons were learned to help improve value chains and access to healthy diets:

- Directly linking small retailers to wholesalers and manufacturers helps increase availability and affordability of nutritious foods. This is because when intermediaries are cut from the value chain, the mark-ups on commodities decrease and the savings can be passed on directly to the customer.
- Access to credit for small retailers is critical to improving the supply of goods, because small retailers often cannot afford to buy in bulk or to pay suppliers up front. Thus, identifying reliable wholesalers who can supply retailers with commodities at negotiated prices can help small retailers meet consumer demand. As wholesalers develop relationships with the small retailers, this facilitates trust and transparency to extend further credit. As of October 2019, four selected wholesalers extended USD 460 000 worth of credit monthly to small shops in Kakuma Camp.[278]
- Assisting medium-sized wholesalers to purchase their wares from large-scale food manufacturers and importers can help reduce wholesale prices. Savings can then be passed on to retailers and consumers, increasing the value for money of cash assistance, while also strengthening collaboration between small and large market players.
- Linking refugee camp traders to local neighbouring farms can bring new business opportunities for farmers into these camps, while ensuring fresh produce is accessible and affordable for refugees. For example, in linking local farmers and irrigation schemes with traders in Kakuma, the price of tomatoes decreased by 30 percent.
- Facilitating common market days can connect local traders, suppliers, transporters, farmers and fishers across markets. Communication among market actors can help attract new suppliers, as often suppliers are unaware of the scale of a camp market and the business opportunities it offers. In Kakuma, the supply of fresh produce increased from two trucks prior to common market days to seven trucks daily.[279]

The local Turkana county government is in the process of taking over the retail engagement activities and monitor market conditions in Kakuma, gradually increasing its capacity to facilitate smallholder producers and traders' access to markets and optimize food supply chain management.

Given the good practices developed from the retail engagement programme in Kakuma Camp, and the policy guidance it is providing, this successful model has been adopted in other humanitarian contexts. This includes communities in Lebanon, where Syrian Arab Republic refugees reside, and those for Rohingya refugees in Cox's Bazar, Bangladesh.

» **Strengthening nutrition-sensitive social protection mechanisms.** In examining the affordability of the three different diets under consideration, previous sections have provided evidence that even energy sufficient diets are out of reach of millions of people due to high cost barriers. Raising the purchasing power of the poorest through various social protection mechanisms is common practice around the world for improved food security, nutrition and health.[282] Social protection mechanisms represent a set of policies and programmes that address economic, environmental and social vulnerabilities to poverty, food insecurity and malnutrition by protecting and promoting livelihoods, in particular through the reduction of financial and social barriers to accessing food.[283]

These mechanisms can be particularly important in the face of adversity, as we are seeing today during the COVID-19 pandemic. A recent review of social protection policy measures from the World Bank and UNICEF shows that a total of 151 countries have introduced or adapted these measures.[284] Cash transfers have been the most common, in additional to in-kind food and voucher schemes, as well as school feeding programmes. A review of policy examples reveals that the number of countries providing some form of social protection mechanism increased steadily throughout the month of April 2020, for example in low-income countries, with some important gaps in Middle and Eastern Africa, including countries with a protracted crisis situation (Democratic Republic of the Congo, Somalia and South Sudan). This is worrisome, considering that the highest prevalence of undernourishment worldwide is found in sub-Saharan Africa.[284] Overall, while the increased investment in social protection mechanisms is laudable, this has also led to the overburdening of these mechanisms in many countries.

Especially under these circumstances, social protection mechanisms that are nutrition-sensitive are most appropriate to provide better access to nutritious foods to lower-income consumers, as in school feeding programmes through public procurement. Micronutrient supplementation should be promoted where required,[285] and the creation of healthy food environments should be fostered by encouraging consumers to include more diverse, nutritious foods in their diet in order to reduce dependence on starchy staples and reduce consumption of foods high in fats, sugars and/or salt. In El Salvador, for example, policy recommendations to raise the affordability of healthy diets, especially of poor households, included nutrition-sensitive social protection programmes (Box 26).

Cash transfer programmes. Among the different kinds of social protection programmes, the effectiveness of cash transfer programmes depends on: (i) the level of income they complement; (ii) how much of the food affordability gap they close; (iii) the availability of nutritious foods in local markets; or (iv) whether transfers are conditional on the use of a particular service, such as antenatal care. Cash transfers are used in a wide range of programmes including government social safety nets, child grants or old age pensions, as well as food assistance programmes. These last are designed to meet food needs directly, whereas the first three provide a transfer to meet a household's most immediate income needs, part or all of which can be spent on food.

The contribution of these very different programmes towards meeting people's affordability of a nutrient adequate or healthy diet is usually limited, because their objectives are typically designed around meeting dietary energy requirements, rather than aiming to provide healthy diets. However, when designed appropriately, social protection programmes can also help make healthy diets more affordable, provide specific services to nutritionally vulnerable groups, and reach under-served populations.[287]

In sub-Saharan Africa, for example, the implementation of well-designed cash transfers with adequate and reliable transfers has resulted in significant improvements across a range of dietary diversity measures.[288] Factors that help improve nutrition outcomes of cash transfer programmes include: easily accessible and affordable food stores,[289,290] a nutrition-sensitive approach and the combination of the transfer with other initiatives such as nutrition education.[291] Cash transfer programmes can also help improve the dietary diversity of

BOX 26
A SOCIAL PROTECTION APPROACH TO IMPROVE AFFORDABILITY OF HEALTHY DIETS IN EL SALVADOR

In El Salvador, a large proportion of the population cannot afford healthy diets, mainly because of high income inequality, prompting the government to assess the nutrition situation and decide upon corrective policy action. While relying largely on imports of staple foods (maize, rice and beans), local diets in El Salvador have increasingly become energy-dense and are not diversified enough to meet all nutrient intake requirements of the population. A majority of households consume few fruits and vegetables despite their wide availability. Lack of dietary diversity and a shift in dietary habits towards greater consumption of highly processed foods and energy-dense foods high in fats, sugars and/or salt, including sugary drinks, appear to be driven by the high cost of nutritious foods.[286]

A more detailed Fill the Nutrient Gap (FNG) analysis[68] conducted with the Ministry of Social Inclusion (MIES) revealed that: (i) healthy diets are out of reach for a wide range of households (9 to 44 percent, depending on the administrative area); (ii) a large segment of the population cannot afford a nutrient adequate diet, mainly because of high income inequality; (iii) nutritious foods rich in micronutrients are purchased less frequently by poorer households; (iv) among extremely poor households, cereals and sugars contribute about 70 percent of total energy intake, instead of the recommended 50–55 percent; and (v) the proportion of energy from protein intake is very low in poorer households (about 8 percent instead of the recommended minimum of 12 percent), while in wealthier households, the contribution of protein consumption to dietary energy is typically twice as high.[286]

The FNG nutrition analysis also gauged the impact of a variety of interventions on households' and individuals' ability to access healthy diets. Interventions included cash transfers, fresh food vouchers and other social protection programmes that include complementary, nutrient adequate foods. Policy dialogue between nutrition, social protection, education, agriculture and other sectors on the findings of the analysis helped define strategies to overcome the unaffordability of healthy diets.

Recommended policy actions to raise the affordability of healthy diets in the short term included nutrition-sensitive social protection programmes in support of poorer households. Furthermore, a national-level joint project for child development (*"Misión Ternura"*), including food supplements for mothers and children, school feeding and social protection packages, was established. Results from the FNG analysis helped decide which foods should be included in school meals and at what cost, and increased support for developing a pilot for providing cash transfers targeting adolescent girls.

poor farming households through farm-level investments in increased production and diversification.[292] Diets can improve even more if the investments are combined with other improvements, such as greater access to markets.[293]

In-kind transfers, in particular through conditional or unconditional **food distribution**, which are currently implemented by over 80 countries[243] represent another way through which social protection mechanisms may have a positive effect on access to and affordability of healthy diets; apart from providing food, these programmes also free up household income to spend on other nutritious foods. Hence, these interventions directly increase household food consumption and intake of dietary energy, while also supporting dietary diversity. Under certain circumstances, the use of cash transfers is more cost-efficient than in-kind transfers, given the cost of procurement and logistics in food distribution. Under other circumstances, economies of scale could offset the logistics costs of in-kind programmes, making them more efficient than cash transfers in achieving food security and nutrition goals.[294] Generally, cash transfer programmes are considered an appropriate instrument to increase dietary diversity in well-connected urban or rural contexts, while in-kind transfers are more appropriate for remote areas, where access to markets is severely limited.[294,295,296]

In India, for instance, the country's Targeted Public Distribution System represents the largest social protection programme in the world, reaching 800 million people with subsidized cereals that can be purchased from more than 500 000 fair price shops across the country.[297] Evidence of the impact of the programme on dietary diversity and nutrition is mixed, although it showed some positive impact on the intake of macronutrients.[297,298,299] Other studies found that the programme still faces efficiency problems, particularly in regard to targeting food insecure and poor population groups.[299]

School feeding programmes. Apart from increasing school enrolment, school feeding programmes aim at improving nutrition though access to healthy school meals. School meals provided to millions of children worldwide also represent an important contribution to reducing the cost of food, in particular for low-income families, who already cannot afford healthy diets. As such, school meals represent a transfer of the value of the food distributed to households. It has been estimated that with school closures during the COVID-19 pandemic, more than 320 million children around the world are missing out on school meals. As many of these children depend on the daily meals they receive at school for a large part of their daily nutrient requirements, the pandemic is aggravating the unaffordability of healthy diets to poor households.[300]

Improving dietary diversity through school meal programmes has been successful in Ethiopia,[301] while in Ghana, the school menus still face some challenges in offering diverse enough menus to ensure sufficient intake of micronutrients.[302] In Brazil, the National School Feeding Programme increased the quantity of fruits and vegetables in its menus and reduced the presence of highly processed foods containing high amounts of sugar and/or salt. It also successfully encouraged local purchases from smallholders through public procurement mechanisms, which added to the success of the integrated programmes.[303] A nutrition-sensitive approach is key to fighting malnutrition through school feeding programmes.[295]

Linkages with local producers are especially important in the contexts of weak market access and inefficiencies of the food supply chain. Positive synergies associated with predictable and continued demand from schools, as well as other public institutions such as local hospitals, can improve the livelihoods of smallholders, creating shorter supply chains and reducing transaction costs for both producers and consumers.[304]

Subsidization of nutritious foods. The promotion of healthy eating habits through subsidies on grocery store purchases of nutritious foods, such as fruits and vegetables, can be an effective policy towards raising affordability of healthy diets. Food subsidies are used in many parts of the world to decrease the cost of food for the most vulnerable. While they are generally considered a distortive measure compared with cash transfer programmes,[295] targeted food subsidies can be effective in promoting healthy diets.[305,306] A systematic study covering mainly high-income countries found that a decrease of 10 percent in the price of foods that contribute to a healthy diet would increase their consumption by 12 percent.[305] In low- and medium-income countries, large-scale untargeted subsidies of staple foods tend to be more common than targeted subsidies of nutritious foods such as fruits or vegetables. Faced with high and rising levels of overweight and obesity, several low- and middle-income countries in Northern Africa, and parts of Western and Southern Asia have been adjusting their food policies, including their food subsidy programmes, to discourage the consumption of products high in saturated and trans fats, sugars and/or salt (Box 27).

All of these nutrition-sensitive social policy options can be very effective in helping increase the purchasing power of the poor and vulnerable groups, so as to increase their affordability of healthy diets. Nonetheless, given different starting points and challenges in each »

BOX 27
REVISED FISCAL POLICIES AIMED AT ADDRESSING AFFORDABILITY OF MINIMUM FOOD REQUIREMENTS AND HEALTH CONCERNS IN NORTHERN AFRICA AND WESTERN AND SOUTHERN ASIA

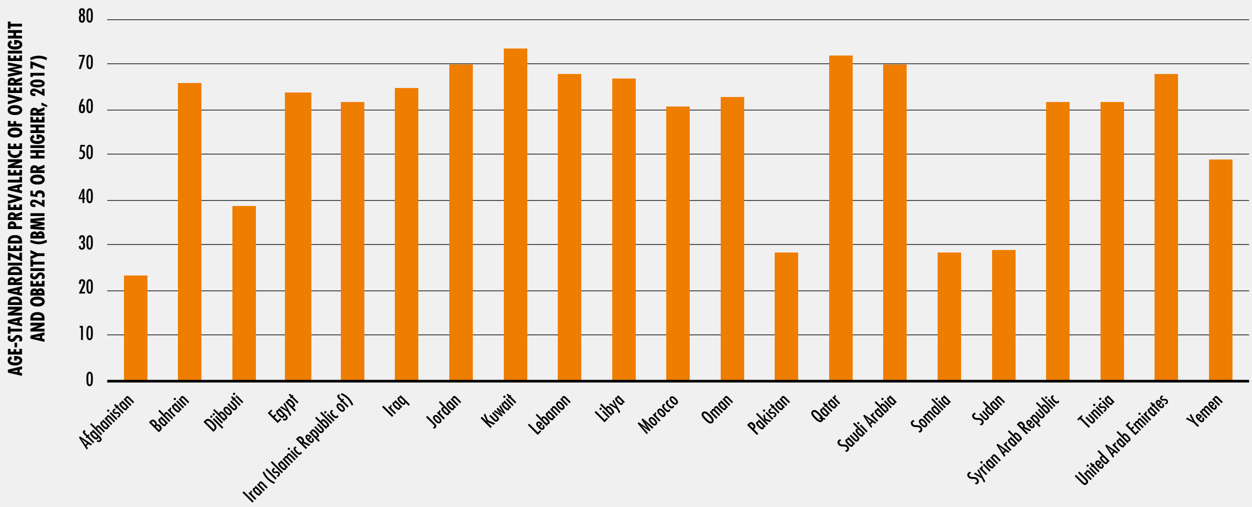
In countries of Northern Africa and some parts of Western and Southern Asia, there has been a long tradition of food subsidies funded by governments to address poverty and improve food security. Commonly subsidized foods include wheat, wheat flour, bread, oils, rice, sugar and powdered milk.[307] These subsidies have been important contributors to increased food intake, providing for example, up to 45 percent of the calorie intake of poor populations in urban Egypt and up to 60 percent in Tunisia.

Food subsidy programmes are, however, expensive – costing, on average, 1 percent of GDP in 2011[307] – and have not always been well-targeted to reach those most in need. Furthermore, as many countries in this region have undergone a nutrition transition, many households now suffer from the multiple burdens of malnutrition. Over 20 million children in the WHO Eastern Mediterranean Region are stunted, while half of the region's adult population is overweight or obese.[308] Subsidies have not always been designed to promote or enable access to affordable healthy diets.

Given the high costs and the need to improve support for the poorest populations,[309] many countries in the region, such as Algeria, Egypt, Iran (Islamic Republic of), Jordan, Tunisia and Yemen, have revised their subsidy programmes in recent years in favour of better-targeted mechanisms.[310] This has resulted in elimination of many of the subsidies that were not well-aligned with healthy diets; nonetheless, some subsidies for oils, sugar and white flour or bread have persisted.[311]

Faced with high and rising levels of overweight and obesity (figure below), several countries are now using policy instruments to discourage the consumption of products high in unhealthy fats, sugars or salt. Most commonly, taxes have been levied on sugar-sweetened beverages (SSBs) and carbonated or energy drinks. Morocco, Oman, Qatar, Saudi Arabia and United Arab Emirates have implemented taxes

ADULT OVERWEIGHT AND OBESITY IN SELECTED COUNTRIES OF THE NORTHERN AFRICA AND WESTERN AND SOUTHERN ASIA REGIONS IN 2017



SOURCE: WHO. 2020. Overweight - Adults (18+ years) - Eastern Mediterranean Health Observatory. In: *WHO Regional Office for the Eastern Mediterranean* [online]. Cairo. [Cited 27 April 2020]. https://rho.emro.who.int/Indicator/TermID/37

BOX 27
(CONTINUED)

at a rate of 50 percent, while Iran (Islamic Republic of) has introduced a 20 percent tax.[312,313,314] In Saudi Arabia, after the introduction of the 50 percent tax on carbonated soft drinks and a 100 percent tax on energy drinks in 2017, per capita purchases declined by 41 percent and 58 percent, respectively, the following year.[315] In December 2019, the tax was extended to other SSBs that had not been initially covered.

Fiscal policies are being reinforced by other measures to foster healthy food environments and promote healthy diets. In Saudi Arabia, the package of measures includes, among others, elimination of industrial trans fats,[316] front-of-pack traffic light labelling on pre-packaged foods and calorie labelling on menus,[317] an upper limit for salt content in bread,[318] and a voluntary reformulation programme to reduce salt, sugar and saturated fats in other foods.[319] These measures have been accompanied by awareness campaigns on what constitutes a healthy diet.

This combination of different approaches to promoting healthy diets is in line with the new *WHO Regional Strategy for Nutrition 2020–2030* for the WHO Eastern Mediterranean Region,[308] which will guide Member States' implementation of action over the second half of the UN Decade of Action on Nutrition in the region.

» country, as well as the potential trade-offs, including those for the livelihoods of people who rely on the rural economy, a combination of complementary policy interventions towards reducing the cost of nutritious foods, while enhancing the affordability of healthy diets is likely to be more effective than any single policy measure.

Complementary policies that promote healthy diets

Earlier parts of this report have highlighted that what people eat, and how that food is produced, not only affects their health, but also has major implications for the state of the environment and for climate change. The analysis presented suggests that, unless we change our current food consumption patterns, the cost in terms of health for people and climate change to society could together amount to USD 3 trillon per year by 2030 – which is an underestimation, given that other environmental costs are not being accounted for. This is a tremendous cost for individuals and for society, and unless addressed by governments worldwide, it not only threatens the future food security, nutrition and health status of hundreds of millions of people, but will almost certainly prevent a number of SDGs from being achieved by 2030.

As has been pointed out, to achieve healthy dietary patterns, large transformative changes in food systems will be needed at all levels. It is important to underscore that, although there are some overlaps, these changes go beyond the policy options and investments that are explicitly designed and implemented to reduce the cost of and increase the affordability of healthy diets. That is to say, other conditions must also be met, requiring a whole range of other policies that are more explicitly tailored to raise awareness and influence consumer behaviour in favour of healthy diets, possibly with important synergies for environmental sustainability (Box 28). Hence the importance of policy coherence and coordination across all relevant sectors and involving all stakeholders of which we made reference at the beginning of this section.

Such a policy framework could be supported at the national level in ensuring that national food-based dietary guidelines (FBDGs) fully consider sustainability dimensions. While some countries still need to develop their FBDGs, existing guidelines could be used to align policies in different sectors (nutrition, health, agriculture, education, fiscal, trade policies, etc.) with national health and sustainability objectives; for example, to help shape food production strategies towards more sustainable practices. »

BOX 28
COMPLEMENTARY POLICIES THAT PROMOTE HEALTHY DIETS

Further to a number of policy measures and investments to reduce the cost of nutritious foods for greater affordability of healthy diets outlined above, the following are complementary policies that if implemented will support healthy diets.

Promotion of healthy food environments. Safe and supportive food environments provide physical access to nutritious foods for healthy diets that reduce the risk of all forms of malnutrition, including undernutrition, overweight, obesity and diet-related NCDs. By implementing a broad-based strategy across different sectors, governments can create supportive environments for healthy diets in hospitals, schools, workplaces and other public institutions, and address the high burden of hidden costs associated with unhealthy diets highlighted in this report. "Best buys" recommended by WHO for promoting healthy diets include reducing salt intake through programmes that encourage reformulation of food products and introducing front-of-pack nutrition labelling.[320]

WHO also recommends measures to eliminate industrial trans fats through the development of legislation to ban their use in the food chain and to restrict the marketing of foods or beverage products high in fats, sugars and/or salt to children.[321] Other policy options available to national, subnational or local authorities to promote healthy food environments include the use of planning and zoning rules to minimize food deserts and food swamps[104] and to control the type of food outlets permitted in the vicinity of schools.

Taxation of energy-dense foods and beverages with minimal nutritional value. Increasingly, governments are implementing tax policies to increase the price of highly processed, energy-dense foods with minimal nutritional value (see also Box 27). The introduction of taxes on beverages containing high amounts of sugar in an effort to reduce obesity and NCDs has been especially effective in recent years, with the taxation of sugar-sweetened beverages (SSBs) becoming one of the most common fiscal policies in a number of countries. Mexico is a good example of how the mobilization of civil society has spurred government commitment to policy change – in this case, the introduction of a national tax on SSBs in 2014.[145] Another study in the United States of America found that a tax on the consumption of energy-dense foods of minimal nutritional value is a cost-effective intervention to prevent and control diet-related NCDs. In addition to generating approximately USD 13 billion in annual tax revenue, a modest tax on SSBs could reduce the adverse health and cost burdens of obesity, diabetes and cardiovascular diseases by as much as USD 17 billion.[322]

Food industry regulations to help ensure easier and more affordable access to healthy diets, by reducing the content of fat, sugar and salt in foods or increasing access to foods fortified with micronutrients. Recommended regulation measures include the introduction of legislation to ban the use of industrial trans fats, encouraging the reformulation of processed foods, the introduction of improved nutrition labelling (including simplified front-of-pack labelling) and the use of fiscal or agricultural policies to replace trans fats and saturated fats with unsaturated fats, in addition to policies that limit portion and package size.[320]

Regulation of food marketing. Introducing measures on the marketing of energy-dense foods of minimal nutritional value to children should form part of comprehensive strategies directed at promoting healthy diets that include sustainability considerations.[323] These foods include SSBs, pre-sugared cereals, confectionery, snacks and highly processed foods served in fast food restaurants.[324] Children in particular are influenced by marketing strategies. Marketing and communication channels include TV, radio, the Internet, social media, online games, poster sites, magazines and newspapers, in addition to in-store displays and packaging, celebrity endorsements, sports sponsorship and price promotions. Since 2010, WHO has recommended that countries implement measures to reduce the marketing of foods and non-alcoholic drinks to

BOX 28 (CONTINUED)

children,[321] and more than 40 countries now have such measures in place.[243]

Similarly, food packaging directed at children is often designed to promote the purchase of energy-dense foods high in unhealthy fats, sugar and/or salt.[323,325,326,327] Such marketing techniques have implications for the consumption and affordability of healthy diets, in particular for low-income households, as income spent on highly processed energy-dense foods can divert spending from other nutritious foods and/or increase overall family expenditure on food. Therefore, food regulations should also discourage marketing strategies that promote consumption of these foods. In several Latin American countries, policies that regulate food packaging and labelling have been introduced, covering food products, including beverages.

Promote breastfeeding, regulate marketing of breastmilk substitutes and ensure access to nutritious foods by infants. WHO and UNICEF recommend exclusive breastfeeding for children for the first six months and then continued breastfeeding combined with appropriate complementary feeding until two years of age or older. This should be supported with labour conditions that provide for maternity leave and continued income. The promotion of breastfeeding provides short-term and long-term health and economic and environmental advantages to children, women and society. However, to realize these gains, policy support, regulatory measures and financial investments are needed, in particular given the global food industry's large competitive claim on infant feeding, in terms of marketing breastmilk substitutes.[328] Sales in the global market for infant formula reached USD 45 billion in 2018 and are expected to surpass USD 100 billion by 2026,[329] which demonstrates the leverage of this industry.

For infants, aggressive marketing of breastmilk substitutes continues to negatively affect breastfeeding, and hence governments should adopt stricter regulatory frameworks. These should be based on full implementation of the International Code of Marketing of Breast-milk Substitutes[330] and subsequent relevant World Health Assembly resolutions, coupled with independent, quantitative monitoring and compliance enforcement, to counter the impacts of formula marketing globally.[331,332] In addition, they should include measures to end the inappropriate promotion of foods for infants and young children.[333,334]

Policies supporting nutrition education. Policies, legislation and other interventions to transform food systems and create healthy food environments need to be accompanied by the provision of food and nutrition education (FNE) and behaviour change communication, in addition to the implementation of mass media campaigns to promote healthy diets.[320] Policy options include integrating effective FNE into national plans and programmes to influence consumer awareness and foster nutritious food choices and behaviours. FNE with a focus on food budgeting and resource management skills can be integrated into the national school curriculum, social protection and agriculture programmes, and food labelling and taxation schemes. Combining school food environment policies (such as nutrition standards for meals) and school-based food and nutrition education can help children build the motivation and skills necessary to make nutritious food choices. Such initiatives should be included in state laws and regulations to protect them from shifting political priorities.

Policies in support of sustainable food consumption and food waste reduction. Policy measures directed at the consumer to encourage healthy diets that include sustainability considerations, include at the individual level, dietary changes towards predominantly plant-forward diets[73] with limited amounts of animal source foods, while the amount of dietary energy derived from starchy staple foods is also capped (e.g. at 50 percent of total dietary energy requirements). At the retail and household levels, policy measures directed at the reduction of food waste, including through awareness campaigns, informing consumers and advocating for behaviour change towards healthy choices through education and communication strategies that involve different media and interpersonal communication, are critical.

BOX 29
FURTHER RESEARCH TO SUPPORT POLICIES TOWARDS ENSURING AFFORDABLE HEALTHY DIETS THAT INCLUDE SUSTAINABILITY CONSIDERATIONS

1. **Need for nutrition-sensitive poverty lines.** In many countries, poverty lines form the basis for social protection programmes and the targeting of beneficiaries. As shown in Section 2.1, current poverty lines are insufficient to support even the least-cost versions of healthy diets. That is, they do not provide adequate guidance for the formulation of policies and programmes designed to achieve food security and nutrition. Typically, food consumption patterns are used to determine national food poverty lines through what is called a "cost of basic needs" approach. This approach normally calculates the food poverty line as the cost of a basket of foods consumed by relatively poor households, scaled to meet only dietary energy requirements.

   The analysis in this report shows that the poverty line, which includes a provision for basic food needs, does not support a nutrient adequate or a healthy diet in most countries. Thus, there is a strong justification for national poverty lines to be adjusted to account for nutritional needs, for example using alternative compositions of food baskets, which would require further research.[336]
2. **Limited data on cost drivers of healthy diets.** Analysis in this report has highlighted that, globally, more than 3 billion people cannot afford a healthy diet because of the high cost of nutritious foods. The analysis of cost drivers in Section 2.3, shows that the factors driving the high cost of nutritious foods are found throughout the food systems, related to food production, the food supply chains, the food environments, as well as consumer demand and the political economy of food. Nevertheless, there is currently very little food systems research that identifies the most important cost drivers and how these can best be addressed through various policy measures. Research must hence focus on the complex supply and demand forces that determine food prices, which develop throughout the food value chain, as well as various determinants that help ensure physical, social and economic access to food.
3. **Most national food-based dietary guidelines (FBDGs) do not include environmental sustainability considerations.** Results presented in Section 2.2 indicate that healthy diets can present important opportunities for reducing GHG emissions in some contexts. As such, dietary shifts that include sustainability considerations can play an important role as part of a broader strategy, including a combination of approaches for increasing the environmental sustainability of food systems.

   To include sustainability aspects, quantifiable recommendations for food groups would be needed, which would allow the use of FBDGs to shape agricultural production strategies and plans, agro-ecological approaches for more diverse food production in support of sustainable agriculture, as well as other policies and programmes in support of food systems transformation. Research is needed on how FBDGs could best be improved along these lines.

» Countries are encouraged to scale up actions to create supportive environments for nutrition during the second half of the United Nations Decade of Action on Nutrition 2016–2025.[245] Progress in this area can be facilitated by strengthening nutrition action networks at the global, regional, national and local levels to foster inter- and intra-country cooperation and political commitment.[335]

Recommendations for further research. Further research to support policies towards ensuring affordable healthy diets, while also addressing sustainability considerations, is needed. Three specific areas have been identified in Box 29, for which adequate funding should be allocated for successful implementation.

Conclusion

In summary, making healthy diets more affordable for everyone, while reducing the consumption of energy-dense foods of minimal nutritional value and foods with a negative impact on human health and the environment, requires significant transformations of existing food systems worldwide. Given unique country contexts and different starting points for the various transformative processes that need to happen, it is hoped that the recommended policy measures and investments in this last section will prove useful. Furthermore, while acknowledging the data and research gaps, a number of policy options and investments for reducing the cost of nutritious foods and increasing the affordability of healthy diets have been discussed, in particular those with potential for diets to be environmentally sustainable, and whose effectiveness have been proven by a myriad of case studies. The complementary policy environment that needs to be enabled to simultaneously promote healthy diets has also been highlighted, which further justifies the need for policy coherence and coordination across all relevant sectors and involving all key stakeholders.

The guidance provided in this report is in line with key recommendations under the United Nations Decade of Action on Nutrition, 2016–2025, including Action Area 1 covering "Sustainable, resilient food systems for healthy diets", Action Area 3 on "Social protection and nutrition education", as well as Action Area 5 on "Safe and supportive environments for nutrition at all ages". The remaining years of the Decade of Action present an opportunity to accelerate action in these areas.

The analysis conducted and policy recommendations provided should furthermore help set the agenda for the first UN Food Systems Summit, which will take place in 2021. The summit's overarching goal is to help stakeholders better understand and manage complex choices that affect the future of food systems and accelerate progress towards achieving the SDGs by 2030.

The importance of the policy guidance currently being negotiated under the Committee on World Food Security (CFS) based in Rome towards "Voluntary Guidelines on Food Systems for Nutrition" is also fully recognized. The objective of the Voluntary Guidelines are "to contribute to the transformation of food systems and promoting sustainable food systems to ensure that the food that contributes to sustainable healthy diets is available, affordable, accessible, safe, and of adequate quantity and quality while conforming with beliefs, culture and traditions, dietary habits, and preferences of individuals, in accordance with national and international laws and obligations."[337] The guidance provided by these Guidelines, once fully negotiated and endorsed, will be of great interest to governments and development partners on the formulation and implementation of a comprehensive set of policies towards the transformation of food systems. ■

MEXICO
In Chiapas, fresh fruits and vegetables are displayed for sale at a fruit stall in a local market. ©Alex Webb/Magnum Photos for FAO

ANNEXES

ANNEX 1

ANNEX 1A. STATISTICAL TABLES TO PART 1

TABLE A1.1
PROGRESS TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS (SDGs) AND GLOBAL NUTRITION TARGETS: PREVALENCE OF UNDERNOURISHMENT, MODERATE OR SEVERE FOOD INSECURITY, SELECTED FORMS OF MALNUTRITION, EXCLUSIVE BREASTFEEDING AND LOW BIRTHWEIGHT

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1,2,3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
WORLD	12.5	8.8	8.1	9.2	22.7	25.5	6.9	24.8	21.3	5.3	5.6	11.8	13.1	30.3	32.8	37.0	44.1	15.0	14.6
Least Developed Countries	28.1	23.0	18.1	19.2	46.9	50.2	10.9	37.3	31.2	2.8	2.8	4.9	6.0	39.3	39.6	45.7	55.3	16.2	15.6
Land Locked Developing Countries	26.6	20.0	16.0	18.3	44.6	50.3	5.9	35.3	30.3	3.3	3.0	8.3	9.4	32.1	33.1	45.4	54.9	14.3	13.9
Small Island Developing States	19.3	16.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	18.8	20.9	30.0	31.5	36.8	38.6	11.2	11.1
Low-income countries	32.2	28.1	19.7	21.6	50.5	54.7	6.6	38.9	34.1	3.0	2.7	6.6	7.7	38.2	38.4	43.8	55.1	14.8	14.3
Lower-middle-income countries	18.7	12.7	12.0	13.4	29.3	32.3	10.9	35.5	30.1	4.6	4.7	6.1	7.2	42.2	43.0	39.4	49.8	20.6	19.9
Upper-middle-income countries	7.3	3.0	3.9	4.8	15.0	18.3	1.8	9.3	6.0	8.1	8.8	12.2	13.9	22.3	26.1	29.9	26.7	7.4	7.3
High-income countries	<2.5	<2.5	1.5	1.5	8.2	7.5	0.5[a]	3.0	2.8	6.7[a]	7.6[a]	22.4	24.3	15.4	18.0	n.a.	n.a.	7.6	7.6
Low-income food-deficit countries	23.4	17.6	15.9	17.5	35.0	38.6	10.9	37.3	31.2	2.8	2.8	4.3	5.2	46.2	46.3	43.7	55.8	20.9	20.1

TABLE A1.1
(CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
AFRICA	**21.4**	**18.8**	**17.2**	**18.6**	**47.4**	**51.2**	**6.4**	**32.3**	**29.1**	**4.8**	**4.7**	**11.5**	**12.8**	**37.7**	**37.7**	**35.5**	**43.7**	**14.1**	**13.7**
Northern Africa	**9.7**	**6.5**	**9.9**	**9.6**	**28.7**	**32.1**	**7.2**	**19.8**	**17.6**	**10.1**	**11.3**	**23.0**	**25.2**	**30.9**	**31.8**	**40.7**	**42.1**	**12.4**	**12.2**
Algeria	6.7	2.8	13.0	9.3	22.9	17.6	4.1	11.7	n.a.	12.4	n.a.	24.7	27.4	33.6	35.7	25.4	n.a.	7.3	7.3
Egypt	6.5	4.7	8.4[b]	7.8	27.8[b]	34.2	7.9	30.7	22.3	20.4	15.7	29.3	32.0	29.3	28.5	52.8	39.5	n.a.	n.a.
Libya	n.a.	n.a.	11.2	16.8	29.1	35.9	6.5	21.0	38.1	22.4	29.6	30.0	32.5	30.5	32.5	n.a.	n.a.	n.a.	n.a.
Morocco	5.5	4.3	n.a.	n.a.	n.a.	25.9[c]	2.3	14.9	15.1	10.8	10.9	23.4	26.1	34.2	36.9	27.8	35.0	17.5	17.3
Sudan	21.3	12.4	13.4[c]	16.4[c]	41.4[c]	48.9[c]	15.4	34.1	38.2	1.5	3.0	<0.1	<0.1	29.4	30.7	41.0	54.6	n.a.	n.a.
Tunisia	4.3	<2.5	9.1	9.1	18.2	20.0	2.8	10.1	8.4	14.3	17.2	24.6	26.9	28.1	31.2	8.5	13.5	7.5	7.5
Northern Africa (excluding Sudan)	**7.3**	**5.2**	**9.1**	**8.2**	**26.0**	**28.5**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**26.8**	**29.5**	**31.2**	**32.1**	**40.6**	**37.1**	**11.5**	**11.4**
Sub-Saharan Africa	**24.5**	**21.6**	**18.9**	**20.6**	**51.8**	**55.6**	**6.3**	**34.5**	**31.1**	**3.8**	**3.6**	**8.0**	**9.2**	**39.5**	**39.2**	**34.5**	**44.0**	**14.4**	**14.0**
Eastern Africa	**33.4**	**26.9**	**24.2**	**24.4**	**59.2**	**60.9**	**5.3**	**38.5**	**34.5**	**4.0**	**3.7**	**5.3**	**6.4**	**30.6**	**31.2**	**48.6**	**61.1**	**13.8**	**13.4**
Burundi	n.a.	n.a.					6.0	57.6	54.2	2.9	1.4	4.4	5.4	25.6	26.7	69.3	82.3	15.5	15.1
Comoros	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	11.2	31.1	n.a.	10.6	n.a.	6.7	7.8	27.6	29.3	11.4	n.a.	24.2	23.7
Djibouti	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	21.5	33.5	n.a.	8.1	n.a.	12.3	13.5	30.9	32.7	12.4	n.a.	n.a.	n.a.
Eritrea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	14.6	52.5	n.a.	2.1	n.a.	4.1	5.0	36.9	38.1	68.7	n.a.	n.a.	n.a.
Ethiopia	37.2	19.7	14.5	14.1	56.2	57.9	9.8	44.4	36.8	1.8	2.1	3.6	4.5	21.7	23.4	52.0	58.8	n.a.	n.a.
Kenya	28.7	23.0	19.1[c]	n.a.	56.5[c]	n.a.	6.9	35.5	26.2	5.0	4.1	5.9	7.1	27.5	27.2	31.9	61.4	11.7	11.5
Madagascar	33.5	41.7	n.a.	n.a.	n.a.	n.a.	7.5	48.9	41.6	1.1	1.4	4.3	5.3	36.6	36.8	41.9	50.6	17.5	17.1
Malawi	22.5	18.8	51.7[c,d]	51.8[c,d]	81.7[c,d]	82.2[c,d]	4.0	47.3	39.0	9.0	2.5	4.8	5.8	32.3	34.4	70.8	59.4	14.9	14.5
Mauritius	5.1	5.3	5.2	6.7	13.0	20.5	n.a.	n.a.	n.a.	n.a.	n.a.	9.6	10.8	21.6	25.1	n.a.	n.a.	17.0	17.1
Mozambique	33.4	32.6	40.7	40.7	68.4	68.4	6.1	42.9	42.3	7.8	7.0	6.1	7.2	49.9	51.0	40.0	n.a.	14.1	13.8
Rwanda	34.9	35.6					2.4	43.8	36.9	6.0	5.6	4.7	5.8	19.4	22.3	83.8	86.9	8.2	7.9
Seychelles	n.a.	n.a.	3.2[c]	n.a.	14.3[c]	n.a.	4.3	7.9	n.a.	10.2	n.a.	12.4	14.0	20.3	22.3	n.a.	n.a.	11.0	11.7

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Somalia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	14.3	25.3	n.a.	3.0	n.a.	7.0	8.3	43.5	44.4	5.3	n.a.	n.a.	n.a.
South Sudan	--	n.a.	65.4[c]	63.7[c]	85.1[c]	84.9[c]	22.7	31.3	n.a.	6.0	n.a.	<0.1	<0.1	32.3	34.0	44.5	n.a.	n.a.	n.a.
Uganda	n.a.	n.a.	17.5[c,d]	20.6[c,d]	58[c,d]	66.3[c,d]	4.2	33.7	28.9	5.8	3.7	4.3	5.3	38.6	37.2	62.3	65.5	n.a.	n.a.
United Republic of Tanzania	31.7	25.0	n.a.	23.8[c]	n.a.	55.0[c]	6.2	35.0	31.8	5.1	2.8	6.9	8.4	29.6	28.5	48.7	57.8	10.7	10.5
Zambia	n.a.	n.a.					5.6	45.8	34.6	8.4	5.2	6.8	8.1	31.2	33.7	59.9	69.9	11.9	11.6
Zimbabwe	n.a.	n.a.	35.5	34.2	64.7	66.7	3.2	32.2	23.5	5.8	2.5	14.3	15.5	30.1	28.8	31.3	41.9	12.8	12.6
Middle Africa	**35.7**	**29.2**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**6.7**	**34.4**	**31.5**	**4.8**	**5.1**	**6.7**	**7.9**	**45.4**	**43.5**	**28.5**	**n.a.**	**12.8**	**12.5**
Angola	52.2	18.6	21.0	n.a.	66.5	n.a.	8.2	29.2	37.6	n.a.	3.4	6.8	8.2	47.3	47.7	n.a.	37.4	12.0	15.3
Cameroon	16.1	6.3	n.a.	n.a.	n.a.	n.a.	5.7	32.6	28.9	6.5	11.0	9.8	11.4	41.7	41.4	19.9	39.7	9.6	12.0
Central African Republic	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	7.4	39.7	40.8	2.0	n.a.	6.4	7.5	46.2	46.0	33.0	28.8	11.5	14.5
Chad	37.9	39.6	n.a.	n.a.	n.a.	n.a.	16.3	38.7	39.8	2.8	2.8	5.1	6.1	48.1	47.7	3.2	0.1	n.a.	n.a.
Congo	34.1	28.0					6.0	24.4	21.2	3.5	5.9	8.3	9.6	53.8	51.9	20.2	32.9	9.4	11.6
Democratic Republic of the Congo	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	8.5	43.4	n.a.	4.9	n.a.	5.6	6.7	44.7	41.0	36.4	n.a.	8.7	10.8
Equatorial Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.1	26.2	n.a.	9.7	n.a.	6.8	8.0	44.1	43.7	7.4	n.a.	n.a.	n.a.
Gabon	14.5	16.6	n.a.	n.a.	n.a.	n.a.	3.4	17.0	n.a.	7.7	n.a.	13.5	15.0	58.3	59.1	5.1	n.a.	11.4	14.2
Sao Tome and Principe	9.2	12.0	n.a.	n.a.	n.a.	n.a.	11.6	30.8	17.2	11.1	2.4	10.7	12.4	45.4	46.1	50.3	71.7	5.1	6.6
Southern Africa	**5.0**	**7.8**	**19.5**	**19.8**	**44.4**	**44.8**	**3.3**	**30.4**	**29.0**	**11.7**	**12.7**	**25.0**	**27.1**	**25.9**	**26.0**	**n.a.**	**33.5**	**14.3**	**14.2**
Botswana	22.5	24.1	34.9	41.2	59.3	66.7	7.3	28.9	n.a.	10.0	n.a.	17.5	18.9	29.4	30.2	20.3	30.0	15.9	15.6
Eswatini	9.4	16.9	29.4	30.0	62.6	63.3	0.8	30.9	25.5	10.7	9.0	14.9	16.5	26.7	27.2	43.8	63.8	10.5	10.3
Lesotho	13.8	32.6	n.a.	27.0[c]	n.a.	49.7[c]	3.8	39.3	34.6	7.3	6.6	14.9	16.6	27.2	27.4	52.9	59.0	14.8	14.6
Namibia	15.7	14.7	30.6[c,d]	31.3[c,d]	53.3[c,d]	56.4[c,d]	7.6	29.2	n.a.	4.7	n.a.	15.1	17.2	24.7	23.2	22.1	n.a.	15.7	15.5
South Africa	3.5	5.7	18.0	n.a.	42.9	n.a.	5.6	27.2	27.4	17.2	13.3	26.1	28.3	25.7	25.8	n.a.	31.6	14.3	14.2

TABLE A1.1
(CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Western Africa	**13.8**	**14.7**	**12.7**	**16.0**	**44.3**	**50.8**	**7.5**	**30.6**	**27.7**	**2.3**	**1.9**	**7.4**	**8.9**	**50.0**	**49.3**	**22.1**	**32.2**	**15.6**	**15.2**
Benin	12.2	7.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	32.2	n.a.	1.9	8.2	9.6	51.5	46.9	32.5	41.4	17.2	16.9
Burkina Faso	23.0	19.2	10.1[c,d]	13.9[c,d]	42.4[c,d]	47.7[c,d]	10.7	32.8	24.9	0.6	1.0	4.5	5.6	50.5	49.6	38.2	55.8	13.5	13.1
Cabo Verde	11.1	18.5	n.a.	9.6[c]	n.a.	37.7[c]	n.a.	n.a.	n.a.	n.a.	n.a.	10.3	11.8	31.2	33.3	59.6	n.a.	n.a.	n.a.
Côte d'Ivoire	20.3	19.9					7.6	29.9	21.6	3.2	1.5	8.7	10.3	51.8	52.9	11.8	23.1	15.8	15.5
Gambia	21.9	11.9	23.6	24.6	52.7	54.3	9.5	21.1	13.6	1.1	2.5	8.7	10.3	57.2	57.5	33.1	53.3	17.2	16.8
Ghana	11.4	6.5	7.6[c,d]	8.4[c,d]	48.8[c,d]	51.1[c,d]	6.2	22.8	17.5	2.6	1.4	9.4	10.9	48.6	46.4	45.7	42.9	14.5	14.2
Guinea	n.a.	n.a.	44.3	49.7	72.5	74.1	10.0	31.1	30.3	3.8	5.6	6.4	7.7	50.9	50.6	20.4	33.4	n.a.	n.a.
Guinea-Bissau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.9	32.0	27.6	2.8	2.3	7.9	9.5	44.0	43.8	38.3	52.5	21.8	21.1
Liberia	35.9	37.5	63.1	60.4	87.6	88.5	4.0	39.0	30.1	2.7	2.7	8.6	9.9	37.3	34.7	27.8	n.a.	n.a.	n.a.
Mali	13.5	5.1	n.a.	n.a.	n.a.	n.a.	8.9	27.8	26.9	1.0	2.0	7.2	8.6	54.8	51.3	20.2	40.2	n.a.	n.a.
Mauritania	9.6	11.9	14.2	22.4	31.6	44.8	11.7	23.0	22.8	1.2	1.5	11.0	12.7	37.2	37.2	26.7	40.3	n.a.	n.a.
Niger	n.a.	n.a.					13.4	39.9	48.5	0.8	1.0	4.5	5.5	49.2	49.5	23.3	n.a.	n.a.	n.a.
Nigeria	7.4	12.6	6.5[c,d]	9.1[c,d]	36.5[c,d]	44.1[c,d]	10.2	35.8	36.8	3.0	2.1	7.4	8.9	49.9	49.8	14.7	25.2	n.a.	n.a.
Senegal	17.4	9.4	14.5	16.7	39.3	40.7	8.7	15.5	18.8	0.7	2.6	7.6	8.8	53.5	49.9	37.5	42.1	18.9	18.5
Sierra Leone	46.7	26.0	30.4[c,d]	31.8[c,d]	78.4[c,d]	81.4[c,d]	8.5	44.4	29.5	9.6	4.5	7.4	8.7	47.9	48.0	31.2	47.2	14.9	14.4
Togo	27.8	20.7					5.5	26.2	23.8	1.7	1.5	7.1	8.4	50.0	48.9	62.1	64.3	16.3	16.1
Sub-Saharan Africa (including Sudan)	**24.3**	**21.2**	**18.7**	**20.5**	**51.4**	**55.3**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**7.7**	**8.9**	**39.1**	**38.8**	**34.8**	**44.4**	**14.4**	**14.0**
ASIA*	**14.2**	**8.3**	**7.5**	**8.6**	**19.1**	**21.9**	**9.1**	**27.0**	**21.8**	**4.4**	**4.8**	**6.1**	**7.3**	**33.5**	**36.6**	**39.0**	**45.3**	**17.8**	**17.3**
Central Asia	**11.1**	**2.9**	**1.7**	**2.4**	**9.2**	**13.6**	**2.4**	**14.9**	**9.9**	**7.3**	**6.2**	**15.6**	**17.7**	**33.2**	**33.8**	**29.2**	**44.8**	**5.6**	**5.4**
Kazakhstan	7.4	<2.5	n.a.	<0.5[c]	n.a.	2.1[c]	4.1	13.1	8.0	13.3	9.3	19.0	21.0	29.4	30.7	31.8	37.8	6.1	5.4
Kyrgyzstan	9.1	6.4	n.a.	0.8[c]	n.a.	6.3[c]	2.8	17.9	11.8	8.9	6.9	14.4	16.6	32.1	36.2	56.0	45.6	5.6	5.5

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Tajikistan	n.a.	n.a.					9.9	26.9	17.5	6.7	3.3	12.2	14.2	29.7	30.5	32.6	35.8	5.7	5.6
Turkmenistan	4.3	4.0	n.a.	n.a.	n.a.	n.a.	7.2	18.9	11.5	4.5	5.9	16.3	18.6	31.1	32.6	10.9	58.3	5.0	4.9
Uzbekistan	14.9	2.6	1.9	2.8	11.2	17.2	4.4	19.6	10.8	12.2	4.6	14.4	16.6	36.8	36.2	23.8	49.5	5.3	5.3
Eastern Asia*	**7.7**	**<2.5**	**1.0**	**1.6**	**6.1**	**9.0**	**1.7**	**7.9**	**4.5**	**6.4**	**6.3**	**4.9**	**6.0**	**20.8**	**26.1**	**28.5**	**22.0**	**5.1**	**5.1**
China	7.9	<2.5					2.3	9.4	n.a.	6.6	n.a.	5.0	6.2	20.7	26.4	27.6	20.8	5.0	5.0
China, mainland	*8.0*	*<2.5*					*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
Taiwan Province of China	*4.4*	*3.5*					*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
China, Hong Kong SAR	*<2.5*	*<2.5*					*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
China, Macao SAR	*16.0*	*8.5*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
Democratic People's Republic of Korea	33.9	47.6	n.a.	n.a.	n.a.	n.a.	4.0	27.9	19.1	<0.1	2.3	5.9	6.8	30.0	32.5	68.9	71.4	n.a.	n.a.
Japan	<2.5	<2.5	<0.5	0.7	2.6	3.1	2.3	7.1	n.a.	1.5	n.a.	3.6	4.3	19.4	21.5	n.a.	n.a.	9.6	9.5
Mongolia	29.7	21.3	3.4	5.9	21.0	27.5	1.8	15.5	9.4	6.7	10.5	17.9	20.6	16.3	19.5	65.7	50.2	5.5	5.4
Republic of Korea	2.5	<2.5	<0.5[c]	<0.5	4.8[c]	5.1	1.2	2.5	n.a.	7.3	n.a.	4.1	4.7	18.4	22.7	n.a.	n.a.	5.4	5.8
Eastern Asia (excluding China, mainland)	**5.8**	**7.2**	**0.5**	**0.8**	**3.9**	**4.8**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**8.5**	**8.4**
South-eastern Asia	**17.1**	**9.8**	**4.1**	**5.3**	**16.4**	**19.2**	**8.2**	**29.4**	**24.7**	**5.5**	**7.5**	**5.4**	**6.7**	**25.9**	**28.3**	**33.5**	**47.9**	**12.4**	**12.3**
Brunei Darussalam	<2.5	<2.5	n.a.	n.a.	n.a.	n.a.	2.9	19.7	n.a.	8.3	n.a.	12.1	14.1	13.9	16.9	n.a.	n.a.	12.1	10.8
Cambodia	17.1	14.5	16.9	13.6	48.9	44.1	11.0	39.8	32.4	1.9	2.2	3.1	3.9	46.0	46.8	72.8	65.2	12.6	12.1
Indonesia	19.3	9.0	1.0[c,d]	0.8[c,d]	7.6[c,d]	7.0[c,d]	12.3	39.2	30.5	12.3	8.0	5.5	6.9	26.2	28.8	40.9	50.7	10.2	10.0
Lao People's Democratic Republic	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.9	44.2	33.1	2.0	3.5	4.1	5.3	36.5	39.7	39.7	44.4	17.7	17.3
Malaysia	3.3	3.0	7.8	6.7	17.4	15.1	n.a.	17.2	20.7	n.a.	6.0	13.1	15.6	22.2	24.9	n.a.	40.3	11.3	11.3
Myanmar	27.9	14.1	n.a.	n.a.	n.a.	n.a.	7.9	35.1	29.4	2.6	1.5	4.6	5.8	41.7	46.3	23.6	51.2	12.5	12.3

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Philippines	15.0	14.5	12.2	17.6	44.0	55.3	7.0	33.4	30.3	3.7	4.0	5.4	6.4	18.0	15.7	33.0	n.a.	20.4	20.1
Singapore	n.a.	n.a.	1.0	1.4	2.8	4.7	n.a.	n.a.	n.a.	n.a.	n.a.	5.6	6.1	19.0	22.2	n.a.	n.a.	9.7	9.6
Thailand	12.0	9.3					6.7	16.4	10.5	10.9	8.2	7.9	10.0	26.3	31.8	12.3	23.0	10.8	10.5
Timor-Leste	32.3	30.9	n.a.	n.a.	n.a.	n.a.	18.9	57.5	n.a.	5.8	n.a.	2.9	3.8	33.1	41.3	50.8	50.2	n.a.	n.a.
Viet Nam	15.6	6.4	n.a.	<0.5[c]	n.a.	6.2[c]	6.7	26.7	23.8	4.8	5.9	1.6	2.1	21.0	24.2	17.0	n.a.	8.4	8.2
Southern Asia	**20.0**	**13.4**	**14.6**	**16.0**	**30.9**	**33.4**	**14.3**	**38.0**	**31.7**	**2.5**	**2.5**	**4.5**	**5.4**	**48.2**	**48.7**	**47.4**	**57.2**	**27.2**	**26.4**
Afghanistan	36.2	29.9	14.8	22.7	45.1	60.8	n.a.	n.a.	38.2	n.a.	4.1	4.4	5.5	37.4	42.0	n.a.	57.5	n.a.	n.a.
Bangladesh	14.3	13.0	13.3	10.6	32.2	31.5	15.7	41.3	30.8	1.9	2.2	2.8	3.6	40.3	39.9	64.1	65.0	29.0	27.8
Bhutan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.9	33.5	n.a.	7.6	n.a.	5.2	6.4	39.2	35.6	48.7	51.4	11.9	11.7
India	21.7	14.0					20.0	47.8	34.7	1.9	1.6	3.1	3.9	51.3	51.4	46.4	58.0	n.a.	n.a.
Iran (Islamic Republic of)	5.2	4.7	9.5	8.3	48.0	39.7	4.0	6.8	n.a.	n.a.	n.a.	23.3	25.8	27.9	30.5	53.1	n.a.	n.a.	n.a.
Maldives	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	10.6	19.0	n.a.	6.2	n.a.	6.7	8.6	41.1	42.6	45.3	63.0	12.0	11.7
Nepal	16.9	6.1	10.4	10.3	29.5	33.8	11.2	40.5	36.0	1.5	1.2	3.3	4.1	35.4	35.1	69.6	65.2	22.6	21.8
Pakistan	17.7	12.3					14.8	43.0	37.6	6.4	2.5	7.1	8.6	50.1	52.1	37.0	47.5	n.a.	n.a.
Sri Lanka	14.8	7.6					21.3	14.6	17.3	0.6	2.0	4.1	5.2	30.3	32.6	75.8	82.0	16.6	15.9
Southern Asia (excluding India)	**15.6**	**12.1**	**12.4**	**12.7**	**38.6**	**38.1**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**8.2**	**9.5**	**n.a.**	**n.a.**	**49.9**	**55.3**	**n.a.**	**n.a.**
Western Asia	**11.7**	**11.2**	**8.6**	**9.4**	**27.7**	**28.5**	**3.7**	**15.9**	**12.7**	**7.7**	**8.4**	**27.2**	**29.8**	**33.9**	**36.1**	**32.3**	**33.1**	**10.0**	**9.9**
Armenia	12.3	2.6	3.7	4.1	28.7	34.9	4.1	20.9	9.4	16.5	13.7	18.3	20.2	24.7	29.4	34.1	44.5	8.0	9.0
Azerbaijan	4.8	<2.5	<0.5	<0.5	5.9	9.6	6.6	16.4	n.a.	10.4	n.a.	17.7	19.9	36.2	38.5	10.8	n.a.	7.0	7.3
Bahrain	n.a.	n.a.					n.a.	n.a.	n.a.	n.a.	n.a.	27.6	29.8	41.4	42.0	n.a.	n.a.	10.2	11.9
Cyprus	7.7	6.8					n.a.	n.a.	n.a.	n.a.	n.a.	20.4	21.8	21.6	25.2	n.a.	n.a.	n.a.	n.a.

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Georgia	4.2	8.2	7.0	7.3	31.8	38.3	1.6	11.3	n.a.	19.9	n.a.	19.3	21.7	25.8	27.5	54.8	20.4	4.8	6.1
Iraq	23.9	23.7					6.5	22.1	12.6	11.4	6.1	28.0	30.4	29.0	29.1	19.4	25.8	n.a.	n.a.
Israel	<2.5	<2.5	1.3[c,d]	1.6[c,d]	11.3[c,d]	12.2[c,d]	n.a.	n.a.	n.a.	n.a.	n.a.	24.8	26.1	13.1	15.7	n.a.	n.a.	8.0	7.8
Jordan	5.6	8.5					2.4	7.8	n.a.	4.7	n.a.	33.1	35.5	30.8	34.7	22.7	25.4	13.9	13.8
Kuwait	<2.5	<2.5	4.9	4.9	12.6	12.3	2.4	4.3	6.4	9.5	5.5	35.6	37.9	21.0	23.8	n.a.	n.a.	9.9	9.9
Lebanon	11.0	5.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	29.7	32.0	28.1	31.2	n.a.	n.a.	9.3	9.2
Oman	9.7	7.8	n.a.	n.a.	n.a.	n.a.	7.1	9.8	11.4	1.7	4.2	24.3	27.0	36.3	38.2	n.a.	23.2	10.6	10.5
Palestine	n.a.	n.a.	n.a.	4.4[c]	n.a.	26.3[c]	3.3	10.9	7.4	5.3	8.2	n.a.	n.a.	n.a.	n.a.	28.7	38.1	8.5	n.a.
Qatar	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	32.4	35.1	25.8	27.7	29.3	n.a.	7.5	7.3
Saudi Arabia	4.8	4.8					11.8	9.3	n.a.	6.1	n.a.	32.8	35.4	41.5	42.9	n.a.	n.a.	n.a.	n.a.
Syrian Arab Republic	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	11.5	27.9	n.a.	17.9	n.a.	25.1	27.8	31.7	33.6	42.6	n.a.	n.a.	n.a.
Turkey	<2.5	<2.5					1.0	12.5	6.0	9.8	8.1	29.5	32.1	29.0	30.9	41.6	40.7	11.6	11.4
United Arab Emirates	8.9	3.1					n.a.	n.a.	n.a.	n.a.	n.a.	29.0	31.7	25.7	27.8	n.a.	n.a.	12.7	12.7
Yemen	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	13.3	46.6	n.a.	1.5	n.a.	14.6	17.1	65.5	69.6	n.a.	n.a.	n.a.	n.a.
Central Asia and Southern Asia	**19.7**	**13.0**	**14.1**	**15.5**	**30.1**	**32.7**	**13.8**	**37.1**	**30.7**	**2.7**	**2.7**	**4.9**	**5.9**	**47.7**	**48.2**	**46.6**	**56.6**	**26.4**	**25.5**
Eastern Asia and South-eastern Asia*	**10.2**	**4.0**	**1.9**	**2.7**	**8.9**	**11.9**	**4.2**	**16.1**	**12.3**	**6.0**	**6.8**	**5.0**	**6.2**	**22.2**	**26.7**	**30.4**	**29.8**	**8.1**	**8.0**
Western Asia and Northern Africa	**10.7**	**9.0**	**9.2**	**9.5**	**28.1**	**30.2**	**5.5**	**17.8**	**15.2**	**8.9**	**9.9**	**25.3**	**27.7**	**32.5**	**34.1**	**37.4**	**38.7**	**11.2**	**11.1**
LATIN AMERICA AND THE CARIBBEAN	**8.7**	**7.2**	**7.2**	**9.4**	**25.9**	**31.7**	**1.3**	**11.4**	**9.0**	**7.2**	**7.5**	**22.2**	**24.2**	**21.2**	**22.0**	**33.4**	**n.a.**	**8.7**	**8.7**
Caribbean	**21.3**	**16.7**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**2.9**	**10.3**	**8.1**	**6.2**	**7.0**	**22.0**	**24.7**	**30.4**	**31.3**	**29.7**	**25.9**	**10.1**	**9.9**
Antigua and Barbuda	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	17.1	18.9	21.5	22.1	n.a.	n.a.	9.1	9.1

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Bahamas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	29.5	31.6	22.3	23.1	n.a.	n.a.	13.2	13.1
Barbados	6.2	4.3	n.a.	n.a.	n.a.	n.a.	6.8	7.7	n.a.	12.2	n.a.	20.9	23.1	20.7	21.6	19.7	n.a.	n.a.	n.a.
Cuba	<2.5	<2.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	22.6	24.6	24.3	25.1	48.6	32.8	5.2	5.3
Dominica	5.5	5.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	25.6	27.9	23.5	24.4	n.a.	n.a.	n.a.	n.a.
Dominican Republic	19.3	5.5					2.3	10.1	n.a.	8.3	n.a.	24.5	27.6	29.5	29.7	8.0	4.6	11.4	11.3
Grenada	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	19.1	21.3	22.8	23.5	n.a.	n.a.	n.a.	n.a.
Haiti	55.0	48.2	n.a.	n.a.	n.a.	n.a.	5.1	22.0	21.9	3.6	3.4	19.4	22.7	46.1	46.2	39.3	39.9	n.a.	n.a.
Jamaica	7.5	8.7	n.a.	n.a.	n.a.	n.a.	3.0	6.8	6.0	7.8	8.3	22.3	24.7	21.8	22.5	23.8	n.a.	14.7	14.6
Puerto Rico	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saint Kitts and Nevis	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	20.4	22.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saint Lucia	n.a.	n.a.	4.5[c]	n.a.	22.2[c]	n.a.	3.7	2.5	n.a.	6.3	n.a.	17.4	19.7	21.4	21.9	3.5	n.a.	n.a.	n.a.
Saint Vincent and the Grenadines	8.0	5.7					n.a.	n.a.	n.a.	n.a.	n.a.	21.2	23.7	23.9	24.8	n.a.	n.a.	n.a.	n.a.
Trinidad and Tobago	11.2	5.5	n.a.	n.a.	n.a.	n.a.	6.4	9.2	n.a.	11.4	n.a.	16.3	18.6	21.8	22.5	21.5	n.a.	12.5	12.4
Central America	**8.0**	**8.7**	**10.2**	**13.1**	**31.7**	**37.4**	**0.9**	**16.0**	**12.6**	**6.5**	**6.9**	**25.1**	**27.3**	**15.3**	**15.5**	**21.6**	**33.2**	**8.8**	**8.7**
Belize	5.8	7.6	n.a.	n.a.	n.a.	n.a.	3.3	19.3	15.0	7.9	7.3	22.0	24.1	21.0	21.7	14.7	33.2	8.7	8.6
Costa Rica	4.5	3.2	4.7	5.4	21.8	25.5	1.0	5.6	n.a.	8.1	n.a.	22.9	25.7	13.3	14.9	32.5	n.a.	7.3	7.5
El Salvador	9.3	8.9	13.8	14.6	42.2	42.2	1.6	20.8	13.6	5.7	6.4	22.2	24.6	18.9	22.7	31.4	46.7	10.4	10.3
Guatemala	19.0	16.1	16.1	18.1	42.7	45.2	1.0	51.5	46.7	4.9	4.9	18.9	21.2	17.5	16.4	49.6	53.2	11.2	11.0
Honduras	22.4	13.8	23.2	23.9	56.0	55.0	1.4	22.6	n.a.	5.2	n.a.	19.0	21.4	16.3	17.8	30.7	n.a.	11.0	10.9
Mexico	4.5	7.1	8.0	11.5	27.4	34.9	1.6	13.6	10.0	9.0	5.3	26.8	28.9	14.7	14.6	14.4	28.6	8.0	7.9
Nicaragua	23.3	17.2					2.2	17.3	n.a.	8.3	n.a.	21.5	23.7	13.9	16.3	31.7	n.a.	10.8	10.7
Panama	21.7	6.9					1.2	19.0	n.a.	9.7	n.a.	20.6	22.7	24.0	23.4	n.a.	n.a.	10.2	10.1

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
South America	**7.6**	**5.5**	**5.7**	**7.7**	**23.2**	**29.4**	**1.3[a]**	**9.2**	**7.3[a]**	**7.6**	**7.9[a]**	**21.1**	**23.0**	**22.7**	**23.9**	**41.9**	**n.a.**	**8.6**	**8.6**
Argentina	3.8	3.8	5.8	12.9	19.2	35.8	1.2	8.2	7.9	9.9	10.0	26.3	28.3	15.9	18.6	32.0	n.a.	7.1	7.3
Bolivia (Plurinational State of)	26.9	15.5					1.5	18.2	16.1	7.4	10.1	18.3	20.2	30.1	30.2	64.3	58.3	7.3	7.2
Brazil	4.1	<2.5	1.9	1.6	18.3	20.6	1.8	7.0	n.a.	6.4	n.a.	20.1	22.1	25.3	27.2	38.6	n.a.	8.4	8.4
Chile	3.1	3.5	2.7[c,d]	3.8[c,d]	10.2[c,d]	15.6[c,d]	0.3	2.0	1.8	9.5	9.3	26.1	28.0	11.6	15.0	n.a.	n.a.	6.0	6.2
Colombia	11.3	5.5					0.9	12.6	12.7	4.8	5.7	20.4	22.3	22.3	21.1	n.a.	36.1	10.0	10.0
Ecuador	22.5	8.8	7.1[c]	n.a.	23.3[c]	n.a.	2.4	25.4	23.9	7.5	8.0	18.1	19.9	18.4	18.8	n.a.	n.a.	11.3	11.2
Guyana	7.2	5.7	n.a.	n.a.	n.a.	n.a.	5.5	19.3	11.3	6.7	5.3	17.9	20.2	33.4	32.3	31.3	21.1	15.8	15.6
Paraguay	9.6	8.8					2.6	10.7	5.6	11.3	12.4	18.2	20.3	20.5	22.8	24.4	29.6	8.2	8.1
Peru	18.9	6.7	9.0	n.a.	29.9	n.a.	0.6	18.4	12.2	7.2	8.6	18.1	19.7	20.0	18.5	67.4	66.4	9.5	9.4
Suriname	9.9	8.1	n.a.	n.a.	n.a.	n.a.	5.0	8.8	n.a.	4.0	n.a.	24.4	26.4	23.4	24.1	2.8	n.a.	14.9	14.7
Uruguay	3.9	<2.5	6.8	6.4	21.6	23.2	1.3	10.7	n.a.	7.2	n.a.	26.0	27.9	18.3	20.8	n.a.	n.a.	7.9	7.6
Venezuela (Bolivarian Republic of)	8.5	31.4					4.1	13.4	n.a.	6.4	n.a.	24.0	25.6	22.9	23.9	n.a.	n.a.	8.6	9.1
OCEANIA	**5.5**	**5.8**	**2.8**	**4.0**	**10.7**	**13.7**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**25.8**	**28.1**	**14.8**	**16.5**	**n.a.**	**n.a.**	**7.8**	**7.9**
Australia and New Zealand**	**<2.5**	**<2.5**	**2.8**	**4.0**	**10.6**	**13.6**	**n.a.**	**n.a.**	**n.a.**	**16.2**	**20.7**	**27.0**	**29.3**	**8.3**	**9.5**	**n.a.**	**n.a.**	**6.2**	**6.4**
Australia	<2.5	<2.5	2.8	3.9	10.8	13.5	<0.1	2.0	n.a.	7.7	22.0	26.7	29.0	8.1	9.1	n.a.	n.a.	6.3	6.5
New Zealand	<2.5	<2.5	2.8	4.5	10.0	14.0	n.a.	n.a.	n.a.	n.a.	n.a.	28.4	30.8	9.7	11.6	n.a.	n.a.	5.9	5.7
Oceania excluding Australia and New Zealand	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**9.5**	**37.9**	**38.4**	**7.3**	**9.4**	**21.3**	**23.6**	**33.2**	**35.4**	**56.9**	**61.3**	**10.0**	**9.9**
Melanesia	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**20.1**	**22.3**	**33.9**	**35.9**	**56.9**	**61.1**	**10.1**	**9.9**
Fiji	3.8	3.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	27.7	30.2	29.8	31.0	n.a.	n.a.	n.a.	n.a.

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
New Caledonia	9.6	8.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Papua New Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	14.1	49.5	n.a.	13.7	n.a.	19.0	21.3	34.4	36.6	56.1	59.7	n.a.	n.a.
Solomon Islands	10.6	13.2	n.a.	n.a.	n.a.	n.a.	4.3	32.8	31.7	2.5	4.5	19.9	22.5	38.4	38.9	73.7	76.2	n.a.	n.a.
Vanuatu	6.4	9.8	n.a.	n.a.	n.a.	n.a.	5.9	25.7	n.a.	4.7	n.a.	22.6	25.2	24.1	24.0	39.5	n.a.	11.0	10.9
Micronesia	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**43.2**	**45.9**	**22.3**	**25.1**	**66.4**	**n.a.**	**9.4**	**9.3**
Kiribati	5.0	3.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	43.5	46.0	23.8	26.1	66.4	n.a.	n.a.	n.a.
Marshall Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	34.8	n.a.	4.1	50.7	52.9	24.1	26.6	27.3	43.1	n.a.	n.a.
Micronesia (Federated States of)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	42.9	45.8	19.5	23.3	n.a.	n.a.	n.a.	n.a.
Nauru	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.0	24.0	n.a.	2.8	n.a.	59.6	61.0	n.a.	n.a.	67.2	n.a.	n.a.	n.a.
Palau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	53.1	55.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Polynesia	**3.5**	**3.0**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**44.9**	**47.6**	**23.0**	**27.6**	**51.6**	**70.3**	**8.1**	**8.1**
American Samoa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cook Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	53.8	55.9	n.a.	n.a.	n.a.	n.a.	3.5	3.5
French Polynesia	3.9	3.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Niue	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	46.8	50.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Samoa	2.9	<2.5	n.a.	3.4[c]	n.a.	23.6[c]	n.a.	n.a.	4.9	n.a.	5.3	44.7	47.3	25.4	31.3	51.3	70.3	n.a.	n.a.
Tokelau (Associate Member)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tonga	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.2	8.1	n.a.	17.3	n.a.	45.4	48.2	19.0	21.3	52.2	n.a.	n.a.	n.a.
Tuvalu	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.3	10.0	n.a.	6.3	n.a.	48.6	51.6	n.a.	n.a.	34.7	n.a.	n.a.	n.a.
NORTHERN AMERICA AND EUROPE	**<2.5**	**<2.5**	**1.4**	**1.1**	**9.2**	**8.0**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**25.0**	**26.9**	**15.4**	**17.8**	**n.a.**	**n.a.**	**7.0**	**7.0**
Northern America**	**<2.5**	**<2.5**	**1.0**	**0.8**	**9.9**	**8.2**	**0.4**	**2.7**	**2.6**	**8.0**	**8.9**	**32.9**	**35.5**	**10.6**	**12.9**	**25.5**	**34.7**	**7.9**	**7.9**
Bermuda	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

TABLE A1.1
(CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Canada	<2.5	<2.5	0.6[c]	n.a.	5.0[c]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	27.1	29.4	8.5	9.5	n.a.	n.a.	6.2	6.4
Greenland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United States of America	<2.5	<2.5	1.1[c]	0.8[c]	10.5[c]	8.5[c]	0.5	2.1	3.5	6.0	9.4	33.6	36.2	10.9	13.3	25.5	34.7	8.1	8.0
Europe	**<2.5**	**<2.5**	**1.5**	**1.2**	**8.8**	**7.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**21.4**	**22.9**	**17.6**	**20.2**	**n.a.**	**n.a.**	**6.6**	**6.5**
Eastern Europe	**<2.5**	**<2.5**	**1.5**	**1.1**	**11.2**	**9.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**22.0**	**23.4**	**22.1**	**24.2**	**n.a.**	**n.a.**	**6.2**	**6.1**
Belarus	<2.5	<2.5					2.2	4.5	n.a.	9.7	n.a.	23.0	24.5	20.4	22.6	19.0	n.a.	4.9	5.1
Bulgaria	4.9	3.0	1.9	1.9	14.9	12.5	4.5	6.6	7.0	6.5	6.9	23.2	25.0	24.2	26.4	n.a.	n.a.	9.4	9.6
Czechia	<2.5	<2.5	0.7	<0.5	5.8	3.7	n.a.	n.a.	n.a.	n.a.	n.a.	24.5	26.0	23.3	25.7	n.a.	n.a.	7.9	7.8
Hungary	<2.5	<2.5	1.4	0.8	11.3	6.9	n.a.	n.a.	n.a.	n.a.	n.a.	24.5	26.4	23.6	25.8	n.a.	n.a.	8.6	8.8
Poland	<2.5	<2.5	1.8	<0.5	8.9	4.3	n.a.	2.9	2.6	n.a.	n.a.	21.5	23.1	23.5	25.7	n.a.	n.a.	5.7	5.9
Republic of Moldova	n.a.	n.a.	1.6	4.0	19.3	27.5	1.9	6.4	n.a.	4.9	n.a.	17.5	18.9	25.6	26.8	36.4	n.a.	5.0	5.0
Romania	<2.5	<2.5	5.6	3.4	19.3	14.5	n.a.	n.a.	n.a.	n.a.	n.a.	20.7	22.5	24.6	26.7	n.a.	n.a.	8.3	8.2
Russian Federation	<2.5	<2.5	0.7	0.8[c]	8.2	8.4[c]	n.a.	n.a.	n.a.	n.a.	n.a.	21.9	23.1	21.3	23.3	n.a.	n.a.	6.0	5.8
Slovakia	5.5	6.1	1.1	0.8	6.2	5.0	n.a.	n.a.	n.a.	n.a.	n.a.	19.1	20.5	24.5	26.6	n.a.	n.a.	8.0	7.6
Ukraine	<2.5	3.5	2.0	1.6	19.8	18.3	n.a.	n.a.	n.a.	n.a.	n.a.	22.7	24.1	21.3	23.5	19.7	n.a.	5.4	5.6
Northern Europe	**<2.5**	**<2.5**	**1.8**	**1.4**	**6.7**	**5.6**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**23.7**	**25.8**	**12.6**	**16.0**	**n.a.**	**n.a.**	**6.1**	**6.0**
Denmark	<2.5	<2.5	1.0	1.1	5.9	5.2	n.a.	n.a.	n.a.	n.a.	n.a.	18.1	19.7	13.4	16.3	n.a.	n.a.	5.3	5.3
Estonia	<2.5	<2.5	0.9	0.9	9.5	7.4	n.a.	n.a.	n.a.	n.a.	n.a.	20.1	21.2	23.4	25.6	n.a.	n.a.	4.4	4.3
Finland	<2.5	<2.5	2.4	2.0	9.3	7.7	n.a.	n.a.	n.a.	n.a.	n.a.	20.7	22.2	13.1	15.9	n.a.	n.a.	4.2	4.1
Iceland	<2.5	<2.5	1.7	1.5	6.4	7.3	n.a.	n.a.	n.a.	n.a.	n.a.	20.3	21.9	13.2	16.1	n.a.	n.a.	3.9	4.2
Ireland	<2.5	<2.5	3.4	3.5	8.9	7.0	n.a.	n.a.	n.a.	n.a.	n.a.	22.8	25.3	12.2	14.8	n.a.	n.a.	5.3	5.9
Latvia	<2.5	<2.5	0.6	0.6	9.9	9.5	n.a.	n.a.	n.a.	n.a.	n.a.	22.4	23.6	22.9	25.1	n.a.	n.a.	4.5	4.5
Lithuania	<2.5	<2.5	2.5	1.1	15.3	10.7	n.a.	n.a.	n.a.	n.a.	n.a.	25.0	26.3	23.2	25.5	n.a.	n.a.	4.5	4.5

TABLE A1.1 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Norway	<2.5	<2.5	1.1	1.1	4.8	4.9	n.a.	n.a.	n.a.	n.a.	n.a.	21.3	23.1	12.7	15.3	n.a.	n.a.	4.7	4.5
Sweden	<2.5	<2.5	0.8	1.2	4.5	5.8	n.a.	n.a.	n.a.	n.a.	n.a.	19.0	20.6	12.8	15.4	n.a.	n.a.	3.8	2.4
United Kingdom of Great Britain and Northern Ireland	<2.5	<2.5	1.9	1.3	6.3	5.0	n.a.	n.a.	n.a.	n.a.	n.a.	25.4	27.8	11.5	15.3	n.a.	n.a.	6.9	7.0
Southern Europe	**<2.5**	**<2.5**	**1.7**	**1.7**	**9.9**	**9.5**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**20.4**	**21.8**	**15.8**	**18.6**	**n.a.**	**n.a.**	**7.2**	**7.3**
Albania	8.9	3.6	10.0	10.0	38.8	37.1	9.6	23.2	11.3	23.2	16.4	19.3	21.7	22.7	25.3	37.1	36.5	4.6	4.6
Andorra	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	24.8	25.6	11.6	13.9	n.a.	n.a.	7.5	7.4
Bosnia and Herzegovina	<2.5	<2.5	1.5	1.5	9.6	9.2	2.3	8.9	n.a.	17.4	n.a.	16.3	17.9	27.1	29.4	18.2	n.a.	3.4	3.4
Croatia	<2.5	<2.5	0.6	0.9	6.5	10.0	n.a.	n.a.	n.a.	n.a.	n.a.	22.5	24.4	25.2	27.3	n.a.	n.a.	4.8	5.1
Greece	<2.5	<2.5	2.6	2.3[c,e]	15.8	13.3[c,e]	n.a.	n.a.	n.a.	n.a.	n.a.	23.2	24.9	13.1	15.9	n.a.	n.a.	8.7	8.7
Italy	<2.5	<2.5	1.2	1.1	8.6	7.3	n.a.	n.a.	n.a.	n.a.	n.a.	18.7	19.9	14.4	17.3	n.a.	n.a.	7.0	7.0
Malta	<2.5	<2.5	1.5	0.8	5.9	4.4	n.a.	n.a.	n.a.	n.a.	n.a.	27.5	28.9	13.7	16.4	n.a.	n.a.	7.0	6.3
Montenegro	<2.5	<2.5	2.1	2.2	12.6	12.9	4.2	7.9	n.a.	15.7	n.a.	21.6	23.3	22.8	25.2	19.3	n.a.	5.2	5.5
North Macedonia	5.0	3.1	3.6	3.2	15.1	14.4	1.8	4.9	n.a.	12.4	n.a.	20.8	22.4	19.5	23.3	23.0	n.a.	8.8	9.1
Portugal	<2.5	<2.5	4.1	2.9	14.7	10.6	n.a.	n.a.	n.a.	n.a.	n.a.	19.0	20.8	14.7	17.5	n.a.	n.a.	8.5	8.9
Serbia	<2.5	4.6	1.7	2.0	11.4	12.4	3.5	6.6	6.0	15.6	13.9	20.0	21.5	24.9	27.2	13.4	12.8	4.6	4.5
Slovenia	<2.5	<2.5	0.9	<0.5	12.3	10.4	n.a.	n.a.	n.a.	n.a.	n.a.	18.8	20.2	21.9	24.4	n.a.	n.a.	6.2	6.1
Spain	<2.5	<2.5	1.1	1.8	7.1	8.6	n.a.	n.a.	n.a.	n.a.	n.a.	22.4	23.8	13.8	16.6	n.a.	n.a.	8.2	8.3
Western Europe	**<2.5**	**<2.5**	**1.4**	**1.0**	**5.6**	**4.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**20.1**	**21.7**	**14.0**	**17.0**	**n.a.**	**n.a.**	**7.0**	**6.9**
Austria	<2.5	<2.5	1.1	1.1	5.5	3.6	n.a.	n.a.	n.a.	n.a.	n.a.	18.4	20.1	14.4	17.3	n.a.	n.a.	6.9	6.5
Belgium	<2.5	<2.5	3.1	3.6	9.5	10.8	n.a.	n.a.	n.a.	n.a.	n.a.	20.7	22.1	13.4	16.2	n.a.	n.a.	6.9	7.3
France	<2.5	<2.5	1.6	0.7	6.8	6.0	n.a.	n.a.	n.a.	n.a.	n.a.	20.1	21.6	14.9	18.1	n.a.	n.a.	7.4	7.4

TABLE A1.1
(CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION [1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION [1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (UNDER 5 YEARS OF AGE)	PREVALENCE OF STUNTING IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OVERWEIGHT IN CHILDREN (UNDER 5 YEARS OF AGE)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (18 YEARS AND OLDER)		PREVALENCE OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE (15–49)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS 0–5 MONTHS OF AGE		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Germany	<2.5	<2.5	1.0	0.7	4.1	3.5	n.a.	n.a.	1.7	n.a.	3.2	20.7	22.3	13.4	16.3	n.a.	n.a.	6.8	6.6
Luxembourg	<2.5	<2.5	1.8	0.9	4.7	3.3	n.a.	n.a.	n.a.	n.a.	n.a.	20.9	22.6	13.3	16.1	n.a.	n.a.	6.8	6.5
Netherlands	<2.5	<2.5	1.5	1.7	5.7	5.1	n.a.	n.a.	n.a.	n.a.	n.a.	18.6	20.4	13.4	16.4	n.a.	n.a.	6.2	6.2
Switzerland	<2.5	<2.5	1.5	0.7	4.8	2.7	n.a.	n.a.	n.a.	n.a.	n.a.	18.0	19.5	15.1	18.3	n.a.	n.a.	6.5	6.5

[1] Regional estimates were included when more than 50 percent of population was covered. To reduce the margin of error, estimates are presented as three-year averages.
[2] FAO estimates of the percentage of people in the total population living in households where at least one adult has been found to be food insecure.
[3] Country-level results are presented only for those countries for which estimates are based on official national data (see note c) or as provisional estimates, based on FAO data collected through the Gallup® World Poll, for countries whose national relevant authorities expressed no objection to their publication. *Note that consent to publication does not necessarily imply validation of the estimate by the national authorities involved and that the estimate is subject to revision as soon as suitable data from official national sources are available.* Global, regional and subregional aggregates are based on data collected in approximately 150 countries.
[4] For regional estimates, values correspond to the model predicted estimate for the year 2019. For countries, the latest data available from 2014 to 2019 are used.
[5] For regional estimates, values correspond to the model predicted estimate for the year 2012. For countries, the latest data available from 2005 to 2012 are used.
[6] Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2005 to 2012 are used.
[7] Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2014 to 2019 are used with the exception of China where the latest data are from the year 2013.
* Wasting, stunting and overweight under 5 years of age and low birthweight regional aggregates exclude Japan.
** The Northern America estimates are derived applying mixed-effect models with subregions as fixed effects; for stunting, wasting and severe wasting, data were available only for the United States of America, preventing the estimation of standard errors (and confidence intervals). The Australia and New Zealand estimates are based only on Australian data applying linear regression; for stunting, only two data points were available, and thus estimation of standard errors (and confidence intervals) was not possible. Further details on the methodology are described in De Onis, M., Blössner, M., Borghi, E., Frongillo, E.A. & Morris, R. 2004. Estimates of global prevalence of childhood underweight in 1990 and 2015. *Journal of the American Medical Association*, 291(21): 2600–2606. Model selection is based on best fit.

[a] Consecutive low population coverage; interpret with caution.
[b] The Central Agency for Public Mobilization & Statistics (CAPMAS) reports an estimate of severe food insecurity of 1.3 percent for 2015, based on HIECS data, using the WFP consolidated approach for reporting indicators of food security. Note that the two estimates are not directly comparable due to different definitions of "severe food insecurity".
[c] Based on official national data.
[d] For years when official national data are not available, the estimates are projected using FAO data. See Annex 1B for further details.
[e] Based on official national data collected in 2019 through EU-SILC. 2019 national estimates of prevalence of food insecurity are 8.1 percent at moderate or severe level and 1.5 percent at severe level.

<2.5 = proportion of undernourishment less than 2.5 percent;
<0.5 = prevalence of severe food insecurity less than 0.5 percent.
n.a. = data not available.

TABLE A1.2

PROGRESS TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS (SDGs) AND GLOBAL NUTRITION TARGETS: NUMBER OF PEOPLE WHO ARE AFFECTED BY UNDERNOURISHMENT, MODERATE OR SEVERE FOOD INSECURITY AND SELECTED FORMS OF MALNUTRITION; NUMBER OF INFANTS EXCLUSIVELY BREASTFED AND NUMBER OF BABIES BORN WITH LOW BIRTHWEIGHT

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012 [5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
WORLD	**819.3**	**673.0**	**597.8**	**703.3**	**1 672.8**	**1 948.4**	**47.0**	**164.3**	**144.0**	**35.4**	**38.3**	**574.3**	**675.7**	**552.2**	**613.2**	**49.9**	**59.8**	**20.9**	**20.5**
Least Developed Countries	**209.4**	**232.7**	**170.8**	**194.4**	**442.0**	**507.7**	**16.0**	**49.6**	**45.9**	**3.7**	**4.1**	**22.5**	**30.8**	**85.0**	**95.3**	**12.7**	**16.9**	**4.9**	**4.9**
Land Locked Developing Countries	**99.8**	**101.8**	**76.0**	**93.1**	**211.2**	**255.8**	**4.4**	**23.8**	**22.6**	**2.2**	**2.3**	**19.3**	**24.5**	**34.6**	**39.7**	**6.4**	**8.4**	**2.2**	**2.2**
Small Island Developing States	**11.3**	**10.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**8.1**	**9.5**	**4.9**	**5.3**	**0.4**	**0.5**	**0.1**	**0.1**
Low-income countries	**162.1**	**198.3**	**128.9**	**152.1**	**329.9**	**386.0**	**7.7**	**40.5**	**39.7**	**3.1**	**3.2**	**20.1**	**26.2**	**52.8**	**60.1**	**9.2**	**12.9**	**3.3**	**3.3**
Lower-middle-income countries	**465.6**	**382.6**	**348.1**	**403.7**	**849.2**	**977.4**	**33.8**	**108.6**	**93.2**	**14.0**	**14.6**	**105.1**	**134.1**	**308.8**	**333.4**	**24.6**	**31.5**	**13.9**	**13.5**
Upper-middle-income countries	**178.4**	**80.1**	**102.1**	**129.4**	**394.6**	**493.0**	**3.3**	**16.9**	**11.0**	**14.6**	**16.1**	**233.6**	**276.9**	**153.1**	**176.5**	**11.4**	**9.8**	**2.8**	**2.7**
High-income countries	**n.r.**	**n.r.**	**18.3**	**17.7**	**98.0**	**90.8**	**0.4[a]**	**2.1**	**1.9**	**4.7[a]**	**5.2[a]**	**203.1**	**227.7**	**40.2**	**46.5**	**n.a.**	**n.a.**	**1.0**	**1.0**
Low-income food-deficit countries	**484.8**	**452.7**	**392.0**	**451.2**	**859.8**	**996.0**	**31.3**	**105.0**	**89.7**	**7.9**	**8.0**	**59.9**	**79.6**	**300.1**	**325.3**	**24.8**	**33.0**	**14.9**	**14.5**
AFRICA	**196.5**	**239.6**	**203.7**	**237.2**	**561.1**	**653.6**	**12.7**	**56.3**	**57.5**	**8.3**	**9.3**	**65.5**	**81.5**	**98.9**	**109.8**	**13.1**	**17.8**	**5.6**	**5.7**
Northern Africa	**18.0**	**15.4**	**22.1**	**22.8**	**64.3**	**76.1**	**2.1**	**5.1**	**5.1**	**2.6**	**3.3**	**30.2**	**35.7**	**17.2**	**18.6**	**2.3**	**2.4**	**0.7**	**0.7**
Algeria	2.2	1.2	5.2	3.9	9.1	7.4	0.2	0.5	n.a.	0.5	n.a.	6.2	7.4	3.5	3.8	0.2	n.a.	<0.1	<0.1
Egypt	4.9	4.6	7.8[b]	7.6	25.7[b]	33.6	0.7	2.8	2.7	1.9	1.9	15.6	18.4	6.5	6.7	1.3	1.0	n.a.	n.a.
Libya	n.a.	n.a.	0.7	1.1	1.9	2.4	<0.1	0.1	0.3	0.1	0.2	1.2	1.4	0.5	0.6	n.a.	n.a.	n.a.	n.a.
Morocco	1.7	1.6	n.a.	n.a.	n.a.	9.3[c]	0.1	0.5	0.5	0.3	0.4	5.2	6.2	3.1	3.5	0.2	0.2	0.1	0.1
Sudan	6.6	5.2	5.2[c]	6.8[c]	16.1[c]	20.4[c]	0.9	1.9	2.2	0.1	0.2	<0.1	<0.1	2.7	3.1	0.5	0.7	n.a.	n.a.
Tunisia	0.4	n.r.	1.0	1.1	2.0	2.3	<0.1	0.1	0.1	0.1	0.2	1.9	2.2	0.9	1.0	<0.1	<0.1	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1] 2004–06 (millions)	NUMBER OF UNDERNOURISHED PEOPLE [1] 2017–19 (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3] 2014–16 (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3] 2017–19 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3] 2014–16 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3] 2017–19 (millions)	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING 2019[4] (millions)	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED 2012[5] (millions)	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED 2019[4] (millions)	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT 2012[5] (millions)	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT 2019[4] (millions)	NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE 2012 (millions)	NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE 2016 (millions)	NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA 2012 (millions)	NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA 2016 (millions)	NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED 2012[6] (millions)	NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED 2019[7] (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2012 (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2015 (millions)
Northern Africa (excluding Sudan)	**11.4**	**10.2**	**16.9**	**16.0**	**48.2**	**55.7**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**30.2**	**35.7**	**14.5**	**15.5**	**1.8**	**1.6**	**0.5**	**0.5**
Sub-Saharan Africa	**178.5**	**224.3**	**181.6**	**214.3**	**496.8**	**577.5**	**10.6**	**51.2**	**52.4**	**5.7**	**6.1**	**35.3**	**45.9**	**81.8**	**91.2**	**10.9**	**15.4**	**4.9**	**5.0**
Eastern Africa	**98.8**	**113.7**	**94.3**	**103.0**	**230.9**	**257.3**	**3.6**	**23.2**	**23.1**	**2.4**	**2.5**	**9.3**	**12.7**	**25.9**	**30.1**	**6.1**	**8.5**	**1.9**	**1.9**
Burundi	n.a.	n.a.					0.1	0.9	1.1	<0.1	<0.1	0.2	0.3	0.6	0.7	0.3	0.3	<0.1	<0.1
Comoros	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	0.1	<0.1	n.a.	<0.1	<0.1
Djibouti	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	0.1	0.1	0.1	0.1	<0.1	n.a.	n.a.	n.a.
Eritrea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.3	n.a.	<0.1	n.a.	0.1	0.1	0.4	0.5	0.1	n.a.	n.a.	n.a.
Ethiopia	28.4	21.5	14.7	15.4	56.7	63.3	1.4	6.4	6.1	0.3	0.3	1.6	2.4	4.7	5.8	1.6	2.0	n.a.	n.a.
Kenya	10.5	11.8	9.2[c]	n.a.	27.1[c]	n.a.	0.5	2.3	1.8	0.3	0.3	1.3	1.8	2.8	3.1	0.5	0.9	0.2	0.2
Madagascar	6.1	11.0	n.a.	n.a.	n.a.	n.a.	0.3	1.7	1.6	<0.1	0.1	0.5	0.7	1.9	2.2	0.3	0.4	0.1	0.1
Malawi	2.8	3.4	8.7[c,d]	9.4[c,d]	13.7[c,d]	14.9[c,d]	0.1	1.2	1.1	0.2	0.1	0.3	0.5	1.1	1.4	0.4	0.4	<0.1	<0.1
Mauritius	<0.1	<0.1	0.1	0.1	0.2	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Mozambique	6.8	9.6	11.0	12.0	18.5	20.2	0.3	1.8	2.0	0.3	0.3	0.7	1.0	2.9	3.4	0.4	n.a.	0.1	0.2
Rwanda	3.1	4.4					<0.1	0.7	0.6	0.1	0.1	0.3	0.4	0.5	0.7	0.3	0.3	<0.1	<0.1
Seychelles	n.a.	n.a.	<0.1[c]	n.a.	<0.1[c]	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Somalia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.6	n.a.	0.1	n.a.	0.4	0.5	1.0	1.1	<0.1	n.a.	n.a.	n.a.
South Sudan	--	n.a.	7.0[c]	7.0[c]	9.1[c]	9.3[c]	0.4	0.5	n.a.	0.1	n.a.	<0.1	<0.1	0.8	1.0	0.2	n.a.	n.a.	n.a.
Uganda	n.a.	n.a.	6.7[c,d]	8.8[c,d]	22.2[c,d]	28.3[c,d]	0.3	2.2	2.1	0.4	0.3	0.7	1.0	2.3	2.6	0.9	1.0	n.a.	n.a.
United Republic of Tanzania	12.2	14.1	n.a.	13.4[c]	n.a.	31.0[c]	0.5	2.8	3.0	0.4	0.3	1.6	2.2	4.3	4.7	0.8	1.2	0.2	0.2
Zambia	n.a.	n.a.					0.1	1.1	1.0	0.2	0.1	0.5	0.6	1.0	1.3	0.3	0.4	<0.1	<0.1
Zimbabwe	n.a.	n.a.	4.9	4.9	8.9	9.6	0.1	0.6	0.5	0.1	0.1	1.0	1.1	1.1	1.2	0.1	0.2	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012 [5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Middle Africa	**40.0**	**49.4**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**2.0**	**8.9**	**9.5**	**1.2**	**1.5**	**4.5**	**6.0**	**14.2**	**15.5**	**1.6**	**n.a.**	**0.8**	**0.8**
Angola	10.2	5.7	5.9	n.a.	18.5	n.a.	0.3	1.2	2.0	n.a.	0.2	0.8	1.1	2.4	2.7	n.a.	0.4	0.2	0.2
Cameroon	2.9	1.6	n.a.	n.a.	n.a.	n.a.	0.2	1.2	1.2	0.2	0.4	1.0	1.4	2.1	2.4	0.2	0.3	<0.1	0.1
Central African Republic	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.3	0.3	<0.1	n.a.	0.1	0.2	0.5	0.6	0.1	<0.1	<0.1	<0.1
Chad	3.8	6.1	n.a.	n.a.	n.a.	n.a.	0.4	0.9	1.0	0.1	0.1	0.3	0.4	1.3	1.5	<0.1	<0.1	n.a.	n.a.
Congo	1.2	1.5					<0.1	0.2	0.2	<0.1	<0.1	0.2	0.2	0.5	0.6	<0.1	0.1	<0.1	<0.1
Democratic Republic of the Congo	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.0	5.3	n.a.	0.6	n.a.	1.8	2.5	7.0	7.4	1.0	n.a.	0.3	0.4
Equatorial Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	0.1	0.1	0.1	<0.1	n.a.	n.a.	n.a.
Gabon	0.2	0.4	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	0.1	0.2	0.2	0.3	<0.1	n.a.	<0.1	<0.1
Sao Tome and Principe	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Southern Africa	**2.7**	**5.1**	**12.3**	**13.0**	**27.9**	**29.4**	**0.2**	**2.0**	**2.0**	**0.8**	**0.9**	**9.6**	**11.2**	**4.2**	**4.4**	**n.a.**	**0.4**	**0.2**	**0.2**
Botswana	0.4	0.5	0.7	0.9	1.3	1.5	<0.1	0.1	n.a.	<0.1	n.a.	0.2	0.2	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Eswatini	<0.1	0.2	0.3	0.3	0.7	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Lesotho	0.3	0.7	n.a.	0.6[c]	n.a.	1.0[c]	<0.1	0.1	0.1	<0.1	<0.1	0.2	0.2	0.1	0.2	<0.1	<0.1	<0.1	<0.1
Namibia	0.3	0.4	0.7[c,d]	0.8[c,d]	1.2[c,d]	1.4[c,d]	<0.1	0.1	n.a.	<0.1	n.a.	0.2	0.2	0.2	0.2	<0.1	n.a.	<0.1	<0.1
South Africa	1.7	3.3	10.0	n.a.	23.7	n.a.	0.3	1.6	1.6	1.0	0.8	9.0	10.4	3.7	3.8	n.a.	0.4	0.2	0.2
Western Africa	**37.0**	**56.1**	**44.6**	**60.9**	**155.8**	**193.7**	**4.8**	**17.1**	**17.8**	**1.3**	**1.2**	**11.9**	**15.9**	**37.4**	**41.2**	**2.6**	**4.3**	**2.0**	**2.1**
Benin	1.0	0.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.6	n.a.	<0.1	0.4	0.5	1.2	1.3	0.1	0.2	<0.1	<0.1
Burkina Faso	3.1	3.8	1.8[c,d]	2.7[c,d]	7.7[c,d]	9.4[c,d]	0.3	1.0	0.8	<0.1	<0.1	0.4	0.5	1.9	2.1	0.2	0.4	<0.1	<0.1
Cabo Verde	<0.1	0.1	n.a.	0.1[c]	n.a.	0.2[c]	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.
Côte d'Ivoire	3.7	5.0					0.3	1.0	0.8	0.1	0.1	0.9	1.2	2.5	2.9	0.1	0.2	0.1	0.1
Gambia	0.3	0.3	0.5	0.6	1.1	1.2	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.2	0.3	<0.1	<0.1	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1,2,3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1,2,3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012 [5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)
Ghana	2.5	1.9	2.1[c,d]	2.5[c,d]	13.6[c,d]	15.2[c,d]	0.2	0.8	0.7	0.1	0.1	1.3	1.7	3.2	3.3	0.4	0.4	0.1	0.1
Guinea	n.a.	n.a.	5.1	6.2	8.3	9.2	0.2	0.6	0.6	0.1	0.1	0.3	0.4	1.4	1.5	0.1	0.1	n.a.	n.a.
Guinea-Bissau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Liberia	1.2	1.8	2.8	2.9	3.9	4.3	<0.1	0.3	0.2	<0.1	<0.1	0.2	0.2	0.4	0.4	<0.1	n.a.	n.a.	n.a.
Mali	1.7	1.0	n.a.	n.a.	n.a.	n.a.	0.3	0.8	0.9	<0.1	0.1	0.5	0.7	1.9	2.0	0.1	0.3	n.a.	n.a.
Mauritania	0.3	0.5	0.6	1.0	1.3	2.0	0.1	0.1	0.2	<0.1	<0.1	0.2	0.3	0.3	0.4	<0.1	0.1	n.a.	n.a.
Niger	n.a.	n.a.					0.5	1.5	2.2	<0.1	<0.1	0.3	0.5	1.8	2.1	0.2	n.a.	n.a.	n.a.
Nigeria	10.3	24.6	11.8[c,d]	17.8[c,d]	66.1[c,d]	86.4[c,d]	2.9	10.2	12.1	0.8	0.7	6.1	8.2	19.1	21.1	0.9	1.8	n.a.	n.a.
Senegal	1.9	1.5	2.1	2.6	5.7	6.5	0.2	0.4	0.5	<0.1	0.1	0.5	0.7	1.8	1.9	0.2	0.2	<0.1	0.1
Sierra Leone	2.6	2.0	2.2[c,d]	2.4[c,d]	5.6[c,d]	6.2[c,d]	0.1	0.5	0.3	0.1	0.1	0.3	0.3	0.7	0.8	0.1	0.1	<0.1	<0.1
Togo	1.6	1.6					0.1	0.3	0.3	<0.1	<0.1	0.2	0.3	0.8	0.9	0.1	0.2	<0.1	<0.1
Sub-Saharan Africa (including Sudan)	**185.1**	**229.5**	**186.9**	**221.2**	**512.9**	**597.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**35.3**	**45.9**	**84.4**	**94.3**	**11.3**	**16.1**	**5.1**	**5.2**
ASIA*	**564.5**	**378.7**	**332.9**	**392.3**	**845.1**	**996.5**	**32.6**	**98.1**	**78.2**	**16.1**	**17.2**	**181.7**	**231.3**	**377.7**	**419.9**	**28.9**	**32.7**	**13.3**	**12.8**
Central Asia	**6.5**	**2.1**	**1.1**	**1.8**	**6.3**	**9.8**	**0.2**	**1.1**	**0.8**	**0.5**	**0.5**	**6.6**	**8.1**	**5.9**	**6.2**	**0.5**	**0.7**	**<0.1**	**<0.1**
Kazakhstan	1.1	n.r.	n.a.	<0.1[c]	n.a.	0.4[c]	0.1	0.2	0.2	0.2	0.2	2.2	2.6	1.4	1.4	0.1	0.1	<0.1	<0.1
Kyrgyzstan	0.5	0.4	n.a.	<0.1[c]	n.a.	0.4[c]	<0.1	0.1	0.1	0.1	0.1	0.5	0.6	0.5	0.6	0.1	0.1	<0.1	<0.1
Tajikistan	n.a.	n.a.					0.1	0.3	0.2	0.1	<0.1	0.6	0.7	0.6	0.7	0.1	0.1	<0.1	<0.1
Turkmenistan	0.2	0.2	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	0.1	<0.1	<0.1	0.6	0.7	0.5	0.5	<0.1	0.1	<0.1	<0.1
Uzbekistan	3.9	0.8	0.6	0.9	3.5	5.6	0.1	0.5	0.4	0.3	0.2	2.8	3.5	3.0	3.0	0.2	0.3	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Eastern Asia*	**120.0**	**n.r.**	**16.8**	**27.1**	**99.7**	**150.1**	**1.5**	**7.2**	**4.1**	**5.8**	**5.7**	**61.1**	**77.5**	**89.4**	**107.4**	**5.6**	**4.0**	**0.9**	**0.9**
China	108.0	n.r.					1.9	8.0	n.a.	5.6	n.a.	53.8	68.7	78.1	95.0	4.9	3.4	0.9	0.8
China, mainland	*106.8*	*n.r.*					*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
Taiwan Province of China	*1.0*	*0.8*					*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
China, Hong Kong SAR	*n.r.*	*n.r.*					*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
China, Macao SAR	*<0.1*	*<0.1*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
Democratic People's Republic of Korea	8.1	12.2	n.a.	n.a.	n.a.	n.a.	0.1	0.5	0.3	<0.1	<0.1	1.1	1.3	2.0	2.2	0.2	0.3	n.a.	n.a.
Japan	n.r.	n.r.	0.5	0.9	3.3	4.0	0.1	0.4	n.a.	0.1	n.a.	3.9	4.6	5.2	5.6	n.a.	n.a.	0.1	0.1
Mongolia	0.7	0.7	0.1	0.2	0.6	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.4	0.1	0.2	<0.1	<0.1	<0.1	<0.1
Republic of Korea	1.2	n.r.	0.2[c]	0.2	2.4[c]	2.6	<0.1	0.1	n.a.	0.2	n.a.	1.7	2.0	2.4	2.8	n.a.	n.a.	<0.1	<0.1
Eastern Asia (excluding China, mainland)	**12.2**	**15.4**	**1.1**	**1.7**	**8.5**	**10.3**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**<0.1**	**<0.1**	**n.a.**	**n.a.**	**0.2**	**0.2**
South-eastern Asia	**96.0**	**64.1**	**25.7**	**34.5**	**103.8**	**126.1**	**4.7**	**16.5**	**13.9**	**3.1**	**4.2**	**22.2**	**29.5**	**43.1**	**48.5**	**3.8**	**5.2**	**1.5**	**1.4**
Brunei Darussalam	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Cambodia	2.3	2.4	2.6	2.2	7.6	7.2	0.2	0.7	0.6	<0.1	<0.1	0.3	0.4	1.9	2.0	0.3	0.2	<0.1	<0.1
Indonesia	43.7	24.1	2.5[c,d]	2.2[c,d]	19.7[c,d]	18.7[c,d]	2.9	9.1	7.4	2.9	1.9	9.1	12.2	17.7	20.2	2.0	2.3	0.5	0.5
Lao People's Democratic Republic	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.4	0.3	<0.1	<0.1	0.2	0.2	0.6	0.7	0.1	0.1	<0.1	<0.1
Malaysia	0.9	0.9	2.4	2.1	5.3	4.7	n.a.	0.4	0.5	n.a.	0.2	2.6	3.3	1.8	2.1	n.a.	0.2	<0.1	<0.1
Myanmar	13.7	7.6	n.a.	n.a.	n.a.	n.a.	0.4	1.8	1.3	0.1	0.1	1.5	2.1	6.0	6.9	0.2	0.5	0.1	0.1
Philippines	13.0	15.4	12.4	18.8	44.9	59.0	0.8	3.7	3.3	0.4	0.4	3.2	4.1	4.5	4.2	0.8	n.a.	0.5	0.5
Singapore	n.a.	n.a.	0.1	0.1	0.2	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.2	0.3	0.3	0.3	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Thailand	7.8	6.5					0.3	0.7	0.4	0.4	0.3	4.1	5.4	4.8	5.6	0.1	0.2	<0.1	<0.1
Timor-Leste	0.3	0.4	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	n.a.	<0.1	n.a.	<0.1	<0.1	0.1	0.1	<0.1	<0.1	n.a.	n.a.
Viet Nam	13.1	6.1	n.a.	0.4[c]	n.a.	6.0[c]	0.5	2.0	1.8	0.4	0.5	1.0	1.4	5.4	6.3	0.3	n.a.	0.1	0.1
Southern Asia	**318.0**	**254.7**	**267.0**	**303.5**	**564.0**	**633.3**	**25.2**	**69.0**	**55.9**	**4.6**	**4.5**	**49.7**	**65.4**	**218.5**	**234.2**	**17.0**	**20.7**	**10.3**	**9.8**
Afghanistan	9.3	11.1	5.1	8.5	15.5	22.6	n.a.	n.a.	2.1	n.a.	0.2	0.6	0.9	2.4	3.2	n.a.	0.7	n.a.	n.a.
Bangladesh	19.9	20.9	20.7	17.2	50.4	50.8	2.4	6.2	4.5	0.3	0.3	2.7	3.7	17.4	18.2	1.9	1.9	0.9	0.9
Bhutan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
India	249.4	189.2					26.0	62.0	40.3	2.5	1.9	25.2	34.3	165.6	175.6	11.2	13.9	n.a.	n.a.
Iran (Islamic Republic of)	3.6	3.9	7.5	6.8	37.7	32.4	0.3	0.4	n.a.	n.a.	n.a.	12.6	14.8	6.4	7.2	0.7	n.a.	n.a.	n.a.
Maldives	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nepal	4.3	1.7	2.8	2.9	8.0	9.5	0.3	1.2	1.0	<0.1	<0.1	0.5	0.7	2.6	2.8	0.4	0.4	0.1	0.1
Pakistan	28.4	26.1					3.6	10.5	10.3	1.6	0.7	7.5	10.2	22.4	25.3	1.9	2.7	n.a.	n.a.
Sri Lanka	2.9	1.6					0.4	0.3	0.3	<0.1	<0.1	0.6	0.8	1.6	1.7	0.3	0.3	<0.1	<0.1
Southern Asia (excluding India)	**68.6**	**65.5**	**64.2**	**68.9**	**199.6**	**206.8**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**24.5**	**31.1**	**n.a.**	**n.a.**	**5.7**	**6.8**	**n.a.**	**n.a.**
Western Asia	**24.0**	**30.2**	**22.2**	**25.5**	**71.2**	**77.3**	**1.0**	**4.2**	**3.4**	**2.0**	**2.3**	**42.4**	**51.4**	**20.8**	**23.7**	**1.8**	**1.8**	**0.6**	**0.6**
Armenia	0.4	<0.1	0.1	0.1	0.8	1.0	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Azerbaijan	0.4	n.r.	<0.1	<0.1	0.6	1.0	<0.1	0.1	n.a.	0.1	n.a.	1.2	1.4	1.0	1.0	<0.1	n.a.	<0.1	<0.1
Bahrain	n.a.	n.a.					n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.3	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Cyprus	<0.1	<0.1					n.a.	n.a.	n.a.	n.a.	n.a.	0.2	0.2	0.1	0.1	n.a.	n.a.	n.a.	n.a.
Georgia	0.2	0.3	0.3	0.3	1.3	1.5	<0.1	<0.1	n.a.	0.1	n.a.	0.6	0.7	0.3	0.3	<0.1	<0.1	<0.1	<0.1
Iraq	6.4	9.1					0.3	1.0	0.7	0.5	0.3	4.7	6.1	2.3	2.7	0.2	0.3	n.a.	n.a.
Israel	n.r.	n.r.	0.1[c,d]	0.1[c,d]	0.9[c,d]	1.0[c,d]	n.a.	n.a.	n.a.	n.a.	n.a.	1.3	1.4	0.2	0.3	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Jordan	0.3	0.9					<0.1	0.1	n.a.	0.1	n.a.	1.5	2.0	0.6	0.7	0.1	0.1	<0.1	<0.1
Kuwait	n.r.	n.r.	0.2	0.2	0.5	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	1.1	0.2	0.3	n.a.	n.a.	<0.1	<0.1
Lebanon	0.5	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.1	1.5	0.4	0.5	n.a.	n.a.	<0.1	<0.1
Oman	0.2	0.4	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.9	0.3	0.3	n.a.	<0.1	<0.1	<0.1
Palestine	n.a.	n.a.	n.a.	0.2[c]	n.a.	1.3[c]	<0.1	0.1	<0.1	<0.1	0.1	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	<0.1	<0.1
Qatar	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.6	0.8	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Saudi Arabia	1.1	1.6					0.3	0.3	n.a.	0.2	n.a.	6.4	8.1	3.0	3.4	n.a.	n.a.	n.a.	n.a.
Syrian Arab Republic	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.8	n.a.	0.5	n.a.	3.0	3.0	1.6	1.6	0.2	n.a.	n.a.	n.a.
Turkey	n.r.	n.r.					0.1	0.8	0.4	0.6	0.5	15.1	17.8	5.9	6.5	0.6	0.5	0.2	0.1
United Arab Emirates	0.4	0.3					n.a.	n.a.	n.a.	n.a.	n.a.	2.2	2.5	0.4	0.5	n.a.	n.a.	<0.1	<0.1
Yemen	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.5	1.7	n.a.	0.1	n.a.	1.8	2.5	4.0	4.8	n.a.	n.a.	n.a.	n.a.
Central Asia and Southern Asia	**324.5**	**256.7**	**268.2**	**305.2**	**570.3**	**643.0**	**25.4**	**70.1**	**56.7**	**5.1**	**5.0**	**56.4**	**73.5**	**224.4**	**240.4**	**17.4**	**21.4**	**10.4**	**9.9**
Eastern Asia and South-eastern Asia*	**216.0**	**91.7**	**42.5**	**61.6**	**203.6**	**276.2**	**6.2**	**23.8**	**18.0**	**8.9**	**10.0**	**83.3**	**107.0**	**132.5**	**155.9**	**9.5**	**8.7**	**2.5**	**2.5**
Western Asia and Northern Africa	**42.0**	**45.6**	**44.4**	**48.3**	**135.5**	**153.4**	**3.1**	**9.3**	**8.5**	**4.6**	**5.6**	**72.6**	**87.0**	**38.0**	**42.3**	**4.1**	**4.2**	**1.3**	**1.3**
LATIN AMERICA AND THE CARIBBEAN	**48.5**	**45.9**	**45**	**60.1**	**161.3**	**203.7**	**0.7**	**6.0**	**4.7**	**3.8**	**3.9**	**90.8**	**106.0**	**34.9**	**37.6**	**3.5**	**n.a.**	**0.9**	**0.9**
Caribbean	**8.4**	**7.2**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**0.1**	**0.4**	**0.3**	**0.2**	**0.2**	**6.3**	**7.3**	**3.2**	**3.4**	**0.2**	**0.2**	**<0.1**	**<0.1**
Antigua and Barbuda	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Bahamas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Barbados	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.
Cuba	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.0	2.2	0.7	0.7	0.1	<0.1	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Dominica	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.
Dominican Republic	1.8	0.6					<0.1	0.1	n.a.	0.1	n.a.	1.6	1.9	0.8	0.8	<0.1	<0.1	<0.1	<0.1
Grenada	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.
Haiti	5.1	5.4	n.a.	n.a.	n.a.	n.a.	0.1	0.3	0.3	<0.1	<0.1	1.2	1.5	1.3	1.3	0.1	0.1	n.a.	n.a.
Jamaica	0.2	0.3	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.2	0.2	<0.1	n.a.	<0.1	<0.1
Puerto Rico	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saint Kitts and Nevis	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saint Lucia	n.a.	n.a.	<0.1[c]	n.a.	<0.1[c]	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.
Saint Vincent and the Grenadines	<0.1	<0.1					n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.
Trinidad and Tobago	0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	0.2	0.2	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Central America	**11.7**	**15.2**	**17.2**	**23.1**	**53.5**	**65.7**	**0.1**	**2.6**	**2.0**	**1.1**	**1.1**	**26.1**	**30.8**	**6.9**	**7.4**	**0.7**	**1.1**	**0.3**	**0.3**
Belize	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Costa Rica	0.2	0.2	0.2	0.3	1.1	1.3	<0.1	<0.1	n.a.	<0.1	n.a.	0.8	0.9	0.2	0.2	<0.1	n.a.	<0.1	<0.1
El Salvador	0.6	0.6	0.9	0.9	2.7	2.7	<0.1	0.1	0.1	<0.1	<0.1	0.9	1.0	0.3	0.4	<0.1	0.1	<0.1	<0.1
Guatemala	2.5	2.8	2.6	3.1	6.9	7.8	<0.1	1.0	0.9	0.1	0.1	1.6	2.0	0.7	0.7	0.2	0.2	<0.1	<0.1
Honduras	1.7	1.3	2.1	2.3	5.1	5.3	<0.1	0.2	n.a.	0.1	n.a.	0.9	1.2	0.3	0.4	0.1	n.a.	<0.1	<0.1
Mexico	4.7	9.0	9.7	14.6	33.4	44.0	0.2	1.5	1.1	1.0	0.6	20.6	24.0	4.9	5.1	0.3	0.6	0.2	0.2
Nicaragua	1.3	1.1					<0.1	0.1	n.a.	0.1	n.a.	0.8	0.9	0.2	0.3	<0.1	n.a.	<0.1	<0.1
Panama	0.7	0.3					<0.1	0.1	n.a.	<0.1	n.a.	0.5	0.6	0.2	0.2	n.a.	n.a.	<0.1	<0.1
South America	**28.4**	**23.5**	**23.7**	**32.5**	**95.5**	**124.5**	**0.4[a]**	**3.1**	**2.4[a]**	**2.5**	**2.6[a]**	**58.4**	**67.9**	**24.8**	**26.9**	**2.8**	**n.a.**	**0.6**	**0.6**
Argentina	1.5	1.7	2.5	5.7	8.3	15.9	<0.1	0.3	0.3	0.4	0.4	7.6	8.6	1.7	2.0	0.2	n.a.	<0.1	<0.1

TABLE A1.2
(CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012 [5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)	(millions)
Bolivia (Plurinational State of)	2.5	1.8					<0.1	0.2	0.2	0.1	0.1	1.1	1.4	0.8	0.8	0.2	0.1	<0.1	<0.1
Brazil	7.7	n.r.	3.9	3.4	37.5	43.1	0.3	1.1	n.a.	1.0	n.a.	28.4	33.3	14.1	15.5	1.1	n.a.	0.3	0.2
Chile	0.5	0.7	0.5[c,d]	0.7[c,d]	1.8[c,d]	2.9[c,d]	<0.1	<0.1	<0.1	0.1	0.1	3.4	3.8	0.5	0.7	n.a.	n.a.	<0.1	<0.1
Colombia	4.8	2.7					<0.1	0.5	0.5	0.2	0.2	6.4	7.6	2.9	2.8	n.a.	0.3	<0.1	<0.1
Ecuador	3.1	1.5	1.2[c]	n.a.	3.8[c]	n.a.	<0.1	0.4	0.4	0.1	0.1	1.8	2.2	0.7	0.8	n.a.	n.a.	<0.1	<0.1
Guyana	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Paraguay	0.6	0.6					<0.1	0.1	<0.1	0.1	0.1	0.7	0.9	0.3	0.4	<0.1	<0.1	<0.1	<0.1
Peru	5.3	2.2	2.7	n.a.	9.1	n.a.	<0.1	0.5	0.3	0.2	0.2	3.5	4.1	1.6	1.6	0.4	0.4	<0.1	<0.1
Suriname	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	0.1	0.1	<0.1	<0.1	<0.1	n.a.	<0.1	<0.1
Uruguay	0.1	n.r.	0.2	0.2	0.7	0.8	<0.1	<0.1	n.a.	<0.1	n.a.	0.6	0.7	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Venezuela (Bolivarian Republic of)	2.2	9.1					0.1	0.4	n.a.	0.2	n.a.	4.6	5.1	1.8	2.0	n.a.	n.a.	<0.1	<0.1
OCEANIA	**1.8**	**2.4**	**1.1**	**1.7**	**4.3**	**5.7**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**7.0**	**8.1**	**1.3**	**1.5**	**n.a.**	**n.a.**	**<0.1**	**<0.1**
Australia and New Zealand**	**n.r.**	**n.r.**	**0.8**	**1.2**	**3.0**	**4.0**	**n.a.**	**n.a.**	**n.a.**	**0.3**	**0.4**	**5.7**	**6.5**	**0.6**	**0.6**	**n.a.**	**n.a.**	**<0.1**	**<0.1**
Australia	n.r.	n.r.	0.7	1.0	2.6	3.4	<0.1	<0.1	n.a.	0.1	0.4	4.7	5.4	0.4	0.5	n.a.	n.a.	<0.1	<0.1
New Zealand	n.r.	n.r.	0.1	0.2	0.5	0.7	n.a.	n.a.	n.a.	n.a.	n.a.	1.0	1.1	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Oceania excluding Australia and New Zealand	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**0.1**	**0.5**	**0.6**	**0.1**	**0.1**	**1.3**	**1.6**	**0.8**	**0.9**	**0.2**	**0.2**	**<0.1**	**<0.1**
Melanesia	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**1.1**	**1.3**	**0.7**	**0.9**	**0.1**	**0.2**	**<0.1**	**<0.1**
Fiji	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.2	0.2	0.1	0.1	n.a.	n.a.	n.a.	n.a.
New Caledonia	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Papua New Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.5	n.a.	0.1	n.a.	0.8	1.0	0.6	0.7	0.1	0.1	n.a.	n.a.
Solomon Islands	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	n.a.	n.a.
Vanuatu	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	<0.1	<0.1
Micronesia	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**0.1**	**0.1**	**<0.1**	**<0.1**	**<0.1**	**n.a.**	**<0.1**	**<0.1**
Kiribati	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.
Marshall Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	n.a.	<0.1	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.
Micronesia (Federated States of)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.
Nauru	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	n.a.	n.a.	n.a.
Palau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Polynesia	**<0.1**	**<0.1**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**0.2**	**0.2**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**
American Samoa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cook Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1
French Polynesia	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Niue	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Samoa	<0.1	n.r.	n.a.	<0.1[c]	n.a.	<0.1[c]	n.a.	n.a.	<0.1	n.a.	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.
Tokelau (Associate Member)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tonga	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.
Tuvalu	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	n.a.	n.a.	n.a.
NORTHERN AMERICA AND EUROPE	**n.r.**	**n.r.**	**15.0**	**12.0**	**101.0**	**88.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**216.2**	**237.2**	**39.4**	**44.3**	**n.a.**	**n.a.**	**0.9**	**0.9**
Northern America**	**n.r.**	**n.r.**	**3.6**	**2.8**	**35.4**	**29.8**	**0.1**	**0.6**	**0.6**	**1.8**	**1.9**	**87.8**	**98.7**	**8.7**	**10.6**	**1.1**	**1.5**	**0.3**	**0.3**
Bermuda	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012 [5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Canada	n.r.	n.r.	0.2[c]	n.a.	1.8[c]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	7.6	8.6	0.7	0.8	n.a.	n.a.	<0.1	<0.1
Greenland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United States of America	n.r.	n.r.	3.4[c]	2.6[c]	33.6[c]	27.9[c]	0.1	0.4	0.7	1.2	1.8	80.2	90.1	8.0	9.8	1.0	1.4	0.3	0.3
Europe	**n.r.**	**n.r.**	**11.4**	**9.2**	**65.6**	**59.1**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**128.4**	**138.4**	**30.7**	**33.7**	**n.a.**	**n.a.**	**0.5**	**0.5**
Eastern Europe	**n.r.**	**n.r.**	**4.3**	**3.2**	**32.9**	**29.2**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**53.0**	**55.8**	**16.2**	**16.8**	**n.a.**	**n.a.**	**0.2**	**0.2**
Belarus	n.r.	n.r.					<0.1	<0.1	n.a.	<0.1	n.a.	1.8	1.9	0.5	0.5	<0.1	n.a.	<0.1	<0.1
Bulgaria	0.4	0.2	0.1	0.1	1.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	1.4	1.5	0.4	0.4	n.a.	n.a.	<0.1	<0.1
Czechia	n.r.	n.r.	0.1	<0.1	0.6	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	2.1	2.3	0.6	0.6	n.a.	n.a.	<0.1	<0.1
Hungary	n.r.	n.r.	0.1	0.1	1.1	0.7	n.a.	n.a.	n.a.	n.a.	n.a.	2.0	2.1	0.6	0.6	n.a.	n.a.	<0.1	<0.1
Poland	n.r.	n.r.	0.7	0.2	3.4	1.6	n.a.	0.1	0.1	n.a.	n.a.	6.7	7.2	2.2	2.4	n.a.	n.a.	<0.1	<0.1
Republic of Moldova	n.a.	n.a.	0.1	0.2	0.8	1.1	<0.1	<0.1	n.a.	<0.1	n.a.	0.6	0.6	0.3	0.3	<0.1	n.a.	<0.1	<0.1
Romania	n.r.	n.r.	1.1	0.7	3.8	2.8	n.a.	n.a.	n.a.	n.a.	n.a.	3.4	3.6	1.2	1.2	n.a.	n.a.	<0.1	<0.1
Russian Federation	n.r.	n.r.	1.0	1.1[c]	11.9	12.2[c]	n.a.	n.a.	n.a.	n.a.	n.a.	25.7	26.9	7.7	8.0	n.a.	n.a.	0.1	0.1
Slovakia	0.3	0.3	0.1	<0.1	0.3	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.9	0.3	0.4	n.a.	n.a.	<0.1	<0.1
Ukraine	n.r.	1.6	0.9	0.7	8.9	8.1	n.a.	n.a.	n.a.	n.a.	n.a.	8.5	8.8	2.4	2.5	0.1	n.a.	<0.1	<0.1
Northern Europe	**n.r.**	**n.r.**	**1.8**	**1.5**	**6.9**	**5.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**19.0**	**21.2**	**3.0**	**3.7**	**n.a.**	**n.a.**	**<0.1**	**<0.1**
Denmark	n.r.	n.r.	0.1	0.1	0.3	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.9	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Estonia	n.r.	n.r.	<0.1	<0.1	0.1	0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.2	0.2	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Finland	n.r.	n.r.	0.1	0.1	0.5	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	0.9	1.0	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Iceland	n.r.	n.r.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Ireland	n.r.	n.r.	0.2	0.2	0.4	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.9	0.1	0.2	n.a.	n.a.	<0.1	<0.1
Latvia	n.r.	n.r.	<0.1	<0.1	0.2	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	0.4	0.4	0.1	0.1	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Lithuania	n.r.	n.r.	0.1	<0.1	0.4	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.6	0.6	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Norway	n.r.	n.r.	0.1	0.1	0.2	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	1.0	0.1	0.2	n.a.	n.a.	<0.1	<0.1
Sweden	n.r.	n.r.	0.1	0.1	0.4	0.6	n.a.	n.a.	n.a.	n.a.	n.a.	1.4	1.6	0.3	0.3	n.a.	n.a.	<0.1	<0.1
United Kingdom of Great Britain and Northern Ireland	n.r.	n.r.	1.2	0.9	4.1	3.4	n.a.	n.a.	n.a.	n.a.	n.a.	12.9	14.6	1.7	2.3	n.a.	n.a.	<0.1	<0.1
Southern Europe	**n.r.**	**n.r.**	**2.6**	**2.6**	**15.1**	**14.6**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**25.6**	**27.5**	**5.6**	**6.2**	**n.a.**	**n.a.**	**0.1**	**<0.1**
Albania	0.3	0.1	0.3	0.3	1.1	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Andorra	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.
Bosnia and Herzegovina	n.r.	n.r.	0.1	<0.1	0.3	0.3	<0.1	<0.1	n.a.	<0.1	n.a.	0.5	0.5	0.3	0.3	<0.1	n.a.	<0.1	<0.1
Croatia	n.r.	n.r.	<0.1	<0.1	0.3	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.8	0.2	0.3	n.a.	n.a.	<0.1	<0.1
Greece	n.r.	n.r.	0.3	0.2[c,e]	1.7	1.4[c,e]	n.a.	n.a.	n.a.	n.a.	n.a.	2.1	2.2	0.3	0.4	n.a.	n.a.	<0.1	<0.1
Italy	n.r.	n.r.	0.7	0.6	5.2	4.4	n.a.	n.a.	n.a.	n.a.	n.a.	9.3	10.1	1.9	2.2	n.a.	n.a.	<0.1	<0.1
Malta	n.r.	n.r.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Montenegro	n.r.	n.r.	<0.1	<0.1	0.1	0.1	<0.1	<0.1	n.a.	<0.1	n.a.	0.1	0.1	<0.1	<0.1	<0.1	n.a.	<0.1	<0.1
North Macedonia	0.1	<0.1	0.1	0.1	0.3	0.3	<0.1	<0.1	n.a.	<0.1	n.a.	0.3	0.4	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Portugal	n.r.	n.r.	0.4	0.3	1.5	1.1	n.a.	n.a.	n.a.	n.a.	n.a.	1.6	1.8	0.4	0.4	n.a.	n.a.	<0.1	<0.1
Serbia	n.r.	0.4	0.2	0.2	1.0	1.1	<0.1	<0.1	<0.1	0.1	0.1	1.4	1.5	0.5	0.6	<0.1	<0.1	<0.1	<0.1
Slovenia	n.r.	n.r.	<0.1	<0.1	0.3	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.3	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Spain	n.r.	n.r.	0.5	0.8	3.3	4.0	n.a.	n.a.	n.a.	n.a.	n.a.	8.7	9.1	1.5	1.7	n.a.	n.a.	<0.1	<0.1
Western Europe	**n.r.**	**n.r.**	**2.7**	**1.9**	**10.7**	**9.5**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**30.8**	**33.9**	**6.0**	**7.0**	**n.a.**	**n.a.**	**0.1**	**0.1**
Austria	n.r.	n.r.	0.1	0.1	0.5	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	1.3	1.5	0.3	0.3	n.a.	n.a.	<0.1	<0.1
Belgium	n.r.	n.r.	0.4	0.4	1.1	1.2	n.a.	n.a.	n.a.	n.a.	n.a.	1.8	2.0	0.3	0.4	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (CONTINUED)

REGIONS/ SUBREGIONS/ COUNTRIES	NUMBER OF UNDERNOURISHED PEOPLE [1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE [1, 2, 3]		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) AFFECTED BY WASTING	NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE STUNTED		NUMBER OF CHILDREN (UNDER 5 YEARS OF AGE) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (18 YEARS AND OLDER) WHO ARE OBESE		NUMBER OF WOMEN OF REPRODUCTIVE AGE (15–49) AFFECTED BY ANAEMIA		NUMBER OF INFANTS 0–5 MONTHS OF AGE EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06	2017–19	2014–16	2017–19	2014–16	2017–19	2019[4]	2012[5]	2019[4]	2012[5]	2019[4]	2012	2016	2012	2016	2012[6]	2019[7]	2012	2015
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*	*(millions)*
France	n.r.	n.r.	1.0	0.5	4.4	3.9	n.a.	n.a.	n.a.	n.a.	n.a.	10.0	10.9	2.1	2.5	n.a.	n.a.	<0.1	<0.1
Germany	n.r.	n.r.	0.8	0.6	3.3	2.9	n.a.	n.a.	0.1	n.a.	0.1	14.0	15.3	2.4	2.8	n.a.	n.a.	<0.1	<0.1
Luxembourg	n.r.	n.r.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	<0.1	<0.1	n.a.	n.a.	<0.1	<0.1
Netherlands	n.r.	n.r.	0.3	0.3	1.0	0.9	n.a.	n.a.	n.a.	n.a.	n.a.	2.5	2.8	0.5	0.6	n.a.	n.a.	<0.1	<0.1
Switzerland	n.r.	n.r.	0.1	0.1	0.4	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	1.2	1.3	0.3	0.4	n.a.	n.a.	<0.1	<0.1

[1] Regional estimates were included when more than 50 percent of population was covered. To reduce the margin of error, estimates are presented as three-year averages.
[2] FAO estimates of the number of people living in households where at least one adult has been found to be food insecure.
[3] Country-level results are presented only for those countries for which estimates are based on official national data (see note c) or as provisional estimates, based on FAO data collected through the Gallup® World Poll, for countries whose national relevant authorities expressed no objection to their publication. *Note that consent to publication does not necessarily imply validation of the estimate by the national authorities involved and that the estimate is subject to revision as soon as suitable data from official national sources are available*. Global, regional and subregional aggregates are based on data collected in approximately 150 countries.
[4] For regional estimates, values correspond to the model predicted estimate for the year 2019. For countries, the latest data available from 2014 to 2019 are used.
[5] For regional estimates, values correspond to the model predicted estimate for the year 2012. For countries, the latest data available from 2005 to 2012 are used.
[6] Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2005 to 2012 are used.
[7] Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2014 to 2019 are used with the exception of China where the latest data are from the year 2013.
* Wasting, stunting and overweight under 5 years of age and low birthweight regional aggregates exclude Japan.
** The Northern America estimates are derived applying mixed-effect models with subregions as fixed effects; for stunting, wasting and severe wasting, data were available only for the United States of America, preventing the estimation of standard errors (and confidence intervals). The Australia and New Zealand estimates are based only on Australian data applying linear regression; for stunting, only two data points were available, and thus estimation of standard errors (and confidence intervals) was not possible. Further details on the methodology are described in de De Onis, M., Blössner, M., Borghi, E., Frongillo, E.A. & Morris, R. 2004. Estimates of global prevalence of childhood underweight in 1990 and 2015. *Journal of the American Medical Association*, 291(21): 2600–2606. Model selection is based on best fit.

[a] Consecutive low population coverage; interpret with caution.
[b] The Central Agency for Public Mobilization & Statistics (CAPMAS) reports an estimate of severe food insecurity of 1.3 percent for 2015, based on HIECS data, using the WFP consolidated approach for reporting indicators of food security. Note that the two estimates are not directly comparable due to different definitions of "severe food insecurity".
[c] Based on official national data.
[d] For years when official national data are not available, the estimates are projected using FAO data. See Annex 1B for further details.
[e] Based on official national data collected in 2019 through EU-SILC. 2019 national results are 0.8 million of food insecure people at moderate or severe level and 0.2 million at severe level.

<0.1 = less than 100 000 people.
n.a. = data not available.
n.r. = data not reported.

ANNEX 1B. METHODOLOGICAL NOTES FOR THE FOOD SECURITY AND NUTRITION INDICATORS

UNDERNOURISHMENT

Definition: Undernourishment is defined as the condition of an individual whose habitual food consumption is insufficient to provide, on average, the amount of dietary energy required to maintain a normal, active and healthy life.

How it is reported: The indicator is reported as a prevalence and is denominated as "prevalence of undernourishment" (PoU), which is an estimate of the percentage of individuals in the total population that are in a condition of undernourishment. National estimates are reported as three-year moving averages, to control for the low reliability of some of the underlying parameters, such as the year-to-year variation in food commodity stocks, one of the components of the annual FAO Food Balance Sheets for which complete, reliable information is very scarce. Regional and global aggregates, on the other hand, are reported as annual estimates, on account of the fact that possible estimation errors are expected not to be correlated across countries.

Methodology: To compute an estimate of the prevalence of undernourishment in a population, the probability distribution of habitual dietary energy intake levels (expressed in kcal per person per day) for the average individual is modelled as a parametric probability density function (pdf), *f(x)*. The indicator is obtained as the cumulative probability that the habitual dietary energy intake (*x*) is below the minimum dietary energy requirements (MDER) (i.e. the lowest limit of the range of energy requirements for the population's representative average individual) as in the formula below:

$$PoU = \int_{x<MDER} f(x|\theta)dx,$$

where θ is a vector of parameters that characterizes the pdf. The distribution is assumed to be lognormal, and thus fully characterized by only two parameters: the mean dietary energy consumption (DEC), and its coefficient of variation (CV).

Data sources: Different data sources are used to estimate the different parameters of the model.

***Minimum dietary energy requirement (MDER)*:** Human energy requirements for an individual in a given sex/age class are determined on the basis of normative requirements for basic metabolic rate (BMR) per kilogram of body mass, multiplied by the ideal weights that a healthy person of that sex/age class may have, given his or her height, and then multiplied by a coefficient of physical activity level (PAL) to take into account physical activity.[at] Given that both healthy BMIs and PALs vary among active and healthy individuals of the same sex and age, a *range* of energy requirements applies to each sex and age group of the population. The MDER for the average individual in the population, which is the parameter used in the PoU formula, is obtained as the weighted average of the lower bounds of the energy requirement ranges for each sex and age group, using the shares of the population in each sex and age group as weights.

Information on the population structure by sex and age is available for most countries in the world and for each year from the UN Department of Economic and Social Affairs (DESA) Population Prospects, revised every two years. This edition of *The State of Food Security and Nutrition in the World* uses the 2019 revision of the World Population Prospects.[1]

Information on the median height in each sex and age group for a given country is derived from a recent demographic and health survey (DHS) or from other surveys that collect anthropometry data on children and adults. Even if such surveys do not refer to the same year for which

at A person is considered healthy if his or her body mass index (BMI) indicates neither underweight nor overweight. Human energy requirement norms per kilogram of body mass are given in FAO and WHO (2004).[64]

the PoU is estimated, the impact of possible small intervening changes in median heights over the years on PoU estimates is expected to be negligible.

Dietary energy consumption (DEC): Ideally, data on food consumption should come from nationally representative household surveys (such as Living Standard Measurement Surveys or Household Incomes and Expenditure Surveys). However, only very few countries conduct such surveys on an annual basis. Thus, in FAO's PoU estimates for global monitoring, DEC values are estimated from the dietary energy supply (DES) reported in the Food Balance Sheets (FBS), compiled by FAO for most countries in the world (see FAO, 2020[2]).

Since the last edition of this report, the FBS series used to estimate the average DES has been revised with improved methods for most countries. In December 2019, a new FBS domain was added to FAOSTAT, presenting series from 2014 to 2017. Work is ongoing to extend the series to 2018 for all countries by the end of the year 2020. At the time of this report, the FBS series were updated for the following 50 countries with the largest number of undernourished people, bringing them up to date through 2018: Afghanistan, Algeria, Angola, Bangladesh, Bolivia (Plurinational State of), Burkina Faso, Camboroon, Chad, China (mainland), Colombia, Congo, Côte d'Ivoire, Democratic People's Republic of Korea, Ecuador, Eswatini, Ethiopia, Guatemala, Haiti, Honduras, India, Indonesia, Iran (Islamic Republic of), Iraq, Kenya, Liberia, Madagascar, Malawi, Mali, Mexico, Mozambique, Myanmar, Nepal, Nigeria, Pakistan, Peru, Philippines, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Sudan, Thailand, Togo, United Republic of Tanzania, Uzbekistan, Venezuela (Bolivarian Republic of), Viet Nam and Zimbabwe.

Coefficient of variation (CV): When reliable data on food consumption are available from aforementioned nationally representative household surveys, the CV due to income (CV|y) that describes the distribution of average daily dietary energy requirement in the population can be estimated directly. It is estimated indirectly or imputed for the years when no suitable survey data are available.

In the past, FAO had made attempts at estimating the CV as a function of macroeconomic variables, such as per capita GDP, inequality in income (captured by the Gini index) and an index of the relative price of food.[3] However, the ability to correctly project the CV of habitual food consumption in a population with such a model is questionable, due to the sparsity of data on the Gini index and to reservations on the way in which the index of the relative price of food is compiled. We therefore reverted to a simpler (and arguably more robust) method to linearly interpolate values of the CV|y in the years between surveys. The main drawback of such modelling choice is that, when only one survey is available over the monitored period, the resulting value of the CV|y is kept constant over the entire period of assessment, and in any case from the year of last available survey up to the year 2015. Possible changes over time in the ability to access food by different strata of the population that are not fully reflected in changes in the average national food consumption are therefore not captured in PoU estimates. Since the last edition of this report, 25 new surveys from the following 13 countries have been processed to update the CV|y: Bangladesh, China, Colombia, Ecuador, Ethiopia, Mexico, Mongolia, Mozambique, Nigeria, Pakistan, Peru, Sudan and Thailand. That makes for a total of 79 surveys of 51 countries for which CV|y is based on the national surveys.

In the FAO PoU parametric approach, the CV due to body weight and life style, a.k.a. CV due to requirement (CV|r), represents the variability of the distribution of dietary energy requirements of a hypothetical average individual representative of a healthy population, which is also equal to the CV of the distribution of dietary energy intakes of a hypothetical average individual if the population is perfectly nourished.
The distribution of dietary energy requirements of a hypothetical average individual can be assumed to be normal, thus its variability can be estimated if at least two percentiles and their

values are known. As a result, given that we are interested in deriving the theoretical distribution of dietary energy requirements for healthy hypothetical average individuals to estimate the CV|r, the MDER and the average dietary energy requirement (ADER) can be used to approximate the 1st percentile and the 50th percentile of the distribution of energy requirements of the hypothetical average individual as they are built on the same principles of a weighted average from sex-age-physiological status groups.[4] Therefore, the value of CV|r is derived as the inverse cumulative standard normal distribution of the difference between the MDER and the ADER. Similar to the MDER, the ADER is estimated using the average of the minimum and the maximum values of the PAL category "Active or moderately active lifestyle".

The total CV is then obtained as the geometric mean of the CV|y and the CV|r:

$$CV = \sqrt{(CV|y)^2 + (CV|r)^2}$$

Revision of CV|y for China: This year's report benefits from the availability of newly accessible data, which makes it possible to update the estimated inequalities in dietary energy consumption, measured by CV|y, among population of different income groups in mainland China.

Granular data on food consumption that allow a direct assessment of the inequality in the levels of habitual dietary energy consumption across different population groups are rare. For China these are only available publicly from the China Health and Nutrition Survey (CHNS). However, the publicly available CHNS data cover only 12 provinces and municipalities and are available for the years from 1990 to 2011 only.

To obtain estimates for the entire Chinese population and for later years, we linked the CHNS with another survey, the China Household Finance Survey (CHFS), which is available for 28 out of 34 provincial-level administrative regions of China for 2011, 2013, 2015 and 2017. We first estimated the relationship between the habitual dietary energy consumption (DEC) by income decile from the CHNS 2011 and the average food expenditure (FOOD_EXP) by income decile from the CHFS 2011 for the provinces included in both surveys. Using this estimated relationship, and using data on FOOD_EXP by income decile available for all provinces from the CHFS, we predicted the average DEC by income decile in provinces not covered by the CHNS in 2011, and in all provinces in 2013, 2015 and 2017.

The results, properly weighted by the current population in each income decile by province, were used to compute estimates of CV|y in 2011, 2013, 2015 and 2017. These estimates were then used to update the series of PoU for China (see details in Cafiero, Feng & Ishaq [2020][5]).

PoU projections for 2019–2030: Using the methods described above, PoU estimates are produced for all countries for which reliable FBS data are available up to 2018.

To generate national level three-year averages for 2017–2019 and annual values at regional and global level in 2019, projections are needed. Furthermore, for the SDG progress assessment, projections to 2030 are needed.

As in the past editions of this report, PoU estimates for 2019–2030 are obtained by separately projecting each of the model's parameters, and by applying the PoU formula presented above to the projected parameters (see details in **Annex 2**).

Challenges and limitations: While formally the state of being undernourished or not is a condition that applies to individuals, given the data usually available on a large scale, it is impossible to reliably identify which individuals in a certain group are actually undernourished. Through the statistical model described above, the indicator can only be computed with reference to a population or a group of individuals for which a representative sample is available. The prevalence of undernourishment is thus an estimate of the percentage of individuals in that group that are in such condition and cannot be further disaggregated.

Due to the probabilistic nature of the inference and the margins of uncertainty associated with estimates of each of the parameters in the model, the precision of the PoU estimates is generally low. While it is not possible to formally compute margins of error around PoU estimates, these are expected to likely exceed 5 percent in most cases. For this reason, FAO does not consider PoU estimates that result to be lower than 2.5 percent as sufficiently reliable to be reported.

References:

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FAO. 2003. *Proceedings: Measurement and Assessment of Food Deprivation and Undernutrition: International Scientific Symposium*. Rome.
FAO. 2014. *Advances in hunger measurement: traditional FAO methods and recent innovations.* FAO Statistics Division Working Paper No. 14–04. Rome.
Naiken, L. 2002. *Keynote paper: FAO methodology for estimating the prevalence of undernourishment.* Paper presented at the Measurement and Assessment of Food Deprivation and Undernutrition International Scientific Symposium, Rome, 26–28 June 2002. Rome, FAO.
Wanner, N., Cafiero, C., Troubat, N. & Conforti, P. 2014. *Refinements to the FAO methodology for estimating the prevalence of undernourishment indicator.* Rome, FAO.

FOOD INSECURITY AS MEASURED BY THE FOOD INSECURITY EXPERIENCE SCALE (FIES)

Definition: Food insecurity as measured by this indicator refers to limited **access to food,** at the level of individuals or households, due to lack of money or other resources. The severity of food insecurity is measured using data collected with the Food Insecurity Experience Scale survey module (FIES-SM), a set of eight questions asking to self-report conditions and experiences typically associated with limited access to food.

Using sophisticated statistical techniques based on the Rasch measurement model, the information obtained in a survey is validated for internal consistency and converted into a quantitative measure along a scale of severity, ranging from low to high. Based on their responses to the FIES-SM items, the individuals or households interviewed in a nationally representative survey of the population are assigned a probability to be in one of three classes: food secure or only marginally insecure, moderately food insecure and severely food insecure as defined by two globally set thresholds. Based on FIES data collected over three years from 2014 to 2016, FAO has established the FIES reference scale, which is used as the global standard for experience-based food-insecurity measures, and to set the two reference thresholds of severity.

SDG Indicator 2.1.2 is obtained as the cumulated probability to be in the two classes of moderate and severe food insecurity. A separate indicator (FI_{sev}) is computed by considering only the severe food-insecurity class.

How it is reported: In this report, FAO provides estimates of food insecurity at two different levels of severity: moderate or severe food insecurity ($FI_{mod+sev}$) and severe food insecurity (FI_{sev}). For each of these two levels, two estimates are reported:

- the **prevalence (%) of individuals** in the population living in households where at least one adult was found to be food insecure;
- the estimated **number of individuals** in the population living in households where at least one adult was found to be food insecure.

Data source: Since 2014, the eight-question FIES survey module has been applied in nationally representative samples of the adult population (defined as aged 15 or older) in more than 140 countries included in the Gallup® World Poll (GWP), covering 90 percent of the world population. In most countries, samples include about 1 000 individuals, with larger samples of 3 000 individuals in India and 5 000 in mainland China. In 2019, additional oversampling was applied in 11 countries: Bangladesh (3 000), Brazil (3 000), Egypt (2 000), Ethiopia (2 000), India (6 000), Nigeria (3 000), Philippines (2 000), Russian Federation (3 000), Thailand (2 000), Turkey (2 000) and Viet Nam (2 000).

For Burkina Faso, Cabo Verde, Canada, Chile, Ecuador, Ghana, Greece (2019), Indonesia, Israel, Kazakhstan, Kyrgyzstan, Kenya, Palestine, Lesotho, Malawi, Namibia, Nigeria, Saint Lucia, Seychelles, Samoa, Sierra Leone, South Sudan, Sudan, Republic of Korea (2014 and 2015), Russian Federation (2018), Uganda, United Republic of Tanzania, United States of America and Viet Nam, national government survey data were used to calculate the prevalence estimates of food insecurity by applying FAO's statistical methods to adjust national results to the same global reference standard, covering approximately 20 percent of the world population. Countries are considered for the year/years when national data are available, informing the regional and subregional aggregates assuming a constant trend in the period 2014–2019. Exceptions to this rule are: Burkina Faso, Chile, Ghana, Indonesia, Israel, Malawi, Namibia, Nigeria and Sierra Leone. In these cases, the following procedure was followed:

- Use national data collected in one year to inform the corresponding year.
- For the remaining years, apply the smoothed trend coming from the data collected by FAO through the Gallup® World Poll to the national data to describe evolution over time. Smoothed trend is computed by taking the mean of the average rate of change between consecutive three-year averages.

The motivation behind this procedure was the strong evidence found in support of the trend suggested by data collected by FAO (for instance, evolution of poverty, extreme poverty, employment, food inflation, among others), allowing to provide a more updated description of the trend in the period 2014–2019.

In Greece, Republic of Korea and Russian Federation, national data were used for the available years, and in the remaining years FAO data were used to complete the series. In such cases, levels of food insecurity are strongly in line using the different data sources.

Methodology: The data were validated and used to construct a scale of food-insecurity severity using the Rasch model, which postulates that the probability of observing an affirmative answer by respondent *i* to question *j* is a logistic function of the distance, on an underlying scale of severity, between the position of the respondent, a_i, and that of the item, b_j.

$$Prob(X_{i,j} = \text{Yes}) = \frac{\exp(a_i - b_j)}{1 + \exp(a_i - b_j)}$$

By applying the Rasch model to the FIES data, it is possible to estimate the probability of being food insecure ($p_{i,L}$) at each level of severity of food insecurity L (moderate or severe, or severe), for each respondent i, with $0 < p_{i,L} < 1$.

The prevalence of food insecurity at each level of severity (FI_L) in the population is computed as the weighted sum of the probability of being severely food insecure for all respondents (i) in a sample:

$$FI_L = \Sigma p_{i,L} w_i$$

where w_i are post-stratification weights that indicate the proportion of individuals or households in the national population represented by each record in the sample.

As only individuals aged 15 or more are sampled in the GWP, the prevalence estimates directly produced from these data refer to the population 15 years and older. To arrive at the **prevalence and number of individuals (of all ages) in the population**, an estimate is required of the number of people living in the households where at least one adult is estimated to be food insecure. This involves a multistep procedure detailed in Annex II of the *Voices of the Hungry Technical Report* (see link in the "References" section, below).

Regional and global aggregates of food insecurity at moderate or severe, and severe levels, FI_L, are computed as:

$$FI_{L,r} = \frac{\sum_c FI_{L,c} \times N_c}{\sum_c N_c}$$

where r indicates the region, $FI_{L,c}$ is the value of FI at level L estimated for country c in the region and N_c is the corresponding population size. When no estimate of FI_L is available for a country, it is assumed to be equal to the population-weighted average of the estimated values of the remaining countries in the same region. A regional aggregate is produced only if the countries for which an estimate is available cover at least 80 percent of the region's population.

Universal thresholds are defined on the FIES global standard scale (a set of item parameter values based on results from all countries covered by the GWP in 2014–2016) and converted into corresponding values on local scales. The process of calibrating each country's scale against the FIES global standard can be referred to as **equating**, and permits the production of **internationally comparable** measures of food-insecurity severity for individual respondents, as well as comparable national prevalence rates.

The problem stems from the fact that, when defined as a *latent* trait, the severity of food insecurity has no absolute reference against which it could be evaluated. The Rasch model enables identification of the relative position that the various items occupy on a scale that is denominated in logit units, but whose "zero" is arbitrarily set, usually to correspond to the mean estimated severity. This implies that the zero of the scale changes in each application. To produce comparable measures over time and across different populations requires establishing a common scale to use as a reference, and finding the formula needed to convert measures across different scales. As it is the case for converting measures of temperature across difference measuring scales (such as Celsius and Fahrenheit), this requires the identification of a number of "anchoring" points. In the FIES methodology, these anchoring points are the severity levels associated with the items whose *relative* position on the scale of severity can be considered equal to that of the corresponding items on the global reference scale. The "mapping" of the measures from one scale to the other is then obtained by finding the formula that equates the mean and the standard deviations (SD) of the common items' severity levels.

Challenges and limitations: When food-insecurity prevalence estimates are based on FIES data collected in the GWP, with national sample sizes of about 1 000 in most countries, confidence intervals rarely exceed 20 percent of the measured prevalence (that is, prevalence rates of 50 percent would have margins of error of up to plus or minus 5 percent). Confidence intervals are likely to be much smaller, however, when national prevalence rates are estimated using larger samples and for estimates referring to aggregates of several countries. To reduce the impact of year-to-year sampling variability, country-level estimates are presented as three-year averages, computed as averages of all available years in the considered triennia.

References:

FAO. 2016. *Methods for estimating comparable rates of food insecurity experienced by adults throughout the world*. Rome. (also available at www.fao.org/3/a-i4830e.pdf).

FAO. 2018. Voices of the Hungry. In: *Food and Agriculture Organization of the United Nations* [online]. Rome. [Cited 28 April 2020]. www.fao.org/in-action/voices-of-the-hungry

STUNTING, WASTING AND OVERWEIGHT IN CHILDREN UNDER 5 YEARS OF AGE

Definition of stunting (children under 5 years of age): Height/length (cm) for age (months) < -2 SD of the WHO Child Growth Standards median. Low height-for-age is an indicator that reflects the cumulative effects of undernutrition and infections since and even before birth. It may be the result of long-term nutritional deprivation, recurrent infections and lack of water and sanitation infrastructures.

How it is reported: The percentage of children aged 0–59 months who are below -2 SD from the median height-for-age of the WHO Child Growth Standards.

Definition of wasting: Weight (kg) for height/length (cm) < -2 SD of the WHO Child Growth Standards median. Low weight-for-height is an indicator of acute weight loss or a failure to gain weight and can be consequence of insufficient food intake and/or an incidence of infectious diseases, especially diarrhoea.

How it is reported: The percentage of children aged 0–59 months who are below -2 SD from the median weight-for-height of the WHO Child Growth Standards.

Definition of overweight: Weight (kg) for height/length (cm) > +2 SD of the WHO Child Growth Standards median. This indicator reflects excessive weight gain for height generally due to energy intakes exceeding children's energy requirements.

How it is reported: The percentage of children aged 0–59 months who are above +2 SD from the median weight-for-height of the WHO Child Growth Standards.

Data source: UNICEF, WHO and International Bank for Reconstruction and Development/World Bank. 2020. *UNICEF-WHO-The World Bank: Joint child malnutrition estimates – Levels and trends* (March 2020 edition) [online]. data.unicef.org/topic/nutrition; www.who.int/nutgrowthdb/estimates; data. worldbank.org

Methodology: National household surveys (MICS, DHS, national nutrition surveys, etc.) and national nutrition surveillance systems are the preferred primary data sources for child nutrition indicators. For entry in the database, they must be nationally representative, population-based surveys which present results based on the WHO Child Growth standards or provide access to the raw data enabling re-analysis.

A weighted analysis was carried out to account for the different country populations and ensure that the influence in the regional trend analysis of a country's survey estimate was proportional to the country's population. The population weights were derived from the UN Population Prospects, revision 2019. For each data point, the respective under-5 population estimate for the specific survey year was obtained. If a survey was performed over an extended period, for example November 2013 to April 2014, the mean year in which most of the fieldwork was completed (in this case 2014) was used as the year from which to choose the respective population estimate. Weights of countries with single data points were derived by dividing the under-5 population at the time of the survey by the sum of the countries' mean population in the whole region. For countries with multiple data points, the weights were calculated by dividing the mean of the country's under-5 population (over the observed years) by the sum of those mean populations of countries within the whole region.

A linear mixed-effect model was applied for each region or income group, using logistic transform of prevalence and results back-transformed to original scale. The final models were then used to project the trend of malnutrition in children from 1990 to 2019. Using the resulting prevalence estimates (after back-transformation), the total numbers affected were calculated by multiplying the prevalence and lower and upper limits of the confidence intervals by the subregional population derived from the UN population estimates.

Variables in the country data set: region, subregion, country, survey year, sample size, minimum and maximum age surveyed, prevalence of stunting, prevalence of wasting, prevalence of severe wasting, prevalence of overweight, country population of under 5 years of age.

Challenges and limitations: The recommended periodicity for countries to report on stunting, overweight and wasting is every three to five years; however, for some countries, data are available less frequently. While every effort has been made to maximize the comparability of statistics across countries and over time, country data may differ in terms of data collection methods, population coverage and estimation methods used. Survey estimates come with levels of uncertainty due to both sampling errors and non-sampling errors (technical measurement errors, recording errors, etc.). Neither of the two sources of error has been fully taken into account for deriving estimates at country or regional and global levels.

For the prevalence of wasting, as surveys are generally carried out during a specific period of the year, the estimates can be affected by seasonality. Seasonal factors related to wasting include food availability (e.g. pre-harvest periods) and disease (rainy season and diarrhoea, malaria, etc.), while natural disasters and conflicts can also show real shifts in trends that would need to be treated differently than a seasonal variation. Hence, country year estimates for wasting may not necessarily be comparable over time. Consequently, only the most recent (2019) estimates are provided.

References:

UNICEF, WHO and International Bank for Reconstruction and Development/World Bank. 2020. *UNICEF-WHO-The World Bank: Joint child malnutrition estimates – Levels and trends* (March 2020 edition) [online]. data.unicef.org/topic/nutrition, www.who.int/nutgrowthdb/estimates, data. worldbank.org
WHO. 2010. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva, Switzerland.
WHO. 2014. *Comprehensive Implementation Plan on maternal, infant and young child nutrition*. Geneva, Switzerland.

EXCLUSIVE BREASTFEEDING

Definition: Exclusive breastfeeding for infants < 6 months of age is defined as receiving only breastmilk and no additional food or drink, not even water. Exclusive breastfeeding is a cornerstone of child survival and is the best food for newborns, as breastmilk shapes the baby's microbiome, strengthens the immune system and reduces the risk of developing chronic diseases.

Breastfeeding also benefits mothers by preventing postpartum haemorrhage and promoting uterine involution, decreasing risk of iron-deficiency anaemia, reducing the risk of various types of cancer and providing psychological benefits.

How it is reported: Percentage of infants aged 0–5 months who are fed exclusively on breastmilk with no additional food or drink, not even water, in the 24 hours preceding the survey.

Data source: UNICEF. 2020. Infant and young child feeding. In: *UNICEF Data: Monitoring the situation of children and women* [online]. New York, USA. [Cited 26 May 2020]. data.unicef.org/topic/nutrition/infant-and-young-child-feeding

Methodology:

$$\frac{\textit{Infants 0–5 months of age who received only breastmilk during the previous day}}{\textit{Infants 0–5 months of age}}$$

This indicator includes breastfeeding by a wet nurse and feeding expressed breastmilk.

The indicator is based on a recall of the previous day's feeding to a cross-section of infants 0–5 months of age.

In 2012, the regional and global exclusive breastfeeding estimates were generated using the most recent estimate available for each country between 2005 and 2012. Similarly, 2019 estimates were developed using the most recent estimate available for each country between 2014 and 2019. Global and regional estimates were calculated as weighted averages of the prevalence of exclusive breastfeeding in each country, using the total number of births from the World Population Prospects, 2019 revision (2012 for the baseline and 2019 for the current) as weights. Estimates are presented only where the available data are representative of at least 50 percent of corresponding regions' total number of births, unless otherwise noted.

Challenges and limitations: While a high proportion of countries collect data for exclusive breastfeeding, data are lacking in high-income countries in particular. The recommended periodicity of reporting on exclusive breastfeeding is every three to five years. However, for some countries, data are reported less frequently, meaning changes in feeding patterns are often not detected for several years after the change occurs.

Regional and global averages may be affected depending on which countries had data available for the periods considered in this report.

Using the previous day's feeding as a basis may cause the proportion of exclusively breastfed infants to be overestimated, as some infants who may have been given other liquids or foods irregularly may not have received these on the day before the survey.

References:

UNICEF. 2020. Infant and young child feeding: exclusive breastfeeding. In: *UNICEF Data: Monitoring the Situation of Children and Women* [online]. New York, USA. [Cited 26 May 2020]. data.unicef.org/topic/ nutrition/ infant-and-young-child-feeding
WHO. 2008. *Indicators for assessing infant and young child feeding practices. Part 1: Definitions*. Geneva, Switzerland.
WHO. 2010. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva, Switzerland.
WHO. 2014. *Comprehensive Implementation Plan on maternal, infant and young child nutrition*. Geneva, Switzerland.

LOW BIRTHWEIGHT

Definition: Low birthweight is defined as a weight at birth of less than 2 500 grams (less than 5.51 lbs), regardless of gestational age. A newborn's weight at birth is an important marker of maternal and foetal health and nutrition.[9]

How it is reported: The percentage of newborns weighing less than 2 500 g (less than 5.51 lbs) at birth.

Data source: UNICEF & WHO. 2019. UNICEF-WHO joint low birthweight estimates. In: *United Nations Children's Fund* [online]. New York, USA and Geneva, Switzerland. [Cited 28 April 2020]. www.unicef.org/reports/UNICEF-WHO-low-birthweight-estimates-2019, www.who.int/nutrition/publications/UNICEF-WHO-lowbirthweight-estimates-2019

Methodology: Nationally representative estimates of low birthweight prevalence can be derived from a range of sources, broadly defined as national administrative data or representative household surveys. National administrative data are those coming from national systems including Civil Registration and Vital Statistics (CRVS) systems, national Health Management Information Systems (HMIS) and birth registries. National household surveys which contain information about birthweight as well as key related indicators including maternal perception of size at birth (MICS, DHS) are also an important source of low birthweight data especially in contexts where many births are unweighted and/or data heaping is a problem. Prior to entry into the country data set, country data are reviewed for coverage and quality and adjusted where the source is a household survey. Administrative data are categorized as (i) high coverage, if representing ≥90 percent of live births; (ii) medium coverage, if representing between 80 and 90 percent of live births; or (iii) not included, if covering <80 percent of live births. To be included in the data set, survey data need to have:

i. a birthweight in the data set for at minimum 30 percent of the sample;

ii. a minimum of 200 birthweights in the data set;
iii. no indication of severe data heaping – *this means that: a) ≤55 percent of all birthweights can fall on the three most frequent birthweights (i.e. if 3 000 g, 3 500 g and 2 500 g were the three most frequent birthweights, when added together, they have to make up ≤55 percent of all birthweights in the data set); b) ≤10 percent of all birthweights are ≥4 500 g; c) ≤5 percent of birthweights fall on tail ends of 500 g and 5 000 g;* and
iv. undergone an adjustment for missing birthweights and heaping.[11]

Modelling methods were applied to the accepted (and for household survey data, accepted and adjusted) country data to generate annual country estimates from 2000 to 2015, with methods varying by availability and type of input data as follows:

- b-spline: data for countries with ≥8 data points from higher coverage administrative sources ≥1 point prior to 2005 and ≥1 point more recent than 2010 are smoothed with b-spline regression to generate annual low birthweight estimates. A b-spline regression model was used to predict the standard error and calculate 95 percent confidence intervals for the country-level low birthweight estimates. These low birthweight estimates follow very closely those included in the countries' own administrative reports.
- Hierarchical regression: data for countries not meeting requirements for b-spline but with ≥1 low birthweight data point from any source meeting inclusion criteria are fitted into a model using covariates to generate annual low birthweight estimates, as well as uncertainty ranges, using a bootstrap approach. The model includes natural log of neonatal mortality rate; the proportion of children underweight (weight-for-age z score below -2 SD from median weight for age of reference population); data type (higher quality administrative, lower quality administrative, household survey); UN region (e.g. Southern Asia, Caribbean); and a country-specific random effect. These low birthweight estimates may vary substantially from estimates reported by countries in administrative and survey reports, especially given that the household survey estimates are adjusted for missing birthweights and heaping, while survey reports often present a low birthweight estimate just for the children with a birthweight and with no adjustment for data heaping.
- No estimate: countries for which low birthweight input data were not available and/or did not meet inclusion criteria are indicated in the database as "no estimate". A total of 54 countries in the current country database were reported as having "no estimate". Despite not presenting an estimate for these individual 54 countries, annual low birthweight estimates were derived for them using the hierarchical regression methods detailed above but used only to input into regional and global estimates.

Modelled annual country estimates are used to generate regional and global estimates from 2000–2015. Global estimates are derived by summing the estimated number of live births weighing less than 2 500 g for 195[au] countries with an estimate in the United Nations regional grouping for each year, and then dividing by all live births in each year in those 195 countries. Regional estimates are similarly derived, based on countries in each regional grouping. To obtain the global and regional level estimates of uncertainty, 1 000 low birthweight point estimates were made for each country for each year using either b-spline (by randomly sampling from a normal distribution plotted using the calculated standard error) or hierarchical regression approach (using a bootstrap approach). The country low birthweight estimates for each of the 1 000 samples were summed at worldwide or regional level and the 2.5th and 97.5th centiles of the resulting distributions were used as the confidence intervals.

au While the world comprises 202 countries (as per the full set of countries in the regional grouping with the largest set of countries – i.e. the UNICEF regional grouping), seven countries did not have low birthweight input data or covariate data. It was therefore not possible to generate any estimates for these seven countries and they are not included in the regional and global estimates.

Challenges and limitations: A major limitation of monitoring low birthweight globally is the lack of birthweight data for many of the world's children. There is a notable bias among the unweighted, with those born to poorer, less-educated, rural mothers being less likely to have a recorded birthweight when compared to their richer, urban counterparts with more highly educated mothers.[10] As the characteristics of the unweighted are risk factors for having a low birthweight, estimates that do not well represent these children may be lower than the true value. Furthermore, poor quality of available data with regard to excessive heaping on multiples of 500 g or 100 g exists in the majority of available data from LMICs[10] and can further bias low birthweight estimates. The methods applied to adjust for missing birthweights and heaping for survey estimates in the current database[11] are meant to address the problem; however, there were a total of 54 countries for which it was not possible to generate a reliable birthweight estimate. In addition, the confidence limits of the regional and global estimates may be artificially small given that about half of the modelled countries had a country-specific effect generated at random for each bootstrap prediction, some of which were positive and others negative, making the relative uncertainty at the regional and global level tend to be less than that at the individual country level.

References:
Blanc, A. & Wardlaw, T. 2005. Monitoring low birth weight: An evaluation of international estimates and an updated estimation procedure. *Bulletin World Health Organization*, 83(3): 178–185.
Blencowe, H., Krasevec, J., de Onis, M., Black, R.E., An, X., Stevens, G.A., Borghi, E., Hayashi, C., Estevez, D., Cegolon, L., Shiekh, S., Ponce Hardy, V., Lawn, J.E. & Cousens, S. 2019. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. *The Lancet Global Health*, 7(7): e849–e860.

ADULT OBESITY

Definition: BMI ≥ 30.0 kg/m². The body mass index (BMI) is the ratio of weight-to-height commonly used to classify the nutritional status of adults. It is calculated as the body weight in kilograms divided by the square of the body height in metres (kg/m²). Obesity includes individuals with BMI equal to or higher than 30 kg/m².

How it is reported: Percentage of population over 18 years of age with BMI ≥ 30.0 kg/m² standardized by age and weighted by sex.

Data source: WHO. 2020. Global Health Observatory (GHO) data repository. In: *World Health Organization* [online]. Geneva, Switzerland. [Cited 28 April 2020]. apps.who.int/gho/data/ node.main.A900A?lang=en (1698 population-based studies with more than 19.2 million participants aged 18 years or older, measured in 186 countries).

Methodology: A Bayesian hierarchical model was applied to selected population-based studies that had measured height and weight in adults aged 18 years and older to estimate trends from 1975 to 2014 in mean BMI and in the prevalence of BMI categories (underweight, overweight and obesity). The model incorporated nonlinear time trends and age patterns; national versus subnational and community representativeness; and whether data covered both rural and urban areas versus only one of them. The model also included covariates that help predict BMI, including national income, proportion of population living in urban areas, mean number of years of education and summary measures of availability of different food types for human consumption.

Challenges and limitations: Some countries had few data sources and only 42 percent of included sources reported data for people older than 70 years.

References:
NCD Risk Factor Collaboration (NCD-RisC). 2016. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with

19.2 million participants. *The Lancet*, 387(10026): 1377–1396.
WHO. 2010. *Nutrition Landscape Information System, Country Profile Indicators Interpretation guide*. Geneva, Switzerland.

ANAEMIA IN WOMEN OF REPRODUCTIVE AGE

Definition: [Haemoglobin] <110 g/L for pregnant women; [Haemoglobin] <120 g/L for non-pregnant women. Anaemia is defined as a haemoglobin concentration below a specified cut-off point, which can change according to the age, sex, physiological status, smoking habits and altitude at which the population being assessed lives.

How it is reported: Percentage of women of reproductive age (15 to 49 years old) with haemoglobin concentration below 110 g/L for pregnant women and below 120 g/L for non-pregnant women.

Data source: WHO. 2019. Vitamin and Mineral Nutrition Information System (VMNIS) – Micronutrients database. In: *World Health Organization* [online]. Geneva, Switzerland. [Cited 28 April 2020]. www.who.int/vmnis/database/en/

WHO. 2020. Global Health Observatory (GHO) data repository. In: *World Health Organization* [online]. Geneva, Switzerland. [Cited 28 April 2020]. apps.who.int/gho/data/node.imr.PREVANEMIA?lang=enWHO

Methodology: National representative surveys, summary statistics from WHO's Vitamin and Mineral Nutrition Information Systems, and summary statistics reported by other national and international agencies are used.

Data for non-pregnant women and pregnant women were summed and weighted by the prevalence of pregnancy to generate one value for all women of reproductive age. Data were adjusted by altitude and, when available, smoking status.

Trends were modelled over time as a linear trend plus a smooth nonlinear trend, at national, regional and global levels. The model used a weighted average of various bell-shaped densities to estimate full haemoglobin distributions, which might themselves be skewed.

The estimates are also informed by covariates that help predict haemoglobin concentrations, including maternal education, proportion of population in urban areas, mean latitude, prevalence of sickle cell disorders and thalassaemia and mean BMI. All covariates were available for every country and year, except the prevalence of sickle cell disorders and thalassaemia, which was assumed as constant over time during the analysis period for each country.

Challenges and limitations: Despite a high proportion of countries having nationally representative survey data available for anaemia, there is still a lack of reporting on this indicator, especially in high-income countries. As a result, the estimates may not capture the full variation across countries and regions, trending to "shrink" towards global means when data are sparse.

References:
Stevens, G.A., Finucane, M.M., De-Regil, L.M., Paciorek, C.J., Flaxman, S.R., Branca, F., Peña-Rosas, J.P., Bhutta, Z.A. & Ezzati, M. 2013. Global, regional, and national trends in hemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. *The Lancet Global Health*, 1(1): e16–e25.
WHO. 2010. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva, Switzerland.
WHO. 2014. *Comprehensive Implementation Plan on maternal, infant and young child nutrition*. Geneva, Switzerland.
WHO. 2015. *The global prevalence of anaemia in 2011*. Geneva, Switzerland.

ANNEX 2

METHODOLOGIES PART 1

A. Methodology for projections of PoU

PoU estimates are obtained using the following analytic formula:

$$PoU = \int_{-\infty}^{MDER} f(x|DEC;CV)dx \qquad [1]$$

with

$$CV = \sqrt{(CV|y)^2 + (CV|r)^2} \qquad [2]$$

where:

- MDER is an estimate of the lower bound of the range of dietary energy requirements that are compatible with a normally active and healthy life for the average individual in a population.
- CV|r is an estimate of the coefficient of variation (i.e. the standard deviation divided by the mean) of the distribution of energy requirements in the population.
- DEC is an estimate of the per capita level of the average habitual, daily dietary energy consumption in the population. It is obtained as the ratio between the total country's food supply, expressed in dietary energy equivalent (Dietary Energy Supply – DES), and the total population size, adjusted for household and retail level waste.
- CV|y is an estimate of the coefficient of variation of the distribution of per capita levels of habitual dietary energy consumption in the population that can be associated with differences in the households' socio-economic characteristics that are independent of sex, age, body mass and physical activity.

To project PoU estimates, each of the four basic parameters is projected independently:

The MDER and the CV|r are projected based on the projected population structure by sex and age, provided by the UN World Population Prospects (WPP)[1] (assuming constant average heights and physical activity levels by sex and age group).

The DEC is projected using the series of total Dietary Energy Supply (DES) in each country from 2005, to project the trend up to 2030 using an Exponential Smoothing procedure. Each annual value of the total DES is divided by the projected country population size, taken from the WPPs and adjusted for household and retail level food waste (the incidence of household and retail level waste is assumed to be constant over the projection period).

The CV|y is projected starting from 2015 or from the date of the last available food consumption survey (if this is posterior to 2015), using information derived from the estimates of the prevalence of severe food insecurity based on the FIES (FI_{sev}). This is obtained in two steps. First, a series of updated CV|y is obtained for each country for the period 2015–2019, by adjusting the value of CV|y obtained from the last available survey depending on the evolution in the three-year moving average of the FI_{sev}. The function[av] that links two consecutive values of CV|y, when there is 1 percentage point change FI_{sev} is:

$CV|y_t = CV|y_{t-1} \times 1.0011 + 0.0035$, if the change in FI_{sev} is an increase, and

av The function was obtained from an analysis of the full series of past data on PoU and CV|y measured from surveys available to FAO from 1999 to 2015, determining what change in the CV|y would induce the observed changes in PoU, after having taken into account the concomitant changes in the average food consumption. In this way, we ensure that the projected changes in the CV can be applied independently of the projected changes in the DEC. As new data from survey become available, we will validate and possibly update the formula.

$CV|y_t = (CV|y_{t-1} - 0.0035) / 1.0011$, if the change is a decrease.

Then, the series of adjusted CV|y over the 2015–2019 period is linearly projected into the future, up to 2030.

Once the four parameters MDER, DEC, CV|y and CV|r are available, the PoU is computed using the formulas in [1] and [2] above.

B. Methodology for assessment of progress against nutrition targets at the regional and global level

General method for assessment of progress against the targets: For all targets except wasting, the assessment of progress is done using an Average Annual Rate of Reduction (AARR).[aw] First an AARR for the current trend is calculated using estimates from the UN databases which provides an assessment of the rate of progress being made between the baseline year and most recent estimate. The AARR required to reach the target is then calculated using the baseline (2012) estimate from the UN databases and the target. The current AARR is then compared to the required AARR using cut-offs presented in **Table A2.1** to classify each subregion or region into their corresponding progress assessment category.

Baseline year: The baseline reference year for all the nutrition targets is 2012.

Number of stunted children: The numbers of children under 5 years who are stunted are derived multiplying the prevalence estimates by the corresponding population estimates referent to the same year from the World Population Prospects (WPP, 2019 edition).

Current trend: The "recent trend" period is defined as between 2008 and latest available year in most cases.[15] For exclusive breastfeeding, the "recent trend" is derived for years 2012 and 2019, based on data available in the years 2005–2012 and 2014–2019, respectively.

The current Average Annual Rate of Reduction (AARR): Calculated based on available data between the starting year 2008 and the latest, considered as the "recent trend" period, using a log-linear regression (exponential growth model). That is,

$$AARR = 1 - \exp(\beta)$$

where β is the slope in the model $Y=a+ \beta^*X$, Y is natural logarithm of the prevalence and X the survey year (X).[16]

The current Average Annual Rate of Increase (AARI) for exclusive breastfeeding (EBF): Calculated based on available survey data between the starting year 2008 and the latest, in this case, estimates derived for years 2012 and 2019, considered as the "recent trend" period, using a log-linear regression (exponential growth model). That is,

$$AARI = \exp(\beta) - 1$$

where β is the slope in the model $Y=a+ \beta^*X$, Y is natural logarithm of the prevalence and X the survey year (X).[2] [*It is the opposite of AARR, that is, multiplying by -1*].

Number of years to achieve the target, starting from the baseline: Starting from the baseline year, the number of years to achieve the target is given by:

$$n = ln\ (P_{target} / P_0)/ln(1+AARR/100)$$

aw For exclusive breastfeeding, the Average Annual Rate of Increase (AARI) is used instead of AARR since targets for this indicator require prevalence to increase.

TABLE A2.1
MONITORING RULES AND CLASSIFICATION OF PROGRESS TOWARDS ACHIEVING THE NUTRITION TARGETS AT THE REGIONAL AND GLOBAL LEVELS USED IN THIS REPORT

Indicator	On track	Off track – some progress	Off track – no progress or worsening
Stunting	AARR > required AARR[(a)] or level < 5%	AARR < required AARR[(a)] but > 0	AARR < 0
Low birthweight	AARR > required AARR[(b)] or level < 5%	AARR < required AARR[(b)] but > 0	AARR < 0
Exclusive breastfeeding	AARI > required AARI[(c)] or level > 70%	AARI < required AARI[(c)] but > 0	AARI < 0
Overweight (2030)	AARR > required AARR[(d)] or level < 3%	AARR < required AARR[(d)] but > 0	AARR < 0
	On track	**Off track**	
Wasting (2025)	Latest level < 5%	Latest level ≥ 5%	
Wasting (2030)	Latest level < 3%	Latest level ≥ 3%	
Overweight and adult obesity (2025)	AARR ≥ 0	AARR < 0	

NOTES: (a) required AARR based on the stunting prevalence change corresponding to a 40 percent reduction in number of stunted children between 2012 and 2025, or 50 percent between 2012 and 2030, considering the estimated population growth estimated (based on data from UN Population Prospects); (b) required AARR based on a 30 percent reduction in prevalence of low birth weight between 2012 and 2025 and the same 30 percent reduction in prevalence between 2012 and 2030; (c) required AARI to reach the targets of 50 percent for 2025 and 70 percent for 2030; (d) required AARR to reach the target of ≤ 3 percent overweight prevalence for 2030.
SOURCE: WHO and UNICEF. 2017. *Methodology for monitoring progress towards the global nutrition targets for 2025*. Geneva, Switzerland and New York, USA (adapted).

where P_{target} is the target prevalence, P_0 is the baseline one, and the $AARR$ is the calculated current AARR (or AARI for EBF).

Projected trends based on current AARR(I): The projected trends are based on the function:

$$P_{t+n} = P_t * (1\text{-AARR})^n$$

Target prevalence: For stunting, the target is a reduction in number of stunted children and therefore must be treated differently from the other targets. Moreover, the population growth needs to be taken into consideration, by taking into account the population estimates at the baseline and target years.

The target prevalence for stunting is derived by:

$$P_{target} = \frac{Baseline\ number\ of\ stunted * (1 - Target\ reduction/100)}{Population\ estimate\ at\ the\ target\ year}$$

where target reduction is 40 percent for target year 2025 and 50 percent for 2030.

Required AARR: For stunting, the required AARR is calculated for the regions and subregions based on the same targets as the global level. From the baseline year, to reach the target prevalence for year 2025, n=13 years apart, or 2030, n=18 years apart, the required AARR is calculated by:

$$AARR = 1\text{-} (P_{target} / P_0)^{(1/n)}$$

where P_{target} is the target prevalence (for either 2025 or 2030) and P_0 is the baseline one.

For overweight and adult obesity, the 2025 target is the same as the baseline target, as the global target for this indicator is to halt overweight. So required AARR is zero. However, for the 2030 target of 3 percent for childhood overweight, the required AARR is calculated as:

$$AARR = 1- (P_{target} / P_0)^{(1/n)}$$

where P_{target} is 3 percent and P_0 is the baseline prevalence.

For EBF, the required AARI is given by:

$$AARI = (P_{target} / P_0)^{(1/n)}-1$$

where Ptarget is equal to 50 percent by 2025 and 70 percent by 2030.

For low birthweight, the required AARR is given by:

$$AARR = 1- (1\text{-Target reduction})^{(1/n)}$$

where target reduction is given by 30 percent, for both 2025 and 2030, thus n equals to 13 and 18, respectively.

The criteria used to classify the progress of regions and subregions towards achieving the six nutrition targets are presented in Table A2.1.

C. Gender gap in accessing food

This section provides additional details about the analysis performed in the section "Gender differences in food insecurity" of Section 1.1.

C1. Prevalence of moderate or severe food insecurity among adults by gender

Figure 9 is derived using data collected by FAO. These data are collected at individual level. Each respondent (adult – 15 years or older) answers the FIES survey module by referring to his/her own individual food-insecurity condition. For this reason, it is possible to disaggregate the results of food insecurity by male and female respondents. To do so, first, the possible presence of differential item functioning between men and women was checked, to make sure that differences between men and women in food-insecurity levels was not due to the fact that they may experience in a different way the same food-security conditions or that they may interpret the same question in a different way. Results (not shown) point to no significant differential item functioning between men and women at global level. Based on this result, prevalence rates of food insecurity among men and women are calculated by applying different weighted raw score distributions (one for men and one for women) to the same probabilities of food insecurity, calculated at country level based on raw score parameters and errors obtained by the application of the Rasch model. This computation was performed for each year of data for each country. The results shown in the graph are based on yearly regional data in the period 2014–2019.

C2. Regression analysis

The text following Figure 9 in the report describes an analysis that aims at better understanding the determinants of gender gaps in accessing food, once controlling for other factors. The analysis is performed by pooling together individual-level FIES data collected by FAO in 145 countries, from 2014 to 2018, with the purpose of assessing the extent of any differences in the food-insecurity status of men and women, after controlling for socio-economic factors. A logistic regression is applied using the food-insecurity status as a dependent variable, established by considering the cross-country comparable probability of being food insecure at moderate or severe level for each country. If the probability is larger than 50 percent, the individual is classified as "food insecure" and the dependent variable takes the value of 1; otherwise it assumes a value of 0. Gender, area of residence, poverty and employment status, education level, age, marital status, perceived health of the respondents and household size are included as independent variables. The year of data collection (between 2014 and 2018) and geographical subregion are also included as covariates. Results show that, after controlling for area of residence, poverty status and education level of the respondents, the odds of being food insecure are still approximately 13 percent higher for women than for men at moderate or severe level, and 27 percent at severe level.

D. Methodology for calculation of percentage weight contribution of food groups in FBDGs from Australia, China and Thailand

This note refers to the calculations used to create the pie charts in Figure 16, Section 1.3. Three sets of FBDGs were compared by looking at the percentage weight contribution of each food group to the total diet.

D1. Assumptions made in calculating the percentage weight contribution of food groups to each FBDG

Australia:
The "Total Diet" for adults, omnivore pattern for women aged 19–50 years was used as a base. Since this corresponds to an energy requirement of 7 100–7 300kJ (average 7 200kJ or ~1 720 kcal), and the Australian FBDGs suggests that for taller or more active women, additional calories needed can be obtained from any preferred combination of foods from the various food groups; 0.5 servings more were added to each of the five recommended food group amounts in this pattern to obtain a diet of approximately 2 000 kcal.

The serving sizes for fruits group and vegetables and legumes/beans group are expressed in grams in the guide, and these values were used. The remaining three food groups "Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties" (cereals); "Lean meats and poultry, fish, eggs, nuts and seeds and legumes/beans" (lean meats and alternatives); and "Milk, yoghurt, cheese and/or alternatives, mostly reduced fat" (dairy and alternatives) are presented in the FBDGs with different serving size weights depending on the food. Thus, it was necessary to calculate a representative serving size per each food group according to the actual frequency/amounts of each food consumed in the country. The food consumption patterns observed for women aged 19–30 years was used for this purpose. In addition, for the cereal group, since the guidelines specify that 2/3 of the food should be wholegrains, the serving size for the group was calculated by assigning 2/3 of the value to the wholegrain serving size and 1/3 to the refined grains serving size obtained. The serving size obtained in this manner was 56.6 g for the cereal group. For the lean meats and alternatives group, using serving sizes expressed as cooked meat amounts, ~65 g was obtained for the serving size (which was the same for both the food composite of poultry, fish, seafood, eggs, legumes and food composite of red meats). For the dairy and alternatives group, the serving size was calculated to be 243 g, based on the average for Medium fat dairy foods (241 g) and Lower fat dairy foods (245 g). Guidance documents referred to were "A Modelling System to Inform the Revision of the Australian Guide to Healthy Eating",[17] "Eat for Health Educator Guide – Information for nutrition educators",[18] and the "Eat for Health Australian Dietary Guidelines Summary".[19]

China:
For each food group, a range of servings per day are given in the Chinese FBDGs, e.g. "Cereals, tubers and legumes" 250–400 g. These are based on an average adult who requires daily energy intake of 1 400–2 600 kcal.[20] On the assumption that the lower limit given for a food group is applicable for 1 400 kcal and the upper limit for 2 600 kcal, the average was used, which would correspond to 2 000 kcal. Thus, for example, for the "Cereals, tubers and legumes" a serving size of 325 g was used.

Thailand:
The 2 000 kcal pattern given in the FBDGs manual was used,[21] together with information in Sirichakwal *et al.* (2011).[22] For the fruit group, the serving size was not expressed in grams, so the weight of a small banana (40 g according to Sirichakwal *et al.*, 2011[22]) was used. This results in a total of 160 g for fruits, which when considered with the 240 g for vegetables, gives a total of 400 g of fruits and vegetables needed to meet the FAO/WHO daily recommendation. Similarly, for milk, the size of the glass was not specified in the manual but given as 200 g in the published paper.

D2. Description of the differences in the FBDGs

1. The way foods are grouped is not the same in the FBDGs:
   - Australia and China both use five food groups, although they are not exactly the same. Thailand uses six food groups.

- Australia counts legumes/beans with both animal foods and with vegetables while nuts and seeds are with animal foods. Thailand includes legumes and pulses with animal foods (nuts and seeds are not mentioned). China has legumes with the staples but also includes soybeans and nuts with milk and dairy.
- Australia includes milk alternatives in the dairy group, while suggesting that people who choose not to eat dairy foods can consider fortified soymilk, sardines and some nuts as calcium sources. (China includes soybeans and nuts with dairy.) In the case of Thailand, people having lactose maldigestion or intolerance are advised to eat alternative sources of calcium such as small fish with bone or fish meal.
- Thailand groups oil, sugar and salt as one group. China has oil and salt together. In Australia, foods containing saturated fat, added salt, added sugars and alcohol are placed outside the main five food groups, to convey the idea that they should be consumed infrequently and in small amounts.
- Both Australia and Thailand count fruits and vegetables as two separate food groups, while China considers them as one group (although separate serving sizes are given for them in the pagoda image).
- Tap water is indicated in the Australian FBDGs, while a glass of water is seen in the Chinese FBDGs. In addition, physical activity is also promoted in the Chinese FBDGs.

2. The relative proportions of the food groups vary among the three FBDGs:
   - The proportion of the cereal (staple) group is quite different in the three FBDGs, being largest in Thailand and smallest in Australia.
   - Fairly large differences are observed in the recommended proportions for the milk, dairy (and alternatives) group.
   - Combined fruits and vegetables are similar in Australia and China but smaller in Thailand.
   - The larger proportion of staples and "oil, sugar, salt" in Thailand can be linked to the nutritional problems that were targeted when the FBDGs were developed, mentioned as both undernutrition and overweight and obesity.

3. The foods depicted in the FBDGs are different:
   - Each country graphic shows foods that are commonly available and consumed in the country.

E. Strengths and limitations of different data sources for global assessment of diet quality

Table A2.2 summarizes some of the strengths and limitations of different sources of data for global assessment of food and nutrient intake and diet quality.

F. Analysis of the trends in food availability using Supply Utilization Accounts data

This section refers to the analysis in Section 1.3 entitled "Trends in global and regional food availability".

F1. Data

The data come from the Supply Utilization Accounts (SUA) database of the FAO Statistics Division (currently not in the public domain). Data for 184 countries and territories for the years 2000 to 2017 were used.

FAO Food Balance Sheets (FBS) are generated based on the SUA, which are more detailed lists of over 400 different foods. FAO has been compiling SUA and FBS annually for most countries and territories (currently, 184) since 1961.

Both SUA and FBS present a comprehensive picture of the pattern of a country's food availability during a specified reference period, typically a year. The figures are produced by balancing the data on a country's food supply (production, imports and opening stocks) with its food utilization (exports, availability for human consumption, seeds, feed, post-harvest losses, other utilizations and closing stocks)[23,24] »

TABLE A2.2
DATA SOURCES USED TO ASSESS DIETS: STRENGTHS AND LIMITATIONS FOR GLOBAL ASSESSMENT

Data source	Strengths	Limitations
Food Balance Sheets and Supply Utilization Accounts	▸ Wide coverage of countries and availability across time. ▸ Useful for illustrating trends over time in food supply at national level. ▸ Provide information on foods available for human consumption at the national level.	▸ Do not provide any information about actual food or nutrient intake. ▸ Provide information only at the national, aggregate level. ▸ Do not provide information on the distribution of access to available food by different population groups. ▸ May not fully capture all sources of food production (such as food produced in households for own consumption).
Household Consumption and Expenditure Surveys	▸ Wide coverage of countries. ▸ Representative at national and subnational levels (region, urban/rural). ▸ Capture variability in usual dietary energy intake in the population. ▸ Provide information on household food expenditures or acquisition. ▸ If well designed, can capture food consumption at the household level from all sources, including own production in private households.	▸ Do not provide information about food and nutrient intake of individual household members. ▸ Survey designs and definitions of food items/food groups/units of measurement are heterogeneous; thus, estimates may not be cross-country comparable. ▸ Food consumed away from home is usually poorly captured.
Individual-level quantitative food consumption (intake) surveys	▸ Provide detailed quantitative individual food and nutrient intake information. ▸ Data disaggregation possible at many levels (sex, age, etc.). ▸ Allow for characterizing the usual food and nutrient intake distribution of a population. ▸ Allow for estimating the prevalence of intake above or below a given level. ▸ Allow for assessment of overall diet quality and adherence to national dietary guidelines.	▸ Small number of nationally representative surveys available due to their high cost and complexity. ▸ In some countries, only carried out in specific subpopulations, i.e. women and children.
Individual-level non-quantitative food consumption (intake) surveys	▸ Quick, simple and inexpensive data collection and analysis. ▸ May provide information on dietary diversity and on consumption of specific food groups, by using, for instance, the Minimum Dietary Diversity – Women (MDD-W) Indicator, and the Infant and Young Child Dietary Diversity Score (IYCDDS).	▸ Do not provide information about quantities of food consumed. ▸ Do not assess all aspects of diet quality. ▸ Do not allow for characterizing the usual food and nutrient intake of a population. ▸ Data may refer only to specific subpopulation groups (for example, when used to derive MDD-W or IYCDDS).

SOURCE: Based on FAO. 2018. *Dietary Assessment: A resource guide to method selection and application in low resource settings*. Rome.

» for different foods and commodities. For the purpose of analysing global food availability for human consumption, the main difference lies in FBS providing information on quantities expressed in terms of equivalents of primary crops, livestock products and fish commodities, while SUA provide more granular information in terms of official or assessed quantities of commercialized food products. For instance, while the SUA reflect the amount of wheat flour available for consumption, in the FBS, this amount is converted into equivalents of wheat grain (i.e. the primary crop).

Nevertheless, while the two sets of data (SUA and FBS) are internally consistent by construction, users should be aware that none of them is based solely on directly measured variables. The reason is that the database is constructed by combining information on official domestic production of primary commodities (e.g. wheat, milk), with data on internationally traded food products (e.g. pasta, cheese). Balancing requires either the aggregation of imported SUA-level food items into quantities of their primary commodity equivalent (for example, expressing quantities of pasta and biscuits into wheat equivalents to be able to meaningfully sum them up) or the disaggregation of the domestic supply of primary commodities into SUA-level food items (that is, estimating how much of the national net supply of wheat goes into pasta and biscuit production and converting units of wheat into the corresponding units of derived products). This means that part of the SUA data derive from assumptions regarding the way in which the domestic supply of primary commodities is disaggregated up to the level of traded food products, which may be only approximately correct.

It should also be noted that national SUA (as well as FBS) rely on official data from countries, which in some cases might not reflect production from some small farms and/or private households. Furthermore, reliable data on national stock levels, industrial non-food utilization and post-harvest losses are lacking.

Nevertheless, bearing in mind the caveats outlined above, it is nonetheless possible to use SUA and FBS data to show trends in food available for consumption at the global level, or aggregating countries into regions or by country income group. The advantage of using SUA instead of FBS data is that it gives the user the possibility of classifying the various food items into food groups of choice.

F2. Food groupings

Food items were classified into 19 groups on the basis of their nutritional relevance following the classifications used in the FAO/WHO Global Individual Food consumption data Tool (GIFT),[25] with some exceptions. Some modifications were made to cater to the nature of SUA data and the purpose of this analysis, for example: (1) several food groups in the FAO/WHO GIFT (e.g. food supplements, composite dishes) feature food items not included in the SUA database, so these groups were not created; (2) for this analysis, the meat subgroups "Red meat" and "Processed meat" were created following the definition of the International Agency for Research on Cancer.[26]

For these analyses we considered 13 out of the 19 GIFT food groups (see Table A2.3). However, in the analysis of the trends of availability of selected food groups, estimates are shown for 10 food groups (cereals; fruits; vegetables; roots, tubers and plantains; pulses, seeds and nuts; eggs; fish and shellfish; dairy products; fats and oils; and sugars and sweeteners) and 3 meat subgroups (red meat, processed meat and poultry). Whereas, in the analysis of the contribution of food groups to the total food and dietary energy available, estimates represent the 13 food groups combined into 7 groups.

The classification of SUA items into food groups for this analysis differs slightly from the FBS classification, particularly for the following subgroups: (1) **plantains**, in the FBS classification, are grouped together with fruits, whereas in this analysis, plantains have been grouped together with roots and tubers; (2) **fruit juices** (100 percent, nectars and concentrate), in the FBS classification, are grouped together »

TABLE A2.3
FOOD GROUP CLASSIFICATIONS USED IN THE ANALYSIS

Group	Food groups	Subgroup	Subgroups
1	Cereals and their products	1.1	Rice and rice-based products
		1.2	Maize and maize-based products
		1.3	Wheat and wheat-based products
		1.4	Other cereals (including biscuits and wafers)
2	Fruits and their products	2.1	Fruits: fresh (excluding processed)
		2.2	Fruits: processed (including dried and excluding candied)
3	Vegetables and their products	3.1	Vegetables: fresh (including frozen and excluding processed)
		3.2	Vegetables: processed (including dried)
4	Roots, tubers, plantains and their products	4.1	Potato, sweet potato and their products
		4.2	Cassava and their products
		4.3	Other starchy roots and tubers (taro, yam, etc.; excluding sugary roots and tubers) and their products
		4.4	Plantain and plantain-based products
5	Pulses, seeds and nuts and their products	5.1	Pulses (excluding soybeans) and their products
		5.2	Soybean and soy-based products (excluding soybean oil)
		5.3	Nuts and their products
		5.4	Seeds and their products (excluding seed oil)
6	Eggs and their products	6.1	Eggs: fresh
		6.2	Egg products
7	Meat and meat products	7.1	Red meat
		7.2	Processed meat - all types (including processed offal and dried meat)
		7.3	Poultry: fresh (excluding processed and dried)
		7.4	Offal: fresh (excluding dried and processed)
		7.5	Other meats (e.g. reptiles and amphibians): fresh, processed or dried
8	Fish, shellfish and their products	8.1	Fish - all types: fresh and processed
		8.2	Fish cured
		8.3	Shellfish - all types (crustaceans, molluscs, cephalopods and bivalves): fresh and processed
9	Dairy products	9.1	Milk: fresh
		9.2	Milk or subproducts: dried
		9.3	Cheese
		9.4	Others: yogurt, subproducts (e.g. whey)
10	Fats and oils	10.1	Vegetable fat and oil
		10.2	Animal fat and oil
11	Sugars and sweeteners	11.1	Sugar and sweeteners
		11.2	Sugar crops
12	Beverages	12.1	Alcoholic beverages
		12.2	Sweetened beverages
		12.3	Fruit juice
		12.4	Fruit juice concentrated
		12.5	Vegetable juice
		12.6	Vegetable juice concentrated
13	Others	13.1	Miscellaneous
		13.2	Spices and condiments
		13.3	Tea, coffee and cocoa

SOURCE: FAO.

» with fruits, whereas in this analysis, fruit juices have been classified as beverages; (3) **vegetable juices** (100 percent, nectars and concentrate), in the FBS classification, are grouped together with vegetables, whereas in this analysis, they have been classified as beverages; (4) **soybean and soy-based products**, in the FBS classification, are grouped as oil crops, whereas in this analysis, they were grouped with pulses, seeds and nuts.

F3. Analysis

SUA data were used to depict trends in availability of selected food groups (cereals; fruits; vegetables; roots, tubers and plantains; pulses, seeds and nuts; eggs; fish and shellfish; dairy products; fats and oils; and sugars and sweeteners) and subgroups (red meat, processed meat and poultry) at global level, by region and by country income classification for the years 2000–2017. Estimates are presented as daily average per capita edible quantities.

Per capita per day estimates were obtained by dividing total food availability for a particular group by the total population in that year[1] and by the number of days in a year. To derive estimates expressed in quantities that are closer to the food available for consumption, food quantities were first adjusted for losses that may occur at the retail level estimated based on information published at global-regional level,[27] and then converted into corresponding edible quantities by applying inedible portion factors (i.e. refuse factors). It is worth noting that SUA (and FBS) data exclude food losses at the production and post-harvest level. Thus, the estimates presented herein are net of food losses up to the retail level. However, they are not net of potential food wastage that may happen at the household level.

The contribution of all 13 food groups (cereals; fruits; vegetables; roots, tubers and plantains; pulses, seeds and nuts; meat; eggs; fish and shellfish; dairy products; fats and oils; sugars and sweeteners; beverages; and others) to the total food available and to the dietary energy availability in 2017 are also presented, by country income classification. Estimates are presented (combined into 7 food groups) as food group contribution (percent) to total food available, and food group contribution (percent) to total dietary energy available.

Countries were classified by income level (high-income countries, upper-middle-income countries, lower-middle-income countries and low-income countries) using the World Bank classifications for the 2020 year.[28]

For a full description of the methodology (including a detailed list of the SUA food items and inedible portion factors used) and results, see Gheri *et al.* (forthcoming).[29]

G. Analysis of the association between food insecurity and food consumption

This section refers to the analysis in Section 1.3 entitled "How does food insecurity affect what people eat?"

G1. Data sets

The data sets used in the analyses were three Household Consumption and Expenditure Surveys (HCES): Kenya Integrated Household Budget Survey 2015/16, Sudan Study of Consumption Patterns and Nutrition 2018, and Samoa Household Income and Expenditure Survey 2018; and one individual-level dietary intake survey: Mexico National Health and Nutrition Survey (*Encuesta Nacional de Salud y Nutrición* [ENSANUT]) 2012.

G2. Definition of variables

Food insecurity was constructed as a trichotomous variable (food secure/mildly food insecure; moderately food insecure; severely food insecure), based on experience-based food insecurity scale data from the Kenya, Mexico and Sudan data sets. For Samoa, food insecurity was constructed as a dichotomous variable, because the number of sampled households with severe food insecurity was extremely low, thus, to provide reliable estimates of food consumption by class of food security, the severe food insecure class was combined with the moderate food insecure class – the two combined classes are referred to as "moderately food insecure". Each country's food insecurity scale was equated to the FIES global reference scale following the FIES methodology to produce a cross-country comparable measure of food insecurity levels.[30]

The average consumption of selected food groups was estimated in daily grams per capita. Foods were classified into 19 groups on the basis of their nutritional relevance following the criteria used in the FAO/WHO Global Individual Food consumption data Tool (GIFT),[25] with a few exceptions to cater for the nature of household consumption data. For these analyses, we considered 11 (cereals; roots, tubers, plantains; pulses, seeds and nuts; dairy products; eggs; fish and shellfish; meat; fruits; vegetables; fats and oils; and sweeteners and sugars) out of the 19 food groups. All estimates represent edible quantities.

The average apparent intake of dietary energy was estimated in daily kilocalories per capita. In the case of the three HCES data sets, the dietary energy estimate refers only to the at-home consumption. Foods which only had information on the monetary value (typically, food consumed away from home), were excluded. In Mexico's data set, all foods (consumed at home and away from home) were reported in terms of quantities, thus, they were all considered in the estimate of apparent dietary energy intake.

G3. Analysis

Average food group consumption and dietary energy intake estimates were obtained by food insecurity level in each country. The statistics from HCES data were obtained using the ADePT-FSM software.[31,32] Using Mexico's data set, estimates were obtained applying the National Cancer Institute (NCI) method for usual intake of episodically consumed foods and for usual dietary energy intake,[33] implemented through the Mixtran and Distrib SAS macros.[34]

Comparison of means was conducted with regression analysis followed by Tukey's pairwise post-hoc tests (family error rate of 5 percent), except for Samoa, where differences across groups were assessed with regression analysis only. Only the statistically significant results are reported within the text.

The design of the food consumption modules in the four surveys analysed differed substantially. Attempts were made to make food consumption statistics comparable across countries to the extent possible. Nevertheless, comparison of levels of consumption across countries should be done considering this limitation.

For a full description of the methodology and results, see Alvarez-Sanchez *et al.* (forthcoming).[35]

H. Analysis of association between food insecurity based on the FIES and new metrics of diet quality: evidence from Ghana and the United Republic of Tanzania

This section provides additional details about the analyses presented in Box 9.

H1. Data sets

The data used to estimate the diet quality indicators presented in the analysis were collected through the Gallup© World Poll in the context of the Global Diet Quality Project[69] along with the data used to estimate the prevalence rates of food insecurity. The surveys, conducted in 2019 in both countries, included the FIES survey module and Diet Quality Questionnaire (DQ-Q).[70]

H2. Definition of variables

Three diet quality indicators were constructed:

- Food Group Diversity Score (FGDS)
- Score of consumption of nutritious foods that contribute to healthy diets (FLAVOURS)
- Score of consumption of dietary components that should be limited or avoided (FAD)

Each indicator was produced using different combinations of food groups. The FGDS indicator is based on ten groups: grains, white roots and tubers, and plantains; legumes/pulses; nuts and seeds; dairy; meat, poultry and fish; eggs; dark green leafy vegetables; other vitamin a-rich fruits and vegetables; other vegetables; and other fruits. In FGDS, each group counts as one point. The FLAVOURS indicator is based on nine groups: whole grains; legumes/pulses; nuts and seeds; vitamin A-rich orange vegetables; dark green leafy vegetables; other vegetables; vitamin A-rich fruits; citrus fruits; and other fruits. In FLAVOURS, each group counts as one point, with the exception of "whole grains" that gets two points. The FAD indicator is based on six groups: sugar-sweetened beverages; sweets; processed meat; unprocessed read meat; deep fried food; and fast food (highly processed foods high in fat and sugar/salt purchased at a franchise/chain business) and instant noodles. In FAD, each group counts as one point, with the exception of sugar-sweetened beverages and processed meat which each get two points. All the dependent variables were ordinal variables based on food group scores.

Food insecurity was constructed as a trichotomous variable (food secure/mildly food insecure; moderately food insecure; severely food insecure), using the FIES data from each data set. Each country's food insecurity scale was equated to the global reference scale following the FIES methodology to produce a cross-country comparable measure of food insecurity.

H3. Model specification

Ordinal logistic regression equations were used to estimate the likelihood of an individual having a one point higher score for each of the three diet quality indicators, given his/her food insecurity status. Regressions were estimated for each diet quality indicator separately (FGDS, FLAVOURS and FAD). The analyses were conducted controlling for age, sex, education, income, area of residence, household size and marital status.

ANNEX 3

DESCRIPTION, DATA AND METHODOLOGY OF SECTION 2.1

A. Description of the three diets

A1. The energy sufficient diet: definition and cost

The ***energy sufficient*** diet provides adequate calories for energy balance for work each day, achieved using only each country's basic starchy staple (e.g. maize, wheat, or rice). In this report, the benchmark requirements for an energy sufficient diet and the other two diets refer to the *dietary needs* of an adult reference non-pregnant and non-lactating woman aged 30 doing moderate physical activity.

The cost of the energy sufficient diet is computed to identify the absolute lowest cost of meeting calorie needs from the cheapest starchy staple available in a country. The cost of the energy sufficient diet is not intended to create a realistic or typical cost of a diet; rather it represents the absolute lowest cost of calorie sufficiency. In fact, the purpose of calculating this hypothetical benchmark is to establish a lower bound on the cost of short-term survival at each place and time, and to identify the additional cost required to achieve longer-term goals specified in the other two diets.
This benchmark is used in the report as a point of comparison for discussing affordability of the cost of nutrient adequate and healthy diets (see below).

A 30-year-old woman is chosen as a reference to cost the three diets since preliminary analyses show that each country's weighted average of the cost of the diets, obtained by calculating age- and sex-specific calorie and nutrient requirements, is very close to the cost for this reference woman. The estimated energy requirement (EER) for a non-pregnant and non-lactating woman aged 30 with moderate physical activity is determined using the Dietary Reference Intakes (DRIs) developed by the Institute of Medicine (IOM) with the following formula:

$$EER=354 - 6.91*age + PAL*(9.36*Weight\ (kg) + 726\ *Height\ (m))$$

where the weight of 57 kg and the height of 1.63 m are the median values for an adult woman from the WHO growth chart, indicating a median body mass index (BMI) of 21.5; and the Physical Activity Level (PAL) equal to 1.27 is the Active PAL coefficient from DRIs. Thus, the same energy intake value based on the median WHO weight and height, and also a recommended active PAL on physical activity level are applied to all countries and do not reflect country-specific population characteristics.

Based on this formula, the energy intake of the reference population is estimated to be 2 329 kcal per day. This calorie content is applied across all three diets and all countries for comparability.

A2. The nutrient adequate diet: definition and cost

The ***nutrient adequate*** diet provides not only adequate calories but also adequate levels of all essential nutrients for a healthy and active life, through a balanced mix of carbohydrates, protein, fat, vitamins and minerals, within the upper and lower bounds needed to prevent deficiencies and avoid toxicity. The cost of this diet is computed to identify the minimum cost of foods that meet all known requirements for essential nutrients as well as the dietary energy requirement of 2 329 kcal for a reference woman aged 30.

The purpose of calculating this diet is to identify the cost and affordability of acquiring all nutrients in the required proportions, so as to identify the ability of each country's food system to deliver nutrient adequate diets at all times and places. The minimum cost of a nutrient adequate diet also provides a useful lower bound on the cost of nutrients in order to identify the additional cost required to achieve additional goals specified in other diets, such as long-term health protection and culturally preferred diet patterns.

The cost of the nutrient adequate diet is defined as the minimum cost to meet the EER needed for the energy sufficient diet, as well as relevant daily nutrient intake values of 23 macronutrients and micronutrients for the reference group (Table A3.1). Global harmonized average requirements (H-ARs) are applied, which are the levels of nutrients that meet the needs of 50 percent of the healthy population. Furthermore, harmonized upper level of intake (H-ULs) are applied, representing the highest level that is likely to avoid risk of adverse health effects,[36] and the Chronic Disease Risk Reduction Intake (CDRR) for sodium.[37,38]

To calculate the cost of nutrient adequate diets, a linear program selects foods to provide nutrient content above the H-ARs and below the H-ULs and the CDRR for sodium, while specifying that the macronutrient intakes are within the Acceptable Macronutrient Distribution Range (AMDR) set by the IOM,[39] and meeting the energy content of 2 329 kcal. The result is a basket representing the lowest cost of meeting average energy, macronutrient and micronutrient needs in the population.

For half the population, true nutrient needs are lower, so the true cost of a nutrient adequate diet would be lower; for the other half of the population, true nutrient needs are higher, so the true cost of a nutrient adequate diet would be higher. For people who are less physically active, energy needs and therefore costs are lower, and for people who are more physically active, energy needs and therefore costs are higher. The aim is to provide the best estimate of the average cost of meeting energy, macronutrient and micronutrient needs within the population.

In a sensitivity analysis, the cost of a nutrient adequate diet is also calculated using the IOM Recommended Dietary Allowances (RDAs), or Adequate Intakes (AIs), if the latter is not larger than the H-ARs, to determine the cost of a nutrient adequate diet that would cover 97.5 percent of nutrient needs of the population.

In Figures 30 and 31, the cost of the nutrient adequate diet is estimated for a household of five specific individuals and it is then expressed as a per capita average. The modelled household varies by country, but typically includes one breastfed child aged 12–23 months, one school-aged child (6–7 years), one adolescent girl (14–15 years), one lactating woman and one adult man. Unaffordability is measured by the proportion of households in a country whose food expenditure is not sufficient to afford a nutrient adequate diet in their local environment. The nutrient adequate diet includes, per person, the average energy needs and the recommended intake for protein, fat, four minerals and nine vitamins. The reference nutrient intake (RNI) is applied, which is the amount of nutrients that meet the needs of nearly all the population (97.5 percent).

TABLE A3.1
NUTRIENT INTAKE VALUES FOR A REPRESENTATIVE 30-YEAR-OLD WOMAN

	Nutrient	Unit	ARs	RDAs or AIs*	AMDR lower	AMDR upper	UL
1	Energy	kcal	2 329	2 329			
2	Protein	g	37.6	46	58.2	203.8	
3	Lipids	g			51.8	90.6	
4	Carbohydrate	g			262	378.5	
5	Calcium	mg	750	1 000			2 500
6	Iron[3]	mg	22.4	22.4			45
7	Magnesium[1]	mg	265	310			350
8	Phosphorous	mg	580	700			4 000
9	Zinc[b]	mg	8.9	10.2			25
10	Copper	mg	0.7	0.9			5
11	Selenium	mcg	45	55			300
12	Vitamin C[c]	mg	80	80			2 000
13	Thiamin	mg	0.9	1.1			
14	Riboflavin[c]	mg	1.3	1.3			
15	Niacin[1]	mg	11	14			35
16	Vitamin B6[c]	mg	1.3	1.3			25
17	Folate[1]	mcg	250	400			1 000
18	Vitamin B12	mcg	2	2.4			
19	Vitamin A[2]	mcg	490	700			3 000
20	Vitamin E	mg	12	15			300
21	Sodium	mg					2 300
22	Vitamin B5[a]	mg	4	5			
23	Choline[a]	mg	320	425			3 500
24	Manganese[a,c]	mg	2.4	2.4			11

NOTES: Values shown are for a 30-year-old non-pregnant non-lactating woman. ARs denotes average requirements, RDAs denotes Recommended Dietary Allowances, AIs denotes Adequate Intakes, AMDR denotes Acceptable Macronutrient Distribution Range, and UL denotes Upper Levels. * The values in this column are RDAs except where noted: a. is the value is an AI; b. is the value for zinc takes the assumption of an undefined diet; c. is the same values are used for both AR and RDA because the RDA/AI is not larger than the HARs. 1. The upper levels only refer to the supplement intakes, and therefore are not considered in the cost of nutrient adequate diet calculation. 2. The upper level of vitamin A refers to the intake of retinol. 3. The H-AR of iron takes the assumption of a low-absorption diet for the AR value; 4. The H-AR of zinc takes the assumption of a semi-undefined diet for the AR value.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

A3. The healthy diet: definition and cost

The **healthy** diet provides not only adequate calories but also adequate levels of all essential nutrients for a healthy and active life. As per the two diets above, the reference group is an adult woman aged 30. The methodology used here does not test for nutrient adequacy, but ensures that a more diverse variety of foods from different food groups are consumed.

The cost of a healthy diet is defined as the minimum cost of foods that meet a set of dietary recommendations based on FBDGs and intended to provide adequate calories and nutrients. This diet also includes a more diverse intake of foods from several different food groups. Although the healthy diet is not selected on the basis of nutrients but is determined by FBDGs, this diet meets on average 95 percent of nutrient needs, and it can be therefore almost always considered as nutrient adequate.[40]

While the detailed guidance of national FBDGs are designed to be specific to the country, in most cases the definitions of food groups used to define a healthy diet pattern are broadly similar, usually consisting of common 5–6 food groups.

For this global analysis, it is not possible to apply a country specific FBDGs to each country because not every country has defined its own national FBDGs, and even where they exist, only a few FBDGs are quantifiable. To overcome this limitation, and given that there is no single way to define a healthy diet, ten national FBDGs are selected for this analysis which explicitly report recommended food quantities for each food group and provide a wide regional representation: Benin (Western Africa), Oman (Western Asia), Malta (Southern Europe), Netherlands (Western Europe), India (Southern Asia), Viet Nam (South-eastern Asia), China (Eastern Asia), United States of America (Northern America), Jamaica (Caribbean) and Argentina (South America).

For each country, ten costs of the healthy diet are calculated by applying these ten FBDGs. The local cost and affordability of the healthy diet is calculated for each country based on the two least-expensive retail items in each food group, in the total quantity recommended by each FBDGs for that food group, in order to provide an energy intake of 2 329 kcal. The retail food items considered are those locally available at each time when prices are reported, and by marketplace.[ax] This calculation is done for each unique set of the ten recommendations, to produce a range of costs associated with a range of ways to meet healthy diets as they have been defined by Member States. Finally, the mean of the ten least expensive baskets is taken as a point estimate of the cost of healthy diets.

Given that there is no one way to define a healthy diet, this method is a more robust way of estimating the least-cost of a healthy diet rather than applying a single definition of a healthy diet. Sensitivity analysis was carried out on three variant models of the cost of the healthy diet which are described with results presented in **Annex 4**. The finding shows that healthy diets *by any definition* are unaffordable to a very large number of people.

The choice of the ten FBDGs results from a combination of four factors: a) clear quantification of food groups; b) recency of publication; c) representativeness of regions and countries with large populations; and d) representativeness of distinctive dietary patterns. For instance, since more than half of all people in the world live in Asia, and dietary patterns vary significantly between the subregions in Asia, three FBDGs that represent three Asian subregions are considered in this analysis.

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ax Prices fluctuate, so the least-cost set of items will vary by time, and by marketplace; there is no constant set of items that are always least-cost. In the price data used for the analysis,"each time" refers to the time period for which prices were reported. For the monthly data within countries, that is usually one market visit per month, but sometimes is based on one visit per week, and in the ICP data, it is a single average price for the entire year. Similarly, "each place" refers to the physical market locations at which prices were observed, where data used are typically an average over several vendors at open markets and grocery stores in each rural town or city.

In addition, by applying different FBDGs to different countries, cross-country comparability could not be pursued. Instead, by applying all ten FBDGs to each country, a range is produced as each FBDG is associated with a slightly different cost. It should be noted that the cost of the healthy diet is sensitive to the definition and choice of FBDGs. For instance, if the FBDGs for Malta and Oman are removed from the analysis, the cost of a healthy diet becomes USD 3.72 as compared with USD 3.75 when ten FBDGs are used. See **Annex 4** for specific guidelines of each of the ten FBDGs and a cost comparison of each, including a comparison to four EAT-Lancet healthy and sustainable diets.

Out of the ten FBDGs used:

- six use exactly the same six food groupings (starchy staples, protein-rich foods including legumes/flesh/egg, dairy, vegetable, fruit and fats/oils); one of those six also includes nuts as an additional food group recommended daily (two in Asia, two in Europe, Africa and Northern America);
- two use the same six food groupings, except that legumes are grouped with starchy staples instead of protein foods (one in Asia, one in Latin America and the Caribbean);
- one uses the same six food groupings, except that legumes and flesh/egg are both required subgroups of the protein category (Western Asia);
- one uses the same six food groupings, except that dairy and flesh/egg are grouped together, and legumes are a separate required group (one in Latin America and the Caribbean);
- in contrast, the EAT-Lancet reference diet has 12 food groups (including requirements for an exact amount of consumption of red meat, poultry, fish, eggs, legumes and starchy roots, each; food groups vary within four diet patterns). In most cases, the least-cost EAT-Lancet reference diet pattern is vegan.

The way foods are grouped in these ten FBDGs are only some of the possible ways foods can be grouped, which is done primarily based on how foods are used culinary. Globally, approximately half of FBDGs use six food groups.

Coherently with WHO guidelines, the selected ten FBDGs recommend at least 400 g of fruits and vegetables, less than 10 percent of dietary energy from sugar and less than 5 g of salt, as all sugary and salty snack foods are excluded and treated as non-required foods. The least-cost items selected are generally raw commodities such as beans, maize, bread, oranges, papayas, onions, spinach, milk and sunflower oil. They almost always include legumes; they sometimes but not always include nuts, because some FBDGs do not include nuts. Whether or not they include whole grains is more difficult to determine, because many of the grain items in the ICP list are not specified as to whether or not they are whole grain.

The purpose of calculating the cost and affordability of this diet is to identify the ability of each country's food system to deliver diets that meet dietary needs beyond nutrients, which encompass acceptable dietary patterns and protection of long-term health at the lowest possible cost. The minimal cost of a healthy diet provides a useful lower bound on the cost of achieving food security through market purchases. This is an important benchmark because it allows an estimate of whether all people can access a diet that meets minimum standards for healthy and active lives, as defined by Member States.

B. Data and methodology for estimating costs and affordability of the three diets

The analysis on cost and affordability of the three diets is focused on 170 countries for which data are available in year 2017. Following the 2017 World Bank classification of income, out of the 170 countries, 27 are low-income, 37 are lower-middle-income, 43 are upper-middle-income and 63 are high-income countries. Although the work from Herforth *et al.* (2020)[40] includes 173 countries, three countries are excluded from the analysis presented in Section 2.1 (Anguilla, Bonaire and Montserrat), since the World Bank's classification of income is not available for them. See Table A3.2 for a description of the countries.

The cost and affordability analysis focuses on sufficient quantities of the least-cost food items that are available at retail markets in each time and place to meet specified energy and nutritional requirements. More expensive items are usually also available in the markets and would be counted in a country's CPI, but they are omitted from these cost calculations. Therefore, the resulting least-cost diets are hypothetical diets. In fact, the purpose of this analysis is to measure whether the food system brings healthy diets within reach of the poorest, using those foods that meet each standard at the lowest possible cost.

The reference population chosen to measure the cost and affordability of the three diets is a non-pregnant and non-lactating woman doing moderate physical activity. There are two reasons behind the choice of calculating affordability indicators based on a reference woman of reproductive age. First, the least-cost to meet energy and nutrient requirements for this reference group is approximately at the median level of the least-costs for all sex-age groups over the life cycle.[40] Therefore, this reference group is a good representation of the population as a whole.

Second, women of reproductive age are typically a nutritionally vulnerable population group, due to important consequences of energy and nutrient deficiencies on both women and infants, as well as increased risk of dietary inadequacies due to social practices and norms that often disadvantage women and girls. Previous studies have also based cost of nutrient adequate diet findings on this reference group.[41,42] It should be considered, however, that other population groups, such as women during pregnancy and lactation, may have higher energy requirements.

To estimate cost and affordability of the three diets, four kinds of data are used: i) retail prices; ii) dietary requirements; iii) food composition and classification; and iv) welfare indicators.

Retail prices of each food item available for purchase in each market are obtained from the World Bank's ICP for internationally standardized items (one nationally representative price per item) for 2017.[43] The ICP data are based on each United Nations member country's national statistical agency, which may also provide prices for more diverse items at multiple market locations each month for several years. ICP reports data for 737 items in 2017, but 57 were alcohol and tobacco, leaving 680 food and non-alcoholic beverage items. Furthermore, non-caloric food items were also excluded from the analysis, such as baby food formula, condiments, and items with unclear composition. Therefore, the analysis focuses on food prices in local currency units (LCU) for 680 foods in 170 countries, from the ICP's global and regional item lists. Prices expressed in 2017 LCU are converted to international dollars using purchasing power parity (PPP). Prices are measured at retail marketplaces, defined as the locations where people typically acquire their food.

These locations range from open markets with multiple vendors to small neighborhood shops and grocery stores of all sizes. Retail markets may offer thousands of distinct items at different prices that vary over time and space. To compare prices across and within countries, national statistical agencies identify representative items at widely used marketplaces, and observe their price at regular intervals. All prices reported by those national agencies are used, counting items with missing prices as not available (or equivalently, having an infinitely high price).

A key feature of the least-cost diets for each nutritional standard is that the food items chosen may vary over time and place, drawing on locally available or seasonal items as needed to meet *dietary requirement*. For caloric adequacy, the least-cost diet allows for substitution among the starchy staples based only on the energy content of each food. For the nutrient adequate diet, the least-cost diet recognizes substitution among alternative sources of each essential nutrient; for example, month-to-month variation in Vitamin A sources is allowed when different fruits and vegetables are in season, and there is a similar substitution within each food group for healthy diets as defined by dietary guidelines.

Food composition and classification of each item is typically obtained from the nutrient data bank for internationally standardized items implemented by the United States Department of Agriculture (USDA), complemented by other food composition data. The food group classification of each item, for its contribution to a healthy dietary recommendation, is based on the definitions used for each dietary guideline. Each FBDG's specification of the amount of food that meets the recommended amount is followed. If foods are cooked, yield factors are applied, which are from the Western African Food Composition Table (FCT). In all three diets, the edible portions applied are mostly from the USDA FCT, supplemented by the Western African FCT and others for some fish and raw meats.

Classifying foods in the ICP table into food group definitions of the selected FBDGs is quite straightforward. The main assumptions involve the exclusion of certain grain foods (such as biscuits and cakes) from the starchy staple group, as well as fruit juices from the fruit group unless it was explicitly included in the country's FBDGs. In one country's FBDGs, nuts were not mentioned and were therefore excluded from that particular definition of a healthy diet.

Data on *welfare indicators* are used for the affordability analysis, to test if diets are within reach. Three sources are used:

- The global World Bank's poverty line set at USD 1.90 per capita per day expressed in PPP terms.
- National average food expenditures per capita per day in year 2017 from the ICP, calculated by Herforth *et al*. (2020),[40] based on ICP data.[ay]
- Income distributions from the World Bank's PovcalNet tool that are available for year 2018 (not for year 2017), and are based on household surveys across 164 economies.

  The 2015 income distribution was applied only to India, as this is the most recent distribution available in the country. Since all data from the PovcalNet tool[44] are expressed in USD 2011, the costs of the diets measured in 2017 were adjusted to USD 2011 costs. CPI inflation from the Federal Reserve Economic Data were used to make this adjustment for each year between 2012 and 2017.[45]

Using the data described above, to calculate least-cost diets for the energy sufficient and nutrient adequate diets, linear programming is used to select foods in the quantities needed to minimize the cost subject to caloric and nutrient constraints. For the cost of the healthy diet, rank-order optimization method is used to select two foods in each group that fill each category at the lowest cost.

To determine affordability, the cost of the three diets is compared with poverty lines, food expenditures and income, to create three measures of affordability:

1. **Affordability as the cost of the diets compared with poverty line:** the cost of the diets is compared with 63 percent of the international poverty line set at USD 1.90 per day, which is equal to USD 1.20. The 63 percent accounts for a portion of the poverty line that can be credibly reserved for food, based on observations that the poorest segment of the population in low-income countries spend, on average, 63 percent of their incomes on food (World Bank Global Consumption Database).[46] It is thus assumed that a minimum of 37 percent of expenditures must be reserved for non-food items (such as housing, transport, school, farm inputs). In reality, 37 percent of non-food expenditures is a conservative assumption, for instance, in high-income countries, where non-food expenditures may be a higher share. Under this measure, affordability is defined when the cost of each diet per person per day is lower or equal to USD 1.20. When the cost of each diet is greater than USD 1.20, denoting unaffordability, this measure tells

ay The sources for national accounts data on total and food expenditures are the WB ICP reports as per the UN System of National Accounts. These are the same data used to compute "gross national income" (GNI) and GDP, and are based on a variety of sources in each country. For further details on data sources and methodology, see Alemu *et al*. (2019).[68]

how many times a diet is more expensive than the threshold of USD 1.20.

2. **Affordability as the cost of the diets compared with average country's food expenditure:** the cost of the diets is compared with the typical daily per capita food expenditures in each country. Under this measure, affordability is defined when the cost of each diet per person per day is lower or equal to the average food expenditure in each country. When the cost of each diet is greater than this threshold, denoting unaffordability, this measure tells how many times a diet is more expensive than the average country-specific food expenditure per person per day. Table A3.2 reports this measure for the 170 countries in the analysis.
3. **Affordability as the percentage and number of people not able to afford the diets:** the cost of the diets is compared with the average income in each country using income distributions from the World Bank PovcalNet interface.[44] A diet is considered unaffordable when its cost exceeds the 63 percent of the average income in a given country. Based on this threshold, this measure identifies the percentage of people for whom the cost of a specific diet is unaffordable. These proportions are multiplied by the 2017 population in each country using the World Development Indicators (WDI) of the World Bank, to obtain the number of people who cannot afford a given diet in a given country. Note that, out of the 170 countries in the analysis, information on the percentage and number of people who are not able to afford the diets is available for 143 countries. Table A3.2 reports this measure for the countries in the analysis.

To give a range of confidence to the third measure, the prevalence and number of people who cannot afford the three diets are also computed using lower-bound and upper-bound estimates that are shown in Table A3.3 by region and development status.[az] Lower-bound estimates assume that all income available can be spent on food, and this gives a very conservative estimate. For upper-bound estimates, the income needed is defined as the income required to purchase a given diet as well as other non-food needs:

Needed income = cost of the diet / food expenditure share in World Bank's classification of income

Food expenditure shares identify the average proportion of expenditures that are reserved for food, and these vary by country income group. Specifically, food expenditures represent, on average, 15 percent, 28 percent, 42 percent and 50 percent of total expenditures in high-, upper-middle-, lower-middle- and low-income countries, respectively. For example, if the cost of a healthy diet is USD 3.00 in a given low-income country where food expenditures are on average 50 percent of total expenditures, income would need to be USD 6.00 for people to afford the healthy diet as well as non-food needs.

For a full description of the methodology, see Herforth *et al.* (2020).[40]

C. Data and methodology of the simulation of policy impact and transport cost reduction on the cost of the nutrient adequate diet

For the simulation of policy impacts on the cost of the nutrient adequate diet (Box 24), estimates of nominal rates of protection (NRP) are used and expressed as the percentage change in a commodity's farm gate price attributable to government restrictions on international trade and other market price interventions. In fact, the NRP is calculated using the difference between the observed border price and farm gate price of a given food commodity, after accounting for market access costs. Therefore, it represents the effect of trade policy and domestic price support. Simulation results in this box are shown for Central America countries, under the assumption that trade distortions (protection) are removed, meaning that the NRP is made equal to zero.

az The median food expenditure shares are 14 percent, 25 percent, 41 percent and 51 percent for the four income levels, which are quite close to the mean.

NRP estimates are compiled and published by the AgIncentives Consortium with input from the World Bank, the OECD, the Agrimonitor Initiative of the Inter-American Development Bank (IDB) and the Monitoring and Analyzing Food and Agricultural Policies (MAFAP) programme of FAO. NRPs are available in each country for 57 distinct commodity products that are then grouped into nine food group (dairy, fruits, vegetables, grains, legumes, poultry and eggs, red meat, starchy roots and tubers, and sweeteners). Retail price data is from the 2017 round of the World Bank's International Comparison Project (ICP). In order to reduce measurement error and the influence of extreme values, the first step of the analysis is to smooth variation over time and space by collapsing NRP observations from 2008 to 2014 for all food products into the mean NRP for each food group for each country. Subsequently, the NRPs (percentage of farm gate price) are converted into changes in the retail prices of final products that are reported through the ICP. Our upper bound on price effects represents a scenario where farm gate commodity prices account for one-half of retail prices paid, and our lower bound represents a scenario where that fraction is one-fourth. For each scenario we identify the quantities of items needed to meet nutrient requirements at lowest total cost per day, and show the added expense imposed by the country's agricultural trade restrictions. Retail prices include the cost of services at the point of sale, plus transport from the farm gate to retail outlet, none of which are changed by the underlying commodity's farm gate NRP.

For the simulation of transport cost reduction on the cost of nutrient adequate diet (Box 19), the analysis is conducted on 14 sub-Saharan countries (Benin, Burundi, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Uganda and United Republic of Tanzania). The transport cost reduction, representing a positive shock, is derived from the average transport cost data collected by the MAFAP for the 24 value chains analysed in the 14 countries for the period 2014–2017. Such costs are adjusted downward using the average ratio (2014–2017) of the World Bank Logistics Performance Index of the respective country to South Africa, which is the most efficient country in the region in terms of transport networks.

In order to simulate the transport cost reduction scenario, the transport shock, originally expressed as share of the farm gate price, is averaged by food group, and then applied to the retail prices from ICP of all food items in the food group, in order to compute annual cost savings for a nutritionally adequate diet (per person and in constant 2017 USD). The different responses between the 14 sub-Saharan countries stem from differences in the country-specific foods that make up the least cost diet.

The transport cost shock is re-computed at the retail level applying two margin ranges: 100 and 300 percent. In the upper bound (100 percent) transport shock is applied to half the retail price (a scenario where farm gate commodity price accounts for one-half of retail price). In the lower bound (300 percent) it is applied to a quarter of the retail price (farm gate price is one-fourth of the retail price). The quantities of food items needed to meet nutrient requirements at the lowest total cost per day, are identified for each scenario. Subsequently, the potential (annual) savings generated by the potential reduction in transport costs are estimated.

For a full description of the methodology, see Herforth *et al.* (2020).[40]

TABLE A3.2

COST AND AFFORDABILITY OF THE THREE DIETS BY COUNTRY (170 COUNTRIES), BY REGION, COUNTRY INCOME GROUP AND POPULATION (MILLIONS) IN 2017

Country	Region	WB Income classification	Population 2017 (millions)	Cost and affordability of energy sufficient diet: Cost (USD)	Cost and affordability of energy sufficient diet: % food expenditure	Cost and affordability of energy sufficient diet: % population cannot afford	Cost and affordability of nutrient adequate diet: Cost (USD)	Cost and affordability of nutrient adequate diet: % food expenditure	Cost and affordability of nutrient adequate diet: % population cannot afford	Cost and affordability of healthy diet: Cost (USD)	Cost and affordability of healthy diet: % food expenditure	Cost and affordability of healthy diet: % population cannot afford
Algeria		Upper-middle-income	41.4	0.77	12.4	0.1	2.13	34.3	2.0	4.14	66.6	27.9
Angola		Lower-middle-income	29.8	0.97	21.9	35.4	3.22	72.3	82.5	4.87	109.4	92.2
Benin		Low-income	11.2	0.65	31.6	18.9	1.94	94.3	66.4	4.27	207.1	91.0
Botswana		Upper-middle-income	2.2	0.51	3.8	0.8	2.04	15.5	33.1	4.33	32.8	64.5
Burkina Faso		Low-income	19.2	0.45	28.2	0.1	2.16	136.1	70.4	3.63	228.5	89.5
Burundi		Low-income	10.8	0.65	73.8	36.5	1.40	160.3	81.0	3.57	407.4	97.4
Cabo Verde		Lower-middle-income	0.5	0.62	13.9	0.1	2.29	51.4	13.5	3.60	80.8	33.4
Cameroon		Lower-middle-income	24.6	0.54	23.4	2.2	1.63	70.3	29.9	3.59	154.6	63.4
Central African Republic		Low-income	4.6	0.62	50.3	38.9	1.41	113.7	74.5	3.47	279.6	93.6
Chad		Low-income	15.0	0.53	27.3	10.3	1.92	98.8	62.8	3.26	167.8	83.9
Comoros		Low-income	0.8	1.10	29.7	13.0	3.46	93.4	58.3	5.44	146.7	76.5
Congo		Lower-middle-income	5.1	0.96	43.7	27.9	2.53	114.8	70.1	3.40	154.7	80.8
Côte d'Ivoire		Lower-middle-income	24.4	0.60	19.0	3.6	1.41	44.8	25.0	3.23	102.5	69.8
Democratic Republic of the Congo		Low-income	81.4	0.41	26.7	14.7	1.57	100.7	78.3	3.26	209.6	95.1
Djibouti	AFRICA	Lower-middle-income	0.9	0.62	25.7	3.2	2.17	90.7	38.1	3.72	155.1	68.3
Egypt		Lower-middle-income	96.4	0.69	5.7	<0.1	2.74	22.7	45.4	4.99	41.3	84.8
Equatorial Guinea		Upper-middle-income	1.3	0.77	8.0		1.80	18.7		4.07	42.2	
Ethiopia		Low-income	106.4	0.58	40.5	1.7	1.94	136.9	47.7	3.39	238.7	84.0
Gabon		Upper-middle-income	2.1	0.89	20.5	1.0	2.47	56.8	14.6	3.78	87.0	33.0
Gambia		Low-income	2.2	0.98	38.7	3.2	2.34	92.7	38.9	4.49	178.0	78.1
Ghana		Lower-middle-income	29.1	0.82	50.1	5.3	2.08	126.3	26.5	4.65	282.5	64.9
Guinea		Low-income	12.1	0.90	24.6	7.6	2.21	60.0	56.3	4.68	127.5	92.2
Guinea-Bissau		Low-income	1.8	0.78	22.0	34.0	2.00	56.5	79.1	3.93	110.9	92.4
Kenya		Lower-middle-income	50.2	0.77	21.3	9.5	1.70	47.1	47.5	3.24	89.9	79.1
Lesotho		Lower-middle-income	2.1	0.61	23.6	6.2	2.13	82.5	47.6	4.11	159.6	76.2
Liberia		Low-income	4.7	0.97	127.3	24.3	2.96	387.9	85.9	5.45	714.9	97.8
Madagascar		Low-income	25.6	0.48	26.4	22.8	2.37	129.1	91.4	3.46	188.3	96.3
Malawi		Low-income	17.7	0.28	21.9	1.3	1.33	102.2	70.5	2.85	219.1	93.7
Mali		Low-income	18.5	0.60	23.3	4.0	1.71	66.3	60.6	3.19	123.8	89.6
Mauritania		Lower-middle-income	4.3	0.88	26.3	1.7	2.50	75.0	33.2	4.42	132.8	70.3

TABLE A3.2 (CONTINUED)

Country	Region	WB Income classification	Population 2017 (millions)	Cost and affordability of energy sufficient diet			Cost and affordability of nutrient adequate diet			Cost and affordability of healthy diet		
				Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford
Mauritius	AFRICA	Upper-middle-income	1.3	0.81	7.8	<0.1	2.51	24.1	2.7	4.22	40.5	14.8
Morocco		Lower-middle-income	35.6	0.61	14.4	<0.1	1.98	46.9	4.1	2.85	67.4	13.1
Mozambique		Low-income	28.6	0.38	24.4	7.9	1.79	113.8	73.8	4.18	266.4	92.7
Namibia		Upper-middle-income	2.4	1.01	30.3	9.8	1.72	51.8	22.9	3.47	104.4	49.2
Niger		Low-income	21.6	0.44	62.9	1.0	1.47	209.5	50.2	3.58	510.3	91.5
Nigeria		Lower-middle-income	190.9	0.94	15.8	33.3	2.01	34.0	72.2	3.79	64.1	91.1
Rwanda		Low-income	12.0	0.44	30.3	3.4	1.25	86.7	48.9	3.54	245.2	89.6
Sao Tome and Principe		Lower-middle-income	0.2	0.90	19.1	17.4	2.30	49.1	65.7	3.88	82.7	86.1
Senegal		Low-income	15.4	0.74	23.0	6.9	1.63	50.4	39.2	3.01	93.2	72.8
Seychelles		High-income	0.1	0.63	12.8	0.3	2.17	43.6	1.8	4.44	89.3	6.9
Sierra Leone		Low-income	7.5	0.45	21.2	0.5	1.97	91.9	68.6	2.84	132.4	85.1
South Africa		Upper-middle-income	57.0	1.26	29.3	18.6	3.39	78.6	54.4	4.35	100.7	62.0
Sudan		Lower-middle-income	40.8	1.08	24.2	6.8	5.96	133.5	93.4	4.93	110.6	89.0
Swaziland		Lower-middle-income	1.1	0.93	15.3	14.6	2.15	35.3	50.3	3.68	60.3	69.7
Togo		Low-income	7.7	1.94	144.0	64.4	2.18	162.1	69.7	5.72	424.9	96.1
Tunisia		Lower-middle-income	11.4	0.60	11.1	<0.1	1.68	30.9	0.9	3.68	67.8	15.3
Uganda		Low-income	41.2	0.47	31.0	2.0	1.55	102.0	50.4	3.00	197.2	81.3
United Republic of Tanzania		Low-income	54.7	0.58	21.7	5.6	1.73	64.9	65.5	2.77	104.1	85.0
Zambia		Lower-middle-income	16.9	0.61	35.8	28.8	2.17	127.8	73.2	3.38	199.5	84.1
Zimbabwe		Low-income	14.2	0.73	32.4	5.1	2.14	94.7	57.7	3.80	168.2	80.0
Armenia	ASIA	Upper-middle-income	2.9	1.01	8.8	0.8	2.09	18.2	11.2	3.86	33.6	51.7
Azerbaijan		Upper-middle-income	9.9	0.79	9.7	<0.1	1.79	22.0	<0.1	2.90	35.6	<0.1
Bahrain		High-income	1.5	0.79	11.5		2.53	36.9		4.31	62.8	
Bangladesh		Lower-middle-income	159.7	0.64	14.5	0.1	1.63	36.7	18.9	3.54	79.6	74.6
Bhutan		Lower-middle-income	0.7	1.05	18.0	0.2	2.56	44.0	12.9	4.87	83.7	45.8
Brunei Darussalam		High-income	0.4	0.76	14.3		2.31	43.3		4.20	78.7	
Cambodia		Lower-middle-income	16.0	0.99	25.6		2.49	64.3		4.22	108.7	
China		Upper-middle-income	1 386.4	0.79	28.7	0.1	1.66	60.4	0.8	3.71	134.8	16.3
China. Hong Kong SAR		High-income	7.4	0.91	8.0		2.10	18.5		4.30	37.8	
Cyprus		High-income	1.2	0.58	9.6	<0.1	2.08	34.2	0.1	3.03	49.9	0.1
India		Lower-middle-income	1 338.7	0.79	27.3	0.9	1.90	66.0	39.1	3.41	118.2	77.9

TABLE A3.2
(CONTINUED)

Country	Region	WB Income classification	Population 2017 (millions)	Cost and affordability of energy sufficient diet			Cost and affordability of nutrient adequate diet			Cost and affordability of healthy diet		
				Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford
Indonesia	ASIA	Lower-middle-income	264.6	1.02	20.9	1.1	2.59	53.0	34.0	4.80	98.2	68.8
Iraq		Upper-middle-income	37.6	1.06	22.7	0.7	2.08	44.7	13.9	4.00	85.9	59.7
Israel		High-income	8.7	0.51	6.2	<0.1	1.92	23.5	0.5	2.82	34.5	1.2
Japan		High-income	126.8	3.03	35.1	0.9	3.45	40.0	1.2	5.51	63.8	2.1
Jordan		Upper-middle-income	9.8	0.64	13.8	<0.1	1.66	35.5	0.9	4.19	89.7	30.5
Kazakhstan		Upper-middle-income	18.0	0.65	7.7	<0.1	1.64	19.4	0.1	3.07	36.4	2.2
Kuwait		High-income	4.1	0.34	5.4		1.66	26.2		3.96	62.3	
Kyrgyzstan		Lower-middle-income	6.2	0.96	22.0	0.2	2.29	52.2	18.6	3.72	84.7	60.3
Lao People's Democratic Republic		Lower-middle-income	7.0	0.72	17.1	0.5	2.70	64.0	51.2	4.85	115.0	83.3
Malaysia		Upper-middle-income	31.1	0.91	10.4	<0.1	2.20	25.3	0.1	3.37	38.8	1.0
Maldives		Upper-middle-income	0.5	0.42	14.5	<0.1	2.64	90.5	1.0	3.95	135.2	6.5
Mongolia		Lower-middle-income	3.1	0.74	16.0	<0.1	2.06	44.5	4.2	4.63	99.9	42.5
Myanmar		Lower-middle-income	53.4	0.87	24.3	0.2	2.26	63.0	17.7	3.99	111.4	60.9
Nepal		Low-income	27.6	0.99	25.3	1.9	2.28	58.3	36.1	4.16	106.4	76.2
Oman		High-income	4.7	0.52	7.2		1.66	23.1		3.13	43.4	
Pakistan		Lower-middle-income	207.9	0.77	20.9	<0.1	1.77	48.3	10.3	3.87	105.4	68.7
Philippines		Lower-middle-income	105.2	1.16	17.6	2.6	2.43	37.1	30.6	4.31	65.7	63.0
Qatar		High-income	2.7	0.67	13.2		1.15	22.5		3.11	61.1	
Republic of Korea		High-income	51.4	0.68	13.1	<0.1	3.83	73.8	1.0	4.83	93.0	1.5
Saudi Arabia		High-income	33.1	0.88	8.4		1.85	17.6		4.19	40.0	
Singapore		High-income	5.6	0.75	14.8		2.01	39.6		3.39	66.9	
Sri Lanka		Lower-middle-income	21.4	0.97	17.6	0.1	2.02	36.6	6.8	4.71	85.3	53.5
Taiwan Province of China		High-income	23.6	1.46	15.6		2.66	28.4		5.15	55.1	
Tajikistan		Low-income	8.9	0.91	36.2	0.8	2.20	87.3	14.4	3.36	133.6	37.2
Thailand		Upper-middle-income	69.2	1.05	17.3	<0.1	2.71	44.7	1.8	4.89	80.8	19.5
Turkey		Upper-middle-income	81.1	0.73	10.0	<0.1	2.37	32.2	2.1	3.34	45.4	6.2
United Arab Emirates		High-income	9.5	0.75	10.1		1.81	24.5		3.46	46.9	
Viet Nam		Lower-middle-income	94.6	0.97	28.6	0.6	2.47	72.5	9.5	4.01	117.5	26.6
West Bank and Gaza		Lower-middle-income	4.5	1.12	28.4	0.7	1.59	40.2	1.7	3.81	96.3	24.5

TABLE A3.2
(CONTINUED)

Country	Region	WB Income classification	Population 2017 (millions)	Cost and affordability of energy sufficient diet			Cost and affordability of nutrient adequate diet			Cost and affordability of healthy diet		
				Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford
Antigua and Barbuda	LATIN AMERICA AND THE CARIBBEAN	High-income	0.1	0.93	17.4		2.78	51.9		4.90	91.5	
Argentina		High-income	44.0	0.65	7.7	0.2	2.30	27.2	3.3	3.73	44.0	9.2
Aruba		High-income	0.1	1.13	23.9		2.61	55.3		3.82	80.9	
Bahamas		High-income	0.4	1.05	16.9		4.08	65.8		4.22	68.0	
Barbados		High-income	0.3	0.90	21.8		2.07	50.4		3.51	85.5	
Belize		Upper-middle-income	0.4	1.13	46.1	12.1	2.67	109.0	37.0	2.81	114.4	39.3
Bolivia (Plurinational State of)		Lower-middle-income	11.2	1.42	24.9	5.2	3.01	52.8	16.6	3.76	66.1	23.0
Brazil		Upper-middle-income	207.8	0.82	18.5	2.0	2.45	55.2	10.6	3.03	68.3	14.5
British Virgin Islands		High-income	<0.1	1.56	17.3		2.75	30.4		4.36	48.3	
Cayman Islands		High-income	0.1	1.09	17.5		2.01	32.3		3.17	50.8	
Chile		High-income	18.5	0.62	10.0	0.2	2.14	34.5	0.6	3.14	50.4	1.8
Colombia		Upper-middle-income	48.9	1.02	23.1	2.7	2.61	58.8	15.2	3.41	76.8	23.7
Costa Rica		Upper-middle-income	4.9	0.94	15.3	0.8	2.74	44.4	5.9	3.95	64.1	11.8
Curacao		High-income	0.2	1.14	21.8		2.16	41.3		3.51	67.1	
Dominica		Upper-middle-income	0.1	1.22	26.5		3.48	75.7		3.98	86.5	
Dominican Republic		Upper-middle-income	10.5	1.18	15.2	0.4	2.51	32.4	4.3	4.06	52.4	16.0
Ecuador		Upper-middle-income	16.8	1.31	30.5	3.4	2.31	53.9	10.7	3.18	74.2	18.2
El Salvador		Lower-middle-income	6.4	1.46	27.1	2.2	5.09	94.6	41.5	4.52	83.9	34.9
Grenada		Upper-middle-income	0.1	1.33	16.5		3.77	46.9		5.61	69.8	
Guyana		Upper-middle-income	0.8	0.73	18.5	1.1	3.31	84.2	24.4	5.12	130.2	43.1
Haiti		Low-income	11.0	0.86	32.2	11.3	2.63	98.9	61.9	4.91	184.5	88.0
Honduras		Lower-middle-income	9.4	1.15	32.6	13.7	3.32	94.5	44.7	3.65	103.9	48.6
Jamaica		Upper-middle-income	2.9	1.01	15.6	0.8	4.04	62.0	33.9	5.40	82.9	51.0
Mexico		Upper-middle-income	124.8	0.66	8.4	0.3	2.55	32.4	9.6	3.28	41.6	17.2
Nicaragua		Lower-middle-income	6.4	1.44	42.1	3.8	2.31	67.7	12.4	3.52	103.1	29.1
Panama		High-income	4.1	1.13	13.8	1.3	2.57	31.4	6.8	4.94	60.4	18.2
Paraguay		Upper-middle-income	6.9	0.95	16.2	0.6	3.32	56.7	13.7	3.89	66.3	18.0
Peru		Upper-middle-income	31.4	0.65	14.8	0.3	1.88	42.4	6.1	3.43	77.5	19.0
Saint Kitts and Nevis		High-income	0.1	0.53	8.2		2.95	45.4		3.26	50.3	

TABLE A3.2
(CONTINUED)

Country	Region	WB Income classification	Population 2017 (millions)	Cost and affordability of energy sufficient diet			Cost and affordability of nutrient adequate diet			Cost and affordability of healthy diet		
				Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford	Cost (USD)	% food expenditure	% population cannot afford
Saint Lucia	LATIN AMERICA AND THE CARIBBEAN	Upper-middle-income	0.2	1.05	59.1	4.2	2.53	142.2	12.6	3.61	203.4	19.2
Saint Vincent and the Grenadines		Upper-middle-income	0.1	1.32	25.1		2.89	55.0		4.99	94.9	
Sint Maarten (Dutch part)		High-income	<0.1	1.72	32.2		3.76	70.2		4.77	89.1	
Suriname		Upper-middle-income	0.6	1.14	13.9	17.8	3.25	39.6	42.8	5.09	61.9	54.1
Trinidad and Tobago		High-income	1.4	1.01	12.9	0.2	2.63	33.5	2.2	4.33	55.2	9.0
Turks and Caicos Islands		High-income	<0.1	1.13	31.7		2.32	65.4		3.32	93.5	
Uruguay		High-income	3.4	0.69	9.4	<0.1	2.13	28.8	0.3	3.02	40.8	1.2
Albania	NORTHERN AMERICA AND EUROPE	Upper-middle-income	2.9	0.76	8.2	<0.1	2.55	27.4	14.9	4.33	46.5	43.9
Austria		High-income	8.8	0.35	4.9	0.2	2.26	31.8	0.4	2.84	40.0	0.5
Belarus		Upper-middle-income	9.5	0.80	9.5	<0.1	2.01	23.9	<0.1	4.20	50.0	0.7
Belgium		High-income	11.4	0.27	3.2	0.1	2.44	29.6	0.2	2.87	34.8	0.3
Bermuda		High-income	0.1	1.10	10.4		4.09	38.9		3.49	33.1	
Bosnia and Herzegovina		Upper-middle-income	3.4	0.71	8.9	<0.1	3.00	38.0	1.0	4.10	51.9	2.8
Bulgaria		Upper-middle-income	7.1	0.51	7.8	0.1	2.82	43.0	4.8	4.14	63.1	8.0
Canada		High-income	36.5	0.68	10.7	0.2	2.03	32.0	0.5	3.08	48.5	0.7
Croatia		High-income	4.1	0.67	7.8	0.3	3.13	36.1	2.3	4.42	51.1	5.4
Czechia		High-income	10.6	0.45	6.0	<0.1	2.40	31.9	0.1	3.10	41.0	0.2
Denmark		High-income	5.8	0.30	4.5	0.1	1.75	25.6	0.1	2.44	35.8	0.2
Estonia		High-income	1.3	0.42	5.1	0.1	2.34	27.9	0.6	3.30	39.3	0.8
Finland		High-income	5.5	0.28	4.0	0.1	2.17	30.6	0.1	2.75	38.7	0.1
France		High-income	66.9	0.32	4.1	<0.1	1.90	24.2	<0.1	3.09	39.3	<0.1
Germany		High-income	82.7	0.27	3.7	<0.1	2.15	29.6	0.2	2.79	38.5	0.2
Greece		High-income	10.8	0.68	7.7	0.5	2.58	29.3	2.0	3.09	35.1	2.8
Hungary		High-income	9.8	0.45	6.7	0.3	2.34	34.8	1.3	3.53	52.5	2.5
Iceland		High-income	0.3	0.38	4.3	<0.1	2.41	26.9	<0.1	2.39	26.7	<0.1
Ireland		High-income	4.8	0.58	11.8	0.1	2.02	41.3	0.3	2.50	51.1	0.4
Italy		High-income	60.5	0.32	3.6	1.0	2.26	25.4	1.9	3.08	34.7	2.5
Latvia		High-income	1.9	0.45	6.1	0.1	2.06	28.2	1.1	3.34	45.7	2.5
Lithuania		High-income	2.8	0.51	4.5	0.8	1.99	17.4	1.3	3.22	28.2	2.7
Luxembourg		High-income	0.6	0.33	4.0	0.1	1.98	23.7	0.4	2.46	29.5	0.4
Malta		High-income	0.5	0.76	11.2	0.1	2.67	39.2	0.2	4.00	58.6	0.3
Montenegro		Upper-middle-income	0.6	0.56	5.1	<0.1	2.32	21.2	7.5	3.82	34.9	16.1

TABLE A3.2
(CONTINUED)

Country	Region	WB Income classification	Population 2017 (millions)	Cost and affordability of energy sufficient diet: Cost (USD)	% food expenditure	% population cannot afford	Cost and affordability of nutrient adequate diet: Cost (USD)	% food expenditure	% population cannot afford	Cost and affordability of healthy diet: Cost (USD)	% food expenditure	% population cannot afford
Netherlands	NORTHERN AMERICA AND EUROPE	High-income	17.1	0.30	4.3	<0.1	1.75	25.2	0.2	2.76	39.6	0.3
Norway	NORTHERN AMERICA AND EUROPE	High-income	5.3	1.08	14.5	0.2	2.64	35.4	0.4	3.48	46.7	0.5
Poland	NORTHERN AMERICA AND EUROPE	High-income	38.0	0.40	5.2	0.1	1.96	25.7	0.5	3.09	40.4	0.8
Portugal	NORTHERN AMERICA AND EUROPE	High-income	10.3	0.42	4.6	0.1	1.85	20.5	0.5	2.69	29.7	0.9
Republic of Moldova	NORTHERN AMERICA AND EUROPE	Lower-middle-income	2.8	0.71	10.3	<0.1	1.57	22.6	<0.1	2.96	42.8	4.3
Romania	NORTHERN AMERICA AND EUROPE	Upper-middle-income	19.6	0.51	4.8	0.8	2.27	21.3	6.8	3.31	31.0	11.5
Russian Federation	NORTHERN AMERICA AND EUROPE	Upper-middle-income	144.5	0.62	6.8	<0.1	2.27	24.7	0.3	3.40	37.0	1.5
Serbia	NORTHERN AMERICA AND EUROPE	Upper-middle-income	7.0	0.61	9.2	<0.1	2.61	39.0	1.5	4.37	65.3	11.2
Slovakia	NORTHERN AMERICA AND EUROPE	High-income	5.4	0.39	5.6	1.0	2.11	30.4	1.6	3.36	48.4	2.6
Slovenia	NORTHERN AMERICA AND EUROPE	High-income	2.1	0.44	6.2	<0.1	2.05	28.8	<0.1	3.04	42.8	<0.1
Spain	NORTHERN AMERICA AND EUROPE	High-income	46.6	0.44	6.1	0.5	1.77	24.3	0.9	2.77	38.0	1.5
Sweden	NORTHERN AMERICA AND EUROPE	High-income	10.1	0.82	11.1	0.1	2.50	33.8	0.3	2.94	39.8	0.3
Switzerland	NORTHERN AMERICA AND EUROPE	High-income	8.5	0.42	5.6	<0.1	2.07	27.4	<0.1	2.47	32.7	<0.1
The former Yugoslav Republic of Macedonia	NORTHERN AMERICA AND EUROPE	Upper-middle-income	2.1	0.74	9.7	2.0	3.00	39.2	12.7	3.74	49.0	16.9
United Kingdom	NORTHERN AMERICA AND EUROPE	High-income	66.1	0.27	5.0	0.1	1.44	27.0	0.2	1.89	35.3	0.3
United States of America	NORTHERN AMERICA AND EUROPE	High-income	325.0	0.90	12.9	1.0	2.21	31.6	1.5	3.10	44.3	1.7
Australia	OCEANIA	High-income	24.6	0.31	4.6	0.2	1.63	24.0	0.5	2.38	35.1	0.7
Fiji	OCEANIA	Lower-middle-income	0.9	0.85	11.0	<0.1	2.35	30.4	9.6	4.07	52.7	41.3
New Zealand	OCEANIA	High-income	4.8	0.49	5.9		2.23	26.7		2.74	32.8	

NOTES: The table shows the cost and affordability of the three reference diets (energy sufficient, nutrient adequate and healthy diet) for 170 countries in year 2017. Cost and affordability are shown by region (column 2), development status (column 3) and population in year 2017 (column 4). The cost of the three diets is based on retail food price data obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). Two measures of affordability are presented. One shows the cost of each diet as a percentage of average food expenditure per capita per day in a given country (columns 6, 9 and 12): each diet is unaffordable for values greater than 100 percent. The other measure shows the percentage of people who cannot afford the three reference diets: each diet is unaffordable when its cost exceeds the 63 percent of the average income in a given country (columns 7, 10 and 13). The 63 percent accounts for a portion of average income that can be credibly reserved for food.

SOURCES: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries.* Background paper for *The State of Food Security and Nutrition in the World 2020.* Rome, FAO. Population data are taken from World Bank. 2020. World Development Indicators – Home. In: *World Bank* [online]. Washington, DC. [Cited 24 April 2020]. http://datatopics.worldbank.org/world-development-indicators

TABLE A3.3

LOWER- AND UPPER-BOUND ESTIMATES OF THE PERCENTAGE AND NUMBER OF PEOPLE (IN MILLIONS) WHO CANNOT AFFORD THE COST OF EACH DIET, BY REGION AND COUNTRY INCOME GROUP IN 2017

	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)
	Energy sufficient diet				Nutrient adequate diet				Healthy diet			
	Lower-bound		Upper-bound		Lower-bound		Upper-bound		Lower-bound		Upper-bound	
WORLD	**2.0**	**71.2**	**9.5**	**516.4**	**12.9**	**636.0**	**40.3**	**2 843.5**	**26.0**	**1 864.3**	**59.5**	**4 575.0**
AFRICA	4.8	59.6	19.6	267.1	31.0	413.5	66.5	866.7	57.3	754.3	86.6	1 081.5
Northern Africa	0.2	0.4	4.8	10.4	18.3	43.7	46.3	134.5	27.3	86.4	70.1	182.9
Sub-Saharan Africa	5.4	59.2	21.2	256.7	32.4	369.8	68.7	732.2	60.7	667.9	88.5	898.6
Eastern Africa	3.2	8.5	16.5	56.6	33.6	128.6	68.1	277.3	60.8	252.8	88.6	347.6
Middle Africa	8.7	11.9	29.6	43.7	40.5	80.3	74.9	128.3	63.4	122.4	90.0	152.0
Southern Africa	3.5	4.4	27.3	29.1	24.0	22.7	65.3	48.1	46.8	30.2	82.5	52.6
Western Africa	6.3	34.4	19.7	127.3	29.9	138.2	67.3	278.5	63.7	262.4	89.5	346.4
ASIA	0.1	2.8	3.5	199.9	2.8	184.1	32.1	1 684.1	17.3	1 050.7	62.3	3 033.5
Central Asia	<0.1	<0.1	1.2	0.3	1.8	0.4	28.1	6.7	11.1	2.4	63.3	19.3
Eastern Asia	0.2	1.5	2.5	26.0	0.5	3.1	16.5	258.2	5.0	53.9	50.1	887.0
South-eastern Asia	<0.1	0.3	4.3	40.0	6.5	43.1	41.8	283.2	25.4	182.3	68.1	463.3
Southern Asia	<0.1	1.0	2.7	124.7	3.4	136.1	40.9	1 088.0	30.3	800.2	78.3	1 583.6
Western Asia	<0.1	<0.1	4.9	9.0	0.7	1.2	25.4	48.0	7.3	11.8	48.8	80.4
LATIN AMERICA AND THE CARIBBEAN	1.9	4.2	11.3	39.1	9.3	31.0	46.2	224.3	14.5	49.4	61.8	304.1
Caribbean	1.3	0.4	10.9	3.0	11.7	4.5	51.6	14.3	22.6	8.9	71.4	20.1
Latin America	2.1	3.9	11.4	36.1	8.6	26.5	44.7	210.0	12.3	40.5	59.1	284.1
Central America	2.3	1.0	14.2	7.4	11.4	8.1	49.2	72.3	13.8	12.1	60.5	93.2
South America	1.9	2.9	9.5	28.7	6.9	18.4	41.8	137.7	11.3	28.4	58.2	190.8
OCEANIA	0.1	0.1	2.4	0.2	0.8	0.1	30.1	0.9	6.8	0.2	44.1	1.4
NORTHERN AMERICA AND EUROPE	0.2	4.5	0.8	10.0	0.7	7.3	11.5	67.5	1.6	9.6	23.6	154.3

TABLE A3.3 (CONTINUED)

	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)	%	Total number (millions)
	Energy sufficient diet				Nutrient adequate diet				Healthy diet			
	Lower-bound		Upper-bound		Lower-bound		Upper-bound		Lower-bound		Upper-bound	
COUNTRY INCOME GROUPS												
Low-income countries	5.4	17.1	19.0	81.9	36.9	207.1	72.1	423.8	70.4	403.7	91.0	533.8
Lower-middle countries	2.6	40.8	12.8	327.1	17.3	373.2	51.0	1 755.8	37.2	1 316.7	75.4	2 497.6
Upper-middle countries	1.1	7.6	8.1	84.1	5.2	47.4	37.7	562.1	11.4	132.9	59.5	1 331.5
High-income countries	0.2	5.7	1.6	23.3	0.5	8.4	12.5	101.9	1.0	11.0	24.6	212.2

NOTES: The table reports lower- and upper-bound estimates of the percentage (%) and total number (million) of population in each region and country income group who cannot afford the three reference diets (energy sufficient diet, nutrient adequate diet and the healthy diet) in the year 2017. Lower-bound estimates are calculated assuming that 100 percent of income is spent on food, thus, these estimates count the number of people who have a daily income lower than the cost of each diet. Upper-bound estimates account for the fact that a portion of income can be spent on non-food items, and are computed using average food expenditure shares that vary according to the World Bank's classification of income. They represent, on average, 15 percent, 28 percent, 42 percent and 50 percent of total expenditures in high-, upper-middle-, lower-middle- and low-income countries, respectively.

SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

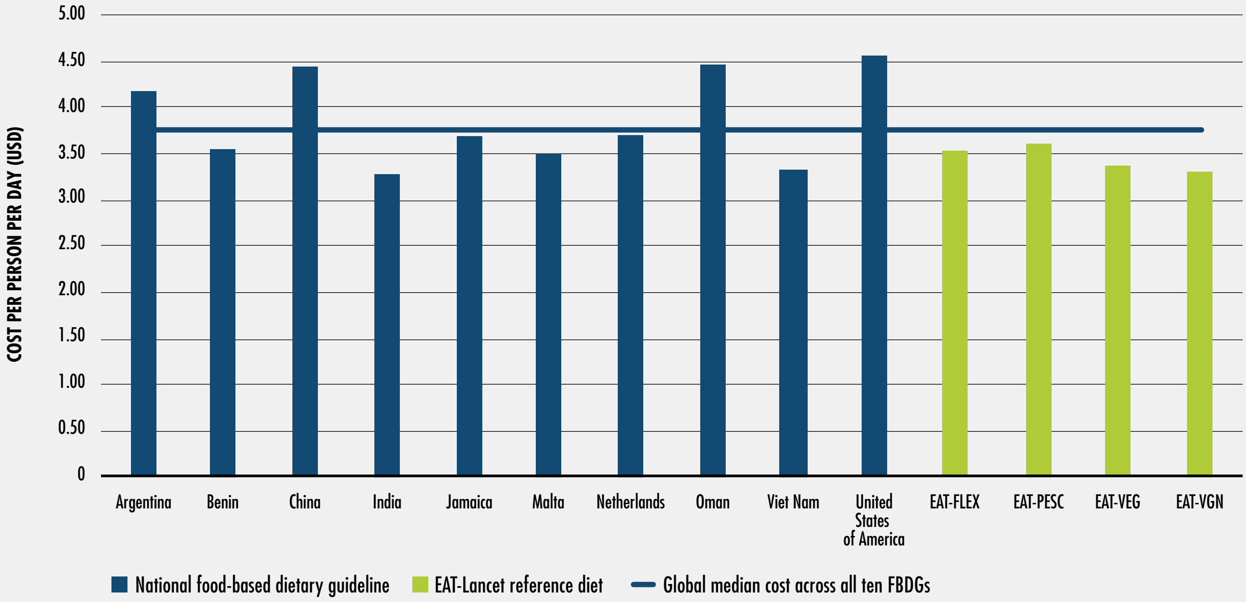
ANNEX 4

NATIONAL FOOD-BASED DIETARY GUIDELINES (FBDGs) USED TO COMPUTE THE COST OF A HEALTHY DIET

Figure A4.1 shows different ranges of cost for a healthy diet, corresponding to different definitions of a healthy diet. These ranges are obtained by costing recommended food quantities published across ten FBDGs (blue bars), as well as across four EAT-Lancet reference diets (green bars) (flexitarian, pescatarian, vegetarian and vegan). Each bar corresponds to the average cost in 2017 obtained when a particular diet pattern is applied to the 170 countries in the data set. The cost is seen to vary depending on the definition applied. Across the ten different definitions of a healthy diet published in the FBDGs, the cost of a healthy diet ranges from USD 3.27–4.57 per day, giving a point estimate based on median costs of USD 3.75 (blue horizontal line in Figure A4.1). This compares to a range of between USD 3.31 and USD 3.61 for the least-cost versions of the EAT-Lancet reference diet variants, giving a point estimate based on median cost of USD 3.44. This is slightly higher than the estimated cost of a EAT-Lancet reference diet which was recently published, estimated at USD 2.89 per day (based on 2010 prices).[42]

The EAT-Lancet diets in Figure A4.1 are based on the EAT-Lancet recommendations for an exemplary diet of 2 500 kcal per person per day and are not comparable to the EAT-Lancet diets analysed in Section 2.2 and discussed in **Annex 7**. However, by applying the same methodology of least-cost estimation, it is useful to provide a simple comparison between the ten FBDGs and the EAT-Lancet diets. The EAT-Lancet diets analysed in Section 2.2 differ as they apply serving-size recommendations based on the epidemiological literature, and the energy intake is based on recommendations for each country-specific age and sex structure (resulting in an average global intake of 2 100 kcal per person per day) (Table A7.2)**.** Table A4.1 provides a detailed description of the ten FBDGs that are used to construct the healthy diet, as explained in **Annex 3**.

FIGURE A4.1
AVERAGE COST OF A HEALTHY DIET BY APPLYING TEN DIFFERENT FBDGs DEFINITIONS ACROSS ALL COUNTRIES GLOBALLY, AND FOUR DIFFERENT EAT-LANCET REFERENCE DIET PATTERNS IN 2017



NOTES: The figure shows the average cost of a healthy diet across different possible definitions. The blue bars show the cost of a healthy diet across the 170 countries analysed by applying the ten national FBDGs that are used to cost the healthy diet in Section 2.1. The horizontal blue line represents the global cost of a healthy diet in year 2017 (USD 3.75), estimated as the median cost of the ten FBDGs and shown in Table 7. The green bars denote the average global cost of a healthy diet by applying the four variants of the EAT-Lancet diet: the flexitarian (FLX), the pescatarian (PSC), the vegetarian (VEG) and the vegan (VGN) diet. See Table A4.1 for a description of these diets. See Box 10 for the definition of the three diets and Box 11 for a brief description of the cost methodology. For the full methodological notes and data sources, see Annex 3.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

TABLE A4.1
FOOD-BASED DIETARY GUIDELINES USED TO COMPUTE THE COST OF A HEALTHY DIET

FAO Region	Country	Date of FBDGs	Number of groups (including sub-groups)	Starchy staple	Protein-rich foods: Legume	Protein-rich foods: Flesh + egg	Dairy	Vegetable	Fruit[1]	Fat	Nuts and seeds	Discretionary/ sugars
AFRICA	Benin	2015	6	3–6 (adult woman, 3–5) servings; serving size: 185 g cooked maize paste, 220 g cooked rice, 160 g cooked pasta, 87.5 g bread, cassava 185–200 g, gari 60 g	2–3 servings; serving size: meat 75 g, fish 100 g, egg 80 g (2), crabs 200 g (3 with shell), shrimp 100 g (including shells), dried fish 50 g, beans 140 g cooked, soya cheese 50 g, peanuts 50 g		1–2 servings; serving size: yogurt 125 g, powder 20 g, local cheese 50 g, concentrated milk non-sweetened 85 g. If milk products are not part of your diet, they can be replaced by other foods rich in calcium such as fin fish, crustaceans and dried fish	4–6 servings; serving size: leaves 50 g, other 100 g, carrot 60 g	2–3 servings; serving size: 100 g on average, or 3/4 cup juice	2–3 tablespoons, 15 g per tablespoon	(in protein-rich foods)	
ASIA AND THE PACIFIC	China	2016	7 (fruits and vegetables are subgroups; dairy and nuts are subgroups)	250–400 g		120–200 g	300 g fluid milk equivalent	300–500 g	200–350 g	25–30 g	25–35 g nuts and tofu	
ASIA AND THE PACIFIC	India (moderate woman)	2011	6	9–20 (moderate woman 11) servings; serving size: 30 g dry/ uncooked (100 kcal)	2–4 (moderate woman 2.5) servings; 50 g meat/chicken/fish (100 kcal), 50 g egg (85 kcal), 30 g dry pulses (100 kcal)		3 servings; serving size 100g (70 kcal)	3 servings (1 DGLV, 2 others; includes potatoes/roots and tubers); serving size: 100 g (28 kcal)	1 serving; serving size: 100 g (40 kcal)	4–8 (moderate woman = 5) servings; serving size: 5 g (45 kcal)	(none – nuts are discussed as additional in protein and fat, not clear)	
ASIA AND THE PACIFIC	Viet Nam	2016	6	12–15 servings; each serving is equivalent to 20 g of carbohydrate (examples: rice, bread, potato, sweet potato)	5–6 servings; each serving is equivalent to 7 g of protein (examples: fish, meat, seafood, tofu, egg, soybeans)		3–4 servings; each serving is equivalent to 100 mg of calcium)	3 servings; each serving is 80 g	3 servings; each serving is 80 g	5–6 servings; each serving is equivalent to 5 g lipid	(in oil and fat)	
EUROPE	Malta	2015	6	4 servings; serving size: 40 g of breakfast cereals; 80–100 g of raw cereals, pasta and rice preferably wholegrain or wholemeal; 80 g potatoes	Approx. 9–12 servings per week = approx. 1.5 servings per day; serving size: 115 g fish raw, 70 legumes raw, 21 g nuts and seeds, 1 egg, 100 g white meat (raw), 90 g red meat (raw)		2 servings; serving size: 250 ml milk; 1 tub (150 mls) yogurt; 30–40 g cheese; 45–50 g irkotta/ġbejna	3–5 servings; serving size: 80 g	2–3 servings; serving size: 80 g	1 serving; serving size: 1 tablespoon (15 ml)	(in protein-rich foods)	

TABLE A4.1 (CONTINUED)

FAO Region	Country	Date of FBDGs	Number of groups (including sub-groups)	Starchy staple	Protein-rich foods: Legume	Protein-rich foods: Flesh + egg	Dairy	Vegetable	Fruit[1]	Fat	Nuts and seeds	Discretionary/ sugars
EUROPE	Netherlands	2017	7 (4 nominally, but "fruits and vegetables" has 2 subgroups; and "protein-rich foods" has 3 subgroups: protein, dairy and nuts)	4–5 portions; portion size examples: 1 brown bread sandwich, 1 serving spoons whole-grain products or potatoes	1 portion fish/pulse/meat; portion size: 100 g meat/fish		2–3 portions; portion size: 150 ml milk, 40 g cheese. Includes soy drinks	250g	200g	40g	25g	
LATIN AMERICA AND THE CARIBBEAN	Argentina	2016	6 (fruits and vegetables are subgroups)	4 servings; 876 kcal total (606 kcal total + 270 kcal "optional foods")	1 serving (224 kcal total)		3 servings (310 kcal total)	400g	300g	2 servings (270 kcal total)	(in fats and seeds, also including dried fruit)	270 kcal optional foods
LATIN AMERICA AND THE CARIBBEAN	Jamaica	2015	6	14 servings; serving size: 70 kcal (980 kcal total)	3 serving; serving size: 73 kcal (219 kcal total)	5 servings; serving size: 75 kcal if meat or whole milk, 40 kcal if skim milk (total of 374 kcal if no skim consumed)		3 servings; serving size: 36 kcal (108 kcal total)	3 servings; serving size: 40 kcal (120 kcal total)	6 servings (including avocado and coconut); serving size: 45 kcal (270 kcal total)	(in legume)	
WESTERN ASIA	Oman (at 2 300 kcal level)	2009	7	0.95 whole, 3.7 refined; serving size: 28 g dry rice or pasta, or 1 cup cereal flakes	0.75 cup cooked lentils	91g; serving size: 30 g lean meat, poultry or fish; 1 egg; 15 g oz nuts or seeds	0.6 servings; serving size: 1 cup equivalent = 1 cup milk or yogurt, 45 g natural chee	3.4 servings; serving size: 1 cup raw vegetables, 2 cup leafy salad greens, 1/2 cup chopped, cooked or canned vegetable, 1/2 cup of vegetables juice	3.95 servings; serving size: 1 cup raw fruits, 1/2 cup of fruit juice, 1/2 cup chopped, cooked or canned fruit	66.5g	(in protein-rich foods)	

TABLE A4.1
(CONTINUED)

FAO Region	Country	Date of FBDGs	Number of groups (including sub-groups)	Starchy staple	Protein-rich foods: Legume	Protein-rich foods: Flesh + egg	Dairy	Vegetable	Fruit[1]	Fat	Nuts and seeds	Discretionary/ sugars
NORTHERN AMERICA	United States of America (American style at 2 300 kcal level)	2015	6	7.5 oz-eq (half should be whole grain)		6.25 oz-eq (including meat, fish, poultry, eggs, nuts, tofu)	3 cup-eq; 1 cup milk, soymilk or yogurt = 1.5 oz cheese	3 cup-eq; 1 cup-eq = 1 cup reg-orange or other vegetables, 1 cup legumes, 2 cup DGLV, 1.5 cup potatoes	2 cup-eq; 1 cup-eq = 1 cup fresh, 1/2 cup dried, 3/4 cup 100% juice	30g	(in protein-rich foods)	230 kcal
NORTHERN AMERICA	United States of America (Mediterranean style at 2 300 kcal level)	2015	6	7.5 oz-eq (half should be whole grain)		7.25 oz-eq (including meat, fish, poultry, eggs, nuts, tofu)	2.25 cup-eq; 1 c milk, soymilk or yogurt = 1.5 oz cheese	3 cup-eq; 1 cup-eq = 1 cup reg-orange or other vegetables, 1 cup legumes, 2 cup DGLV, 1.5 cup potatoes	2.5 cup-eq; 1 cup-eq = 1 cup fresh, 1/2 cup dried, 3/4 cup 100% juice	30g	(in protein-rich foods)	230 kcal
NORTHERN AMERICA	United States of America (vegetarian style at 2 300 kcal level)	2015	6	8 oz-eq (half should be whole grain)	3.75 oz-eq (including eggs, legumes, tofu, nuts)		3 cup-eq; 1 cup milk, soymilk or yogurt = 1.5 oz cheese	3 cup-eq; 1 cup-eq = 1 cup reg-orange or other vegetables, 1 cup legumes, 2 cup DGLV, 1.5 cup potatoes	2 cup-eq; 1 cup-eq = 1 cup fresh, 1/2 cup dried, 3/4 cup 100% juice	30g	(in protein-rich foods)	230 kcal
GLOBAL	EAT-Lancet flexitarian	2019	12	2 groups: 773 kcal cereal grains + 81 kcal starchy roots	254 kcal	4 groups: 14 kcal egg + 38 kcal fish + 28 kcal poultry +29 kcal red meat	90 kcal	96 kcal	95 kcal	405 kcal	180 kcal	
GLOBAL	EAT-Lancet pescatarian	2019	10	2 groups: 773 kcal cereal grains + 81 kcal starchy roots	254 kcal	2 groups: 14 kcal egg + 76 kcal fish	90 kcal	107 kcal	103 kcal	405 kcal	180 kcal	
GLOBAL	EAT-Lancet vegetarian	2019	9	2 groups: 773 kcal cereal grains + 81 kcal starchy roots	317 kcal	14 kcal egg	90 kcal	114 kcal	108 kcal	405 kcal	180 kcal	
GLOBAL	EAT-Lancet vegan	2019	7	2 groups: 773 kcal cereal grains + 81 kcal starchy roots	387 kcal			133 kcal	124 kcal	405 kcal	180 kcal	

NOTE: The table shows recommended food quantities and kilocalorie intake by food group that are published in the ten FBDGs used to cost the healthy diet in Section 2.1. For the United States of America, three FBDGs are available that reflect different eating patterns in the country: American, Mediterranean and vegetarian style. Since by definition, any of these eating patterns meets American FBDGs, the cost of the American healthy diet is computed using the least-cost dietary pattern, out of these three. The table also shows a description of the four EAT-Lancet diets presented in Figure A4.1.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

ANNEX 5

ADDITIONAL TABLES AND FIGURES TO SECTION 2.1

This section provides additional tables and figures for the analysis presented in Section 2.1.

Table A5.1 shows average predicted own-price elasticities at two levels: the aggregate food group level and the product level. Table A5.2 shows own- and cross-price elasticities estimated by Green *et al.* (2013)[47] and Cornelsen *et al.* (2015)[48] by country economic development. Although both price and income elasticities are systematically higher for some products (e.g. meat) than for others (e.g. oils and fats), they tend to decrease with GDP per capita in absolute terms.[49] In fact, Engel and Bennet's laws imply that increases in income associated with economic development are expected to lead first to a decrease in the share of expenditures devoted to food consumption, and then to a decrease in raw products among food expenditures. Thus, food demand becomes less responsive to income and price changes as income rises.[49]

Additional figures show the cost of a healthy diet by food group category (Figure A5.1) and the contribution of each food group to the final cost of a healthy diet across country income groups (Figure A5.2). Finally, world maps in Figure A5.3 describe the percentage of people in each country who were not able to afford the three diets in 2017.

»

TABLE A5.1
AVERAGE ESTIMATES OF OWN-PRICE ELASTICITIES BY FOOD GROUP

	PRICE CHANGE				
CONSUMPTION CHANGE	Fruits and vegetables	Meat and fish	Dairy	Cereals	Fats and oils
All	-0.61	-0.57	-0.59	-0.52	-0.44
	(0.69)	(0.53)	(0.58)	(0.74)	(0.56)
Aggregate for the food group	-0.5	-0.5	-0.57	-0.33	-0.36
	(0.47)	(1.09)	(0.38)	(0.4)	(0.4)
Product level	-0.71	-0.66	-0.63	-0.72	-0.71
	(0.79)	(3.85)	(0.88)	(0.85)	(0.79)
No. observations	**668**	**945**	**419**	**520**	**338**

NOTES: The table shows weighted averages of own-price elasticities by food group, with weighted standard deviations reported in parenthesis. The sample of elasticity estimates includes 3 334 observations on price elasticities collected from 93 primary studies. Primary studies sample sizes are used as weights to compute averages and standard deviations. More weight is given to more precise estimates in the computation of averages and standard deviations.
SOURCE: Femenia, F. 2019. *A meta-analysis of the price and income elasticities of food demand*. Working Paper SMART – LERECO N°19-03. Rennes, France, INRAE.

TABLE A5.2
PREDICTED OWN- AND CROSS-PRICE ELASTICITIES BY FOOD GROUP AND COUNTRY INCOME GROUP IN 2008

a) Low-income countries

	PRICE CHANGE						
CONSUMPTION CHANGE	**Fruits and vegetables**	**Meat**	**Fish**	**Dairy**	**Cereals**	**Fats and oils**	**Sweets**
Fruits and vegetables	**-0.72*****	0.005	-0.014	-0.001	0.065*	-0.014	0.112***
Meat	0.02	**-0.78*****	-0.008	0.011	0.062	0.016	0.101*
Fish	0.014	0.045	**-0.80*****	-0.003	0.092**	0.031	0.098**
Dairy	-0.001	0.003	-0.02	**-0.78*****	0.117***	0.042	0.108***
Cereals	0.009	0.003	0.01	0.068***	**-0.61*****	0.006	0.1***
Fats and oils	0.012	-0.043	-0.061	0.022	0.071*	**-0.60*****	0.094**
Sweets	0.022	0.003	-0.004	0.033	0.074*	0.022	**-0.74*****
No. observations	**206**	**185**	**71**	**70**	**188**	**80**	**60**

b) Middle-income countries

	PRICE CHANGE						
CONSUMPTION CHANGE	**Fruits and vegetables**	**Meat**	**Fish**	**Dairy**	**Cereals**	**Fats and oils**	**Sweets**
Fruits and vegetables	**-0.65*****	-0.026	-0.079**	-0.058**	0.007	-0.039	0.034
Meat	0.001	**-0.72*****	-0.073**	-0.045**	0.005	-0.01	0.024
Fish	-0.004	0.014	**-0.73*****	-0.059**	0.035	0.005	0.021
Dairy	-0.02	-0.028	-0.085**	**-0.72*****	0.06**	0.016	0.031
Cereals	-0.01	-0.028	-0.076**	0.012	**-0.55*****	-0.02	0.023
Fats and oils	-0.006	-0.074**	-0.126**	-0.035	0.014	**-0.54*****	0.017
Sweets	0.003	-0.028	-0.069	-0.024	0.017	-0.003	**-0.68*****
No. observations	**147**	**186**	**56**	**121**	**150**	**62**	**65**

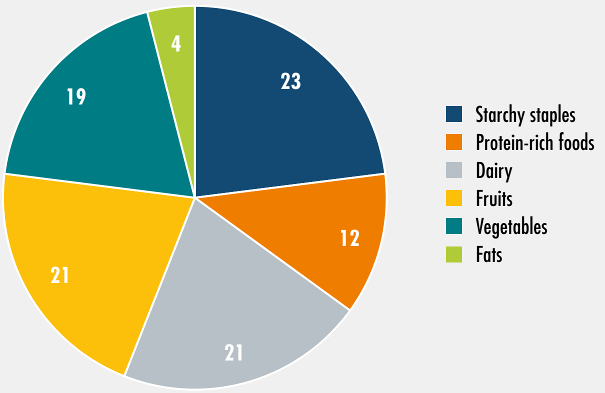
c) High-income countries

	PRICE CHANGE						
CONSUMPTION CHANGE	**Fruits and vegetables**	**Meat**	**Fish**	**Dairy**	**Cereals**	**Fats and oils**	**Sweets**
Fruits and vegetables	**-0.53*****	0.002	0.01	-0.030***	0.048*	-0.033	0.060***
Meat	-0.009	**0.60*****	0.016	-0.018	0.045*	-0.003	0.049**
Fish	-0.015*	0.042*	**0.61*****	-0.032**	0.075*	0.012	0.046
Dairy	-0.03**	0.001	0.004	**-0.60*****	0.100***	0.023	0.057**
Cereals	-0.02**	0	0.013	0.039**	**-0.43*****	-0.013	0.048**
Fats and oils	-0.017	-0.046	-0.037	-0.007	0.054	**-0.42*****	0.043
Sweets	-0.007	0	0.02	0.004	0.057**	-0.003	**-0.56*****
No. observations	**630**	**525**	**260**	**366**	**332**	**123**	**279**

NOTES: The table shows estimates of own-price elasticities from Green *et al.* (2013)[47] in bold on the diagonal, and cross-price elasticity estimates from Cornelsen *et al.* (2015)[48] are reported outside the diagonal. Estimated elasticities describe the percentage change in the consumption of a given food group after a percentage change in its price and are reported for low-income countries (Table A5.2a), middle-income countries (Table A5.2b) and high-income countries (Table A5.2c). Stars denote statistically significant estimates at 10 percent (*), 5 percent (**) and 1 percent level (***).

SOURCES: Green, R., Cornelsen, L., Dangour, A.D., Turner, R., Shankar, B., Mazzocchi, M. & Smith, R.D. 2013. The effect of rising food prices on food consumption: systematic review with meta-regression. *BMJ*, 346 (f3703) and Cornelsen, L., Green, R., Turner, R., Dangour, A.D., Shankar, B., Mazzocchi, M. & Smith, R.D. 2015. What happens to patterns of food consumption when food prices change? Evidence from a systematic review and meta-analysis of food price elasticities globally. *Health Economics*, 24(12): 1548–1559.

FIGURE A5.1
AVERAGE PERCENTAGE CONTRIBUTION OF EACH FOOD GROUP TO THE AVERAGE GLOBAL COST OF A HEALTHY DIET IN 2017 (USD)

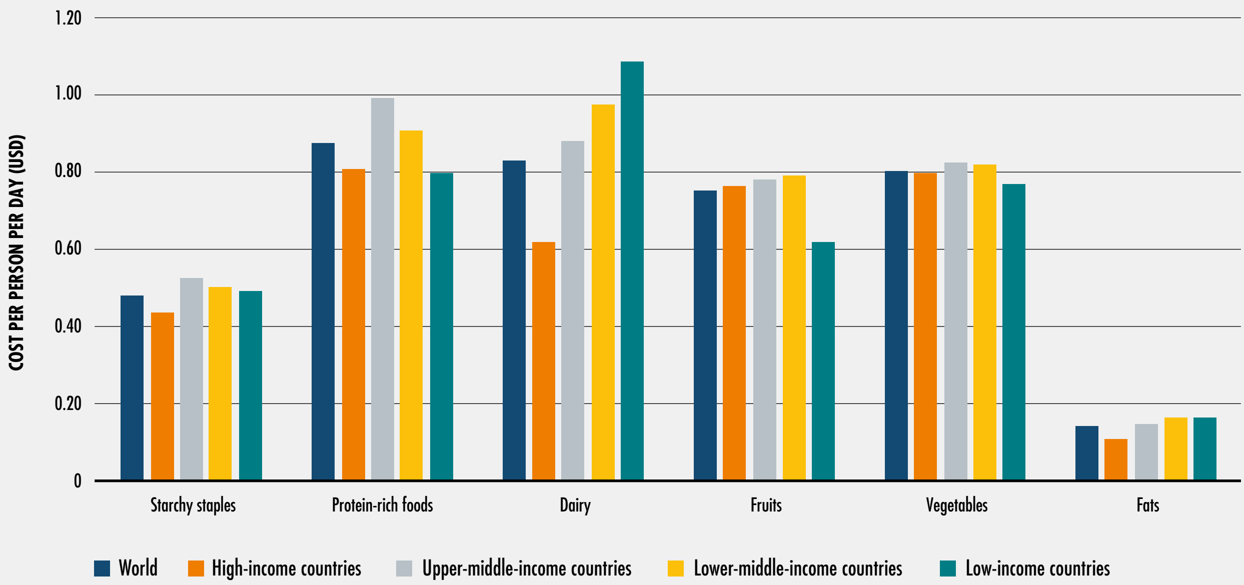


NOTES: The pie chart shows the average percentage contribution of the six food groups to the cost of the healthy diet per person per day. The analysis is based on a sample of 170 countries for which retail food price data are available in year 2017. Prices are obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). See Box 10 for the definition of the three diets and Box 11 for a brief description of the cost methodology. For the full methodological notes and data sources, see Annex 3.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

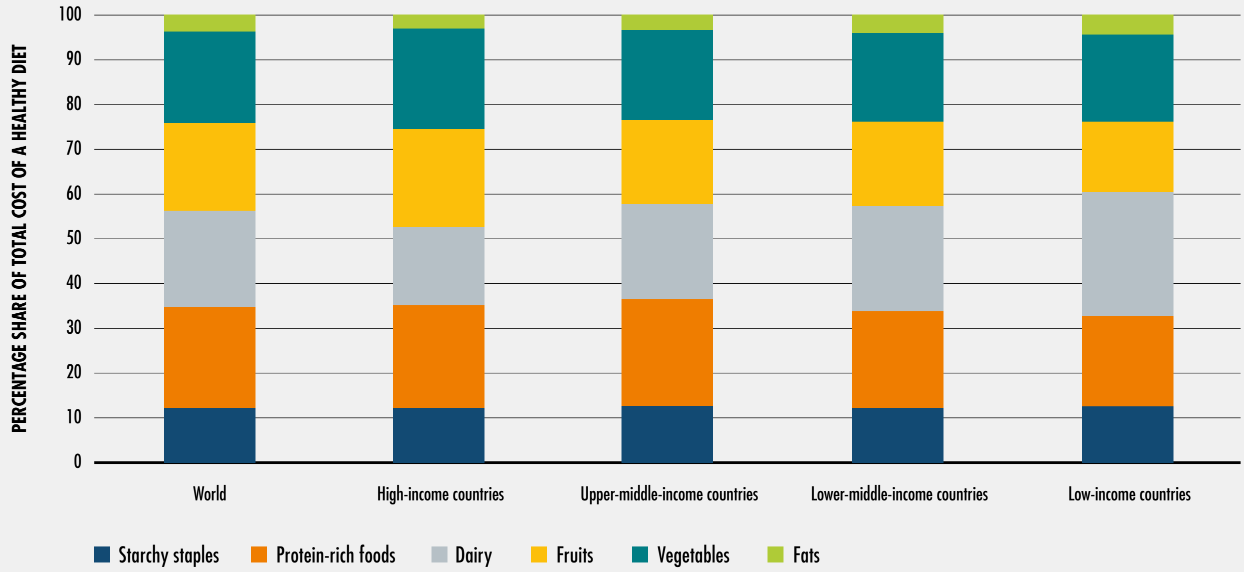
» For Figure A5.3, as well as Figures 28 and 29 in Section 2.1, the following disclaimers on map boundaries apply: the final boundary between the Republic of the Sudan and the Republic of South Sudan has not been yet determined. The final status of the Abyei area, Jammu and Kashmir, and the Malvinas Islands have not yet been determined. The boundaries shown on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

FIGURE A5.2
COST PER PERSON PER DAY AND PERCENTAGE SHARE OF TOTAL COST OF EACH FOOD GROUP FOR A HEALTHY DIET, BY COUNTRY INCOME GROUP IN 2017 (USD)

A) COST PER PERSON PER DAY BY FOOD GROUP AND COUNTRY INCOME GROUP IN 2017 (USD)



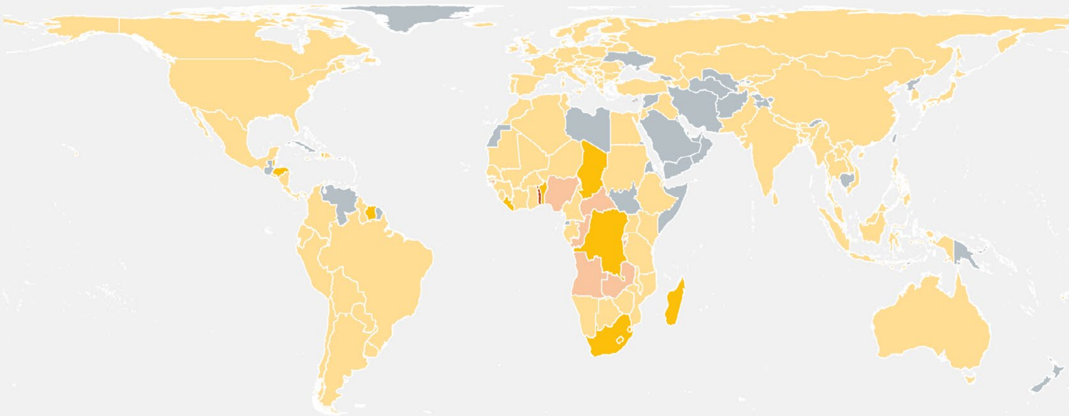
B) COST CONTRIBUTION (PERCENTAGE SHARE OF TOTAL COST) OF A HEALTHY DIET BY FOOD GROUP AND COUNTRY INCOME GROUP IN 2017



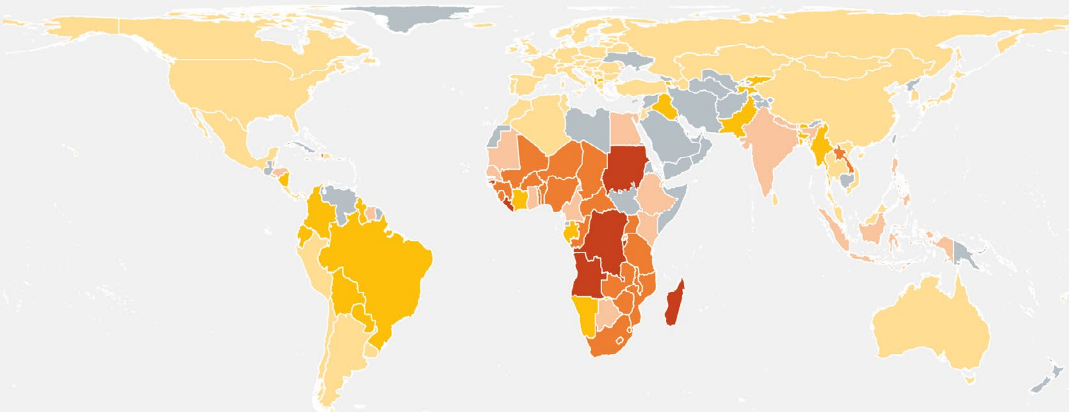
NOTES: The bar chart in panel a) shows the cost per person per day by food group and country income group and the stacked columns in panel b) show the ratio between the average regional cost of each food group and the total cost of a healthy diet. The analysis is based on a sample of 170 countries for which retail food price data are available in year 2017. Prices are obtained from the World Bank's International Comparison Program (ICP) for internationally standardized items, converted to international dollars using purchasing power parity (PPP). See Box 10 for the definition of the three diets and Box 11 for a brief description of the cost methodology. For the full methodological notes and data sources, see Annex 3.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries.* Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

FIGURE A5.3
PROPORTION OF PEOPLE UNABLE TO AFFORD THE THREE REFERENCE DIETS BY COUNTRY IN 2017 – COST OF THE DIETS COMPARED TO AVERAGE NATIONAL INCOME

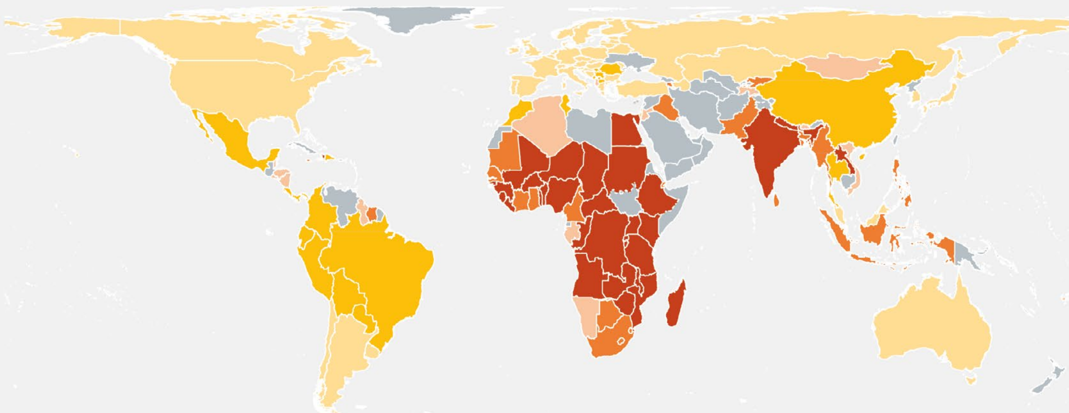
A) PERCENTAGE OF POPULATION WHO CANNOT AFFORD AN ENERGY SUFFICIENT DIET



B) PERCENTAGE OF POPULATION WHO CANNOT AFFORD A NUTRIENT ADEQUATE DIET



C) PERCENTAGE OF POPULATION WHO CANNOT AFFORD A HEALTHY DIET



NOTES: The maps show the average percentage (%) of population who cannot afford the three reference diets (energy sufficient diet, nutrient adequate diet and the healthy diet) in 143 countries in year 2017. Global, regional and country income group averages are presented in Table 7. This measure of affordability compares the cost of each diet with the average estimated income in a given country, under the assumption that 63 percent of the income available can be credibly reserved for food. A diet is considered unaffordable when its cost exceeds the 63 percent of the average income in a given country. See Box 10 for the definition of the three diets and Boxes 11 and 12 for a brief description of the cost and affordability methodology. For the full methodological notes and data sources, see Annex 3. For disclaimers on map boundary lines, see Annex 5.
SOURCE: Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. 2020. *Cost and affordability of healthy diets across and within countries*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

ANNEX 6

DEFINITION OF COUNTRY GROUPS

A. Definition of countries with a protracted crisis situation

The 2017 edition of this report defines protracted crisis situations as "characterized by recurrent natural disasters and/ or conflict, longevity of food crises, breakdown of livelihoods and insufficient institutional capacity to react to the crises." There are three criteria used to define a country with a protracted crisis: (i) longevity of the crisis; (ii) humanitarian aid flow to the country; and (iii) the country's economic and food security status. Specifically, the list of countries with a protracted crisis situation includes those that meet the following three criteria:

1. The country is among the low-income food-deficit countries (LIFDCs), as defined by FAO in 2018.
2. The country has faced a shock – either natural or human-induced – for four consecutive years between 2016 and 2019, or for eight out of ten years between 2010 and 2019, and is reported in the list of countries requiring external assistance for food.[50]
3. The country received more than 10 percent of total ODA in the form of humanitarian assistance between 2009 and 2017.[51]

In 2020, there are 22 countries that meet the above three criteria (see Box 13), but information on cost and affordability is not available for seven of them (Afghanistan, Eritrea, Republic of Korea, Somalia, South Sudan, Syrian Arab Republic and Yemen). See the 2017 edition[52] of this report for an extended analysis of countries with a protracted crisis situation.

B. Definition of countries in the Global South

According to the United Nation Office for South-South Cooperation (UNOSSC), the Global South includes Asia (with the exception of Japan, Hong Kong, Macau, Singapore, South Korea and Taiwan), Central America, South America, Mexico, Africa and the Middle East (with the exception of Israel).[71]

ANNEX 7

DESCRIPTION, DATA AND METHODOLOGY OF SECTION 2.2

A. Description of the five dietary patterns

For the analysis of Section 2.2, five dietary patterns are constructed to measure health and climate-change costs of baseline and alternative dietary consumption patterns. For the baseline diet, food availability estimates in the year 2010 are taken from a harmonized data set of FAO Food Balance Sheets (FBS) that includes the full set of 16 food commodities. Food availability estimates are used as a proxy for national average food consumption, after applying regional data on food wastage at the consumption level combined with conversion factors into edible matter.[27] Food waste at other stages of the production chain is accounted for in the FAO estimates[53] including food processing, which separates the edible parts from non-edible ones. FAO food balance sheet data are aggregated to 16 commodities (vegetables, beef, wheat, roots, fruits, pork, rice, pulses, sugar, poultry, maize, other commodities, oils, eggs, other grains and dairy) for 157 countries in order to match the detail of data used in the health and environmental analysis.[57]

The analysis presented in Section 2.2 considers current estimates of national average food consumption in baseline year 2010, which are projected to future food consumption referred to year 2030, considering estimated expected changes in income, population and dietary preferences.[55] Since models are calibrated to give projections for future years in line with trends in income and population, changing the baseline year from 2010 to more recent years would have not changed the projected results for 2030.

Baseline food consumption is referred to as the **benchmark diet** (**BMK**) and represents a business-as-usual diet. Underlying the analysis, there are estimates of current and future food consumption as well as four alternative consumption scenarios that have been devised as being healthy and more sustainable. Starting from food availability estimates from the FBS, the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT)[56] was used to simulate the benchmark scenario as well as the four alternative healthy diet patterns[ba] in 157 countries in year 2030.[57] Projections were also carried out for year 2050 for sensitivity analysis.

To construct the **BMK**, baseline food consumption was estimated using food availability from FAO Food Balance Sheets and adjusting for the amount of food wasted at the point of consumption. An alternative option would have been to rely on a set of consumption estimates based on a variety of data sources, including dietary surveys, household budget and expenditure surveys, and food availability data.[3,4] However, neither the exact combination of these data sources nor the estimation model used to derive the data have been made publicly available. For some individual countries, using dietary surveys would also have been an alternative. However, underreporting is a persistent problem in dietary surveys,[58,59] and regional differences in survey methods would have implied non-comparability of results between countries. In contrast to dietary surveys, waste-adjusted food-availability estimates indicate levels of energy intake per region that reflect differences in the prevalence of overweight and obesity across regions.[13]

ba See footnote y.

TABLE A7.1
SUMMARY DESCRIPTION OF BASELINE CURRENT FOOD CONSUMPTION (BMK) AND FOUR ALTERNATIVE HEALTHY DIET PATTERNS THAT INCLUDE SUSTAINABILITY CONSIDERATIONS (FLX, PSC, VGT AND VGN)

Scenario	Description	Sources
Benchmark (BMK)	Global energy intake is estimated for an average of 2 300 kcal per person per day in year 2010; in year 2010, per-capita consumption is of approximately 354 g of fruits and vegetables, 50 g for sugar, 28 g of oils, 68 g for red meat, 31 g for poultry, 243 g for eggs and dairy, 134 g for roots and pulses, 297 for cereals (see Table A7.2 for the composition of the BMK diet in year 2010).	Based on projections by the Food and Agriculture Organization of the United Nations (FAO),[53] adjusted for food waste and food conversion into edible parts.[26]
Flexitarian (FLX)	Max 860 kcal/day for energy balance from staple foods; min 125 g/day from legumes and nuts and seeds; min 500 g/day of fruits and vegetables; max 31 g/day from sugar, max 87 g/day from oil; max 43 g/day from poultry and lamb, max 13 g/day for eggs, max 250 g/day for milk; min 28 g/day from fish.	In line with observed dietary patterns.[60,61]
Pescatarian (PSC)	It is a variant of the flexitarian (FLX) diet where animal products are completely replaced by fish products (see Table A7.2 for the difference between the composition in g/day of the FLX and PSC diets at the world level). This diet can also replace animal products with a mix of fish products or legumes and either fruits and vegetables or whole grains, but these variants are not considered in this report.	In line with observed dietary patterns.[60,61]
Vegetarian (VGT)	Min six portions per day of fruits and vegetables (~660 g/day), legumes (~95 g/day), no red meat or poultry or fish, sugar (~27 g/day) and total energy intake as recommended for a moderately active population (~2 100 kcal/day) (see Table A7.2 for the composition of the VGT diet at the world level).	In line with observed dietary patterns.[61,62,63]
Vegan (VGN)	Min seven portions per day of fruits and vegetables (~770 g/day), legumes (~110 g/day), no red meat, poultry, dairy, eggs or fish; sugar (~27 g/day) and total energy intake as recommended for a moderately active population (~2 100) (see Table A7.2 for the composition of the VGN diet at the world level).	In line with observed dietary patterns.[61,62,63]

NOTES: The table shows the description of the five diets analysed in Section 2.2. See footnote y to know more on the four alternative healthy diet patterns.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

The **four alternative healthy diet patterns**[bb] **that include sustainability considerations** (or diet scenarios) conform to the general recommendations of the EAT-Lancet Commission on healthy diets that differ by age and sex and take into account regional preferences for specific staple crops, fruits, vegetables and other food categories, as well as population-specific calorie requirement. These diets differ from the EAT-Lancet diets presented in **Annex 4** since they use country-specific kilocalorie intake that reflects population age and sex structure to achieve an average global intake of 2 100 kcal per person per day (Table A7.1). On the contrary, the EAT-Lancet diets in **Annex 4** (Figure A4.1) are based on the EAT-Lancet recommendations for an exemplary diet of 2 500 kcal per person per day.[42]

bb See footnote y.

Table A7.1 provides descriptions of the diet scenarios and sources on which dietary recommendations are based for the analysis in Section 2.2. The **flexitarian diet (FLX)** includes at least 500 g/day of fruits and vegetables of different colors and groups (the composition of which is determined by regional preferences). It contains at least 100 g/day of plant-based protein sources (legumes, soybeans, nuts), modest amounts of animal-based proteins, such as poultry, fish, milk and eggs, and limited amounts of red meat (1 portion per week), refined sugar (<5 percent of total energy), vegetable oils that are high in saturated fat (in particular palm oil), and starchy foods which have a relatively high glycemic index. Based on the flexitarian diets, we constructed more specialized diets.[60,61]

The **pescatarian diet (PSC)** replaces (on a kcal basis) meat-based protein sources in the flexitarian diet by three quarters with fish and seafood, and by one quarter with either fruits and vegetables or whole grains.

The **vegetarian diet (VEG)** replaces (on a kcal basis) meat-based protein sources in the flexitarian diet by three quarters with plant-based proteins, and by one quarter with either fruits and vegetables or whole grains.

The **vegan diet (VGN)** replaces (on a kcal basis) all animal-based protein sources in the flexitarian diet by three quarters with plant-based proteins, and by one quarter with either fruits and vegetables or whole grains.

The range of dietary patterns described above and developed by the EAT-Lancet Commission are adopted to analyse to what extent the health and environmental costs of diets can be reduced. The baseline year of analysis is 2010, but the focus is on health and climate-change burden in year 2030, as this is a politically relevant year in light of the Sustainable Development Goals for 2030. Therefore, future dietary patterns and their impacts on health and environment are projected using years 2030 and 2050, the latter being used for sensitivity analysis. Health and climate-change costs are evaluated for the benchmark diet (BMK) that approximates current and future food consumption, and for four healthy dietary profiles: flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN). For a full description of the methodology and data sources, see Springmann (2020).[57]

As previously estimated and used by the EAT-Lancet Commission,[60] the average calorie needs differ by country based on its age and sex composition, ending up with a diet whose world-level average provides 2 100 kcal per person per day. Table A7.2 provides information at the world level on the average quantities (grams per day), and on average kilocalorie intake (kcal per day) for each food item across the five diets in year 2010. By taking the average of the kilocalorie intake across the five diets, a global average of 2 100 kcal per person per day is reached. It should be noted that, however, kilocalorie requirements per person per day differ by country and by age and sex group, and Table A7.2 provides only a summary at the world level. For the calculations of calorie intakes, which require estimates of healthy body weights (or BMIs), physical activity levels and heights as inputs, it was assumed that BMIs are in line with WHO recommendations,[64] and moderately physical activity levels are maintained as recommended. In addition, the United States characteristics for height were used,[65] which can be seen as an upper bound that does not penalize future growth of populations. According to the estimates, calorie needs reach a maximum of 2 500 kcal/day for ages 20–24 (average between men and women) but are reduced to 2 000 kcal for ages 65 and older. Health and environmental criteria captured in the healthy diets are based on scientific evidence from a list of systematic reviews, meta-analyses and pooled analyses of primary data used to set the scientific targets for healthy diets.[57]

B. Data and methodology for the valuation of health impacts

For estimating the health burden of diets, methods developed by the Global Burden of Disease (GBD) project are applied to a comparative risk assessment framework of dietary and weight-related risks. In a comparative risk assessment, the burden of diet-related diseases is typically calculated »

TABLE A7.2
OVERVIEW OF PER CAPITA FOOD CONSUMPTION (G/DAY) AND KILOCALORIE INTAKE (KCAL/DAY) BY DIET SCENARIO IN YEAR 2010 – GLOBAL

	BMK		FLX		PSC		VEG		VGN	
Food items	g/day	kcal/day	g/day	kcal/day	g/day	kcal/day	g/day	kcal/day	g/day	kcal/day
Wheat	117	347	91	267	91	267	91	267	91	267
Rice	126	461	81	298	81	298	81	298	81	298
Maize	33	100	23	70	23	70	23	70	23	70
Other grains	22	65	15	43	15	43	15	43	15	43
Roots	134	114	101	82	101	82	101	82	101	82
Legumes	17	60	50	173	50	173	62	215	78	270
Soybeans	5	17	25	82	25	82	31	103	35	117
Vegetables	227	58	353	96	395	107	423	114	494	133
Starchy fruits	28	22	40	27	40	27	40	27	40	27
Fruits	37	17	62	27	69	31	73	33	87	39
Tropical fruits	62	24	101	40	114	45	123	48	148	58
Nuts and seeds	13	46	51	180	51	180	51	180	51	180
Vegetal oil	22	192	42	367	42	367	42	367	42	367
Palm oil	6	56	4	39	4	39	4	39	4	39
Sugar	51	183	27	95	27	95	27	95	27	95
Beef	25	41	5	9						
Lamb	5	11	2	3						
Pork	38	109	5	16						
Poultry	31	44	19	28						
Milk	221	127	155	90	155	90	155	90		
Eggs	22	31	10	14	10	14	10	14		
Fish (demersal)	5	5	7	7	15	15				
Fish (fresh water)	8	10	14	18	26	33				
Fish (pelagic)	3	5	5	8	10	16				
Shellfish	6	5	7	5	15	12				
Other crop	13	28								
Kcal per day		2 177		2 083		2 083		2 083		2 083
Other kcal per day		126								
Total kcal per day		2 303		2 083		2 083		2 083		2 083

NOTES: The table shows per capita food consumption (grams/day) and kilocalorie intake (kcal/day) in year 2010 under the benchmark diet (BMK) and the four alternative healthy diet patterns: the flexitarian (FLX), the pescatarian (PSC), the vegetarian (VEG) and the vegan (VGN) diet (see footnote y for more information).
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» by comparison to a state of minimal risk exposure. For this analysis, we used as minimal risk exposure that dietary pattern out of the set of healthy dietary patterns that include sustainability considerations that was associated with the greatest health benefits, i.e. the vegan pattern.

To analyse the implications of dietary change for chronic disease mortality, mortality attributable to seven dietary risk factors and four disease endpoints was computed by calculating population impact fractions, i.e. the proportion of cases of disease that are avoided when the risk exposure is changed from a baseline (benchmark current diet) to the four alternative diet scenarios. The assessment included four disease endpoints: coronary heart disease, stroke, type 2 diabetes mellitus and cancer (in aggregate and as site-specific ones, such as colon and rectum cancer), in line with available cost-of-illness estimates. The risk factors included seven dietary risks: low intake of fruits, vegetables, legumes, nuts and whole grains, as well as high intake of red meat and processed meat. The risk factors included also three weight-related risks: being underweight, overweight or obese. The relative risk estimates that relate the risk factors to the disease endpoints were adopted from meta-analyses of prospective cohort studies.

Data from the Global Dietary Database[66] were used to allocate total red meat consumption into unprocessed red meat and processed red meat, and to allocate total grain consumption into whole grains and processed grains. For estimating the health costs of diets, the estimates of cause-specific attributable deaths obtained from the comparative risk assessment were paired with cost-of-illness estimates. The latter capture both the direct and indirect costs associated with treating a specific disease, including medical and healthcare costs (direct), and costs of informal care and from lost working days (indirect).

For calculations, a global set of country-specific cost-of-illness estimates developed by Springmann *et al.* (2016)[54] was used. The data set is based on detailed cost-of-illness estimates for cardiovascular diseases and cancer across the European Union, which were transferred to other non-European countries[bc] by scaling the base values by the ratio of health expenditure per capita for direct costs and by the ratio of GDP per capita (adjusted for PPP) for indirect costs.

C. Data and methodology for the valuation of climate-change impacts

For estimating the climate-change costs of diets, we first calculated the GHG emissions associated with food consumption and then paired those with cost estimates of climate damages. For the former, we adopted a set of emissions factors derived from life-cycle assessments, including a global life cycle assessment with regional detail covering livestock products that was undertaken by FAO and a comprehensive meta-analysis of life cycle assessments of other food products. The assessments included all main emissions (carbon dioxide, methane, nitrous oxide) and sources along the food supply chain from the farm gate to the retail point, including production, processing, transport (including international trade) and, for livestock products, land use and feed production.

To measure climate-change impact in future years, we accounted for improvements in the emissions intensities of foods over time by incorporating the mitigation potential of bottom-up changes in management practices and technologies from marginal abatement cost curves. Improvements in the emissions intensities of foods over time are accounted for by incorporating the mitigation potential of bottom-up changes in management practices and technologies from marginal abatement cost curves, in line with previous assessment. The mitigation options include changes in irrigation, cropping and fertilization that

bc Extrapolating direct medical costs from European countries to low- and low-middle-income countries could result in an overestimate, as low- and low-middle-income countries, in general, would not have access to the level of medical care for NCDs and cancers as in Europe.

reduce methane and nitrous oxide emissions for rice and other crops, as well as changes in manure management, feed conversion and feed additives that reduce enteric fermentation in livestock. In line with commitments made as part of the SDGs, we also include a halving of food loss and waste by 2030 in our development pathway.

For monetizing GHG emissions, estimates of the social cost of carbon (SCC) were used, which represents the economic cost caused by an additional tonne of GHG emissions. Estimates were used from a fully revised version of the Dynamic Integrated model of Climate and the Economy (DICE) for a scenario that constrains future temperature rise to 2.5 degrees (with the temperature limit averaged over 100 years), in line with stated policy goals (the "Dice 2016 T2.5" scenario). The SCC values in this scenario were USD/ tCO_2-eq 107, 204 and 543 for the years 2015, 2030 and 2050, respectively. Although the quantification of GHG emissions in Section 2.2 is based on the "Dice 2016 T2.5" scenario, Figure A8.3 shows the social cost of GHG emissions in year 2030 under alternative climate scenarios.

D. Methodology for the estimation of the full cost of the diet

To contextualize the health and climate-change costs estimated in Section 2.2, it is useful to compare the "hidden" health and environmental costs with the wholesale cost of the diets, estimated at the consumption level and valued based on estimates of commodity prices by country. Wholesale cost are a proxy for the cost of diets assessed at the consumption level when hidden costs are not included.

Regional commodity prices were determined by market-clearing, i.e. at the equilibrium price where the quantity demanded for each commodity is equal to the quantity supplied. Prices were adjusted for trade policies and costs, producer and consumer support measures in national markets, and supply and demand relationships. Country- and commodity-specific wholesale prices estimated in this way do not include additional mark-ups at the processing and retail levels and are not directly comparable to the consumer prices used in Section 2.1 on the cost and affordability of diets. However, they are a useful proxy for quantifying the cost externalities of the food system in relationship to the basic cost of diets.

ANNEX 8

HEALTH AND CLIMATE-CHANGE COSTS RELATED TO DIETARY RISKS

A. Additional figures on hidden health costs

Figure 32 shows the number of deaths avoided in year 2030 when moving from the benchmark diet to the four alternative healthy diet patterns[bd] that include sustainability considerations. Furthermore, it is important to see the contribution of weight-related (obesity, overweight and underweight) and diet-related (by food group) risk factors to the total avoided deaths. Table A8.1 shows imbalance in the consumption of food groups (diet-related risk factors) and imbalances in weight levels (weight-related risk factors) associated to deaths that could be avoided in 2030 by moving from the benchmark scenario to the adoption of the four alternative healthy diet patterns. On average, 16.5 percent of avoided deaths in 2030 are due to diet-related risk factors, and 7.7 percent to weight-related risk factors. The remaining percent of deaths are attributed to non-dietary risks that are not accounted for in this analysis.[67] This differentiation by risk factor shows that the majority of avoidable deaths, on average 68 percent, were due to imbalances in dietary composition, as opposed to weight-related risk factors. These imbalances included too-low average consumption of whole grains (6.7 percent), fruits (2.2 percent), vegetables (2.4 percent), legumes (2.5 percent), nuts (2 percent), and too-high consumption of red meat (2.4 percent) and processed meat (2.4 percent). The remaining 32 percent of the avoided deaths were due to imbalanced weight levels, including underweight (0.5 percent), overweight (2.3 percent) and obesity (4.8 percent) (see **Annex 8**, Table A8.1**,** last column).

Note that while, on average, 16.5 percent of avoided deaths were related to the combination of all dietary risk factors, this percentage is smaller than the sum of individual percentages by food group, since it accounts for co-exposure of risks. It means that people can be exposed to multiple dietary risk factors, but each recorded death must be allocated to one risk factor only, so that there is no overlap between risks and deaths. On the contrary, the combination of all weight-related risk factors (7.7 percent) is exactly equal to the sum of individual percentages related to underweight, overweight and obesity, since these risk factors are mutually exclusive, i.e. each death is exclusively allocated to one risk factor only. Furthermore, it should be noted that weight-related factors in Table A8.1 show the same values across four alternative healthy diet patterns, indicating that all these diets are based on optimal energy intake and, therefore, there are no risks associated with imbalanced weight.

Figure A8.1 shows health costs (direct and indirect) at the global level and across country income groups in 2030 (USD billion), if current food consumption patterns continue (benchmark diet). Direct costs include direct medical and healthcare costs and indirect costs refer to loss of productivity per working days and the costs of informal care associated with each specific disease.

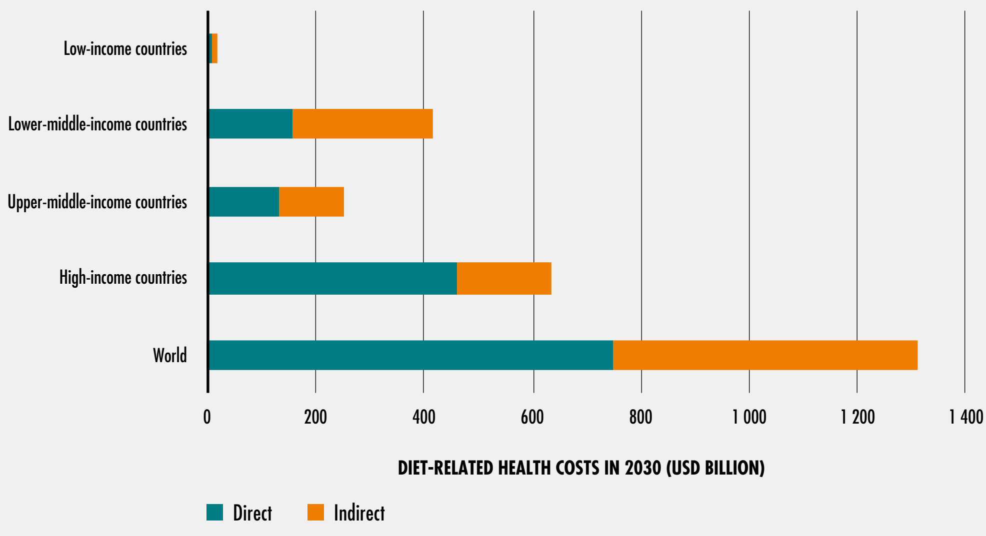
bd See footnote y.

TABLE A8.1
PERCENT CONTRIBUTION OF DIET- AND WEIGHT-RELATED RISK FACTORS TO THE REDUCTION IN MORTALITY IN YEAR 2030 WHEN MOVING FROM THE BENCHMARK DIET TO THE FOUR ALTERNATIVE HEALTHY DIET PATTERNS – GLOBAL

	FLX	PSC	VEG	VGN	Mean risk factors under the four scenarios
Diet-related risk factors	15.7	16.7	16.1	17.5	16.5
Fruits	1.9	1.9	2.2	2.6	2.2
Vegetables	1.6	2.2	2.4	3.4	2.4
Legumes	1.9	1.9	2.6	3.5	2.5
Nuts and seeds	2	2	2	2	2
Whole grains	6.7	6.7	6.7	6.7	6.7
Fish	0.6	1.4	-1.7	-1.7	-0.3
Red meat	2.1	2.6	2.6	2.6	2.4
Processed meat	2.4	2.4	2.4	2.4	2.4
Weight-related risk factors	7.7	7.7	7.7	7.7	7.7
Underweight	0.5	0.5	0.5	0.5	0.5
Overweight	2.3	2.3	2.3	2.3	2.3
Obesity	4.8	4.8	4.8	4.8	4.8

NOTES: The table shows the percent contribution of dietary- and weight-related risk factors to the reduction in mortality in year 2030 when moving from benchmark food consumption patterns (BMK) to the four alternative healthy diet patterns: the flexitarian (FLX), the pescatarian (PSC), the vegetarian (VEG) and the vegan (VGN) diet (see footnote y for more information).
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

FIGURE A8.1
IF CURRENT FOOD CONSUMPTION PATTERNS CONTINUE, DIET-RELATED HEALTH COSTS ARE PROJECTED TO BE USD 1.3 TRILLION IN 2030 – BY COUNTRY INCOME GROUP AND COST COMPONENT



NOTE: The figure shows diet-related health costs in 2030 (USD billion) by direct and indirect cost component and country income group, under current food consumption patterns (BMK). Costs are shown for 157 countries. Direct costs include direct medical and healthcare costs associated with treating a specific disease. Indirect costs include loss of productivity per working days and the costs of informal care associated with a specific disease. Health costs refer to four diet-related diseases included in the analysis: coronary heart disease, stroke, cancer and type-2 diabetes mellitus.
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

B. Additional figures on hidden climate-change costs

Figure A8.2 refers to the total amount of GHG emissions in 2030 for the world and by country income group for each dietary pattern. The figure shows substantial reduction in GHG emissions under the four alternative healthy diet scenarios with respect to the benchmark scenario.

The quantification of GHG emissions in Section 2.2 is based on the "Dice 2016 T2.5" scenario. For comparability, Figure A8.3 shows the social cost of GHG emissions under current food consumption pattern (BMK) in year 2030 for the "Dice 2016 T2.5" scenario, as well as for five other alternative climate scenarios. In particular, Figure A8.3 shows an unconstrained DICE scenario (DICE 2016) that discounts future climate damages by 3 percent, and four climate scenarios from the Interagency Working Group of the United States of America (IWG) that include integrated assessment models with estimates for four different discount rates: 5 percent, 3 percent, 2.5 percent and the 95th percentile of 3 percent.

Figure A8.4 shows the social cost of GHG emissions differentiated by food groups, for each dietary pattern and by country income group.

C. Description of the diets presented in Box 15

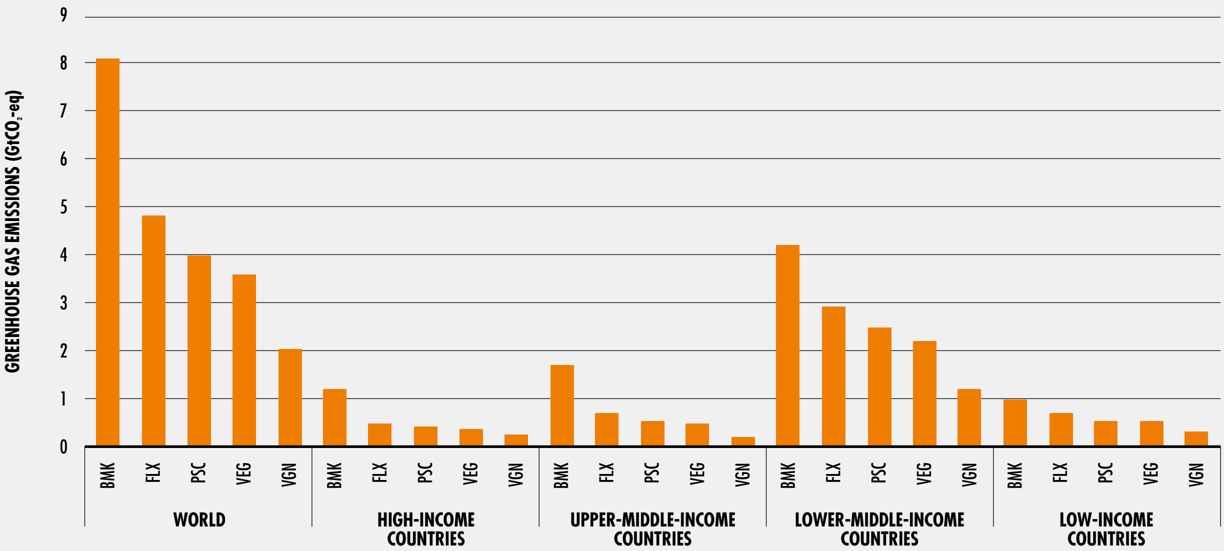
In the figure presented in Box 15 for Indonesia, kilocalorie intake and GHG emissions are shown for a set of "diets" and "plant-forward diets". The definition of "diets" includes:

- The **baseline diet**: it represents the current kilocalorie intake as derived from the FAO Food Balance Sheets (FBS).
- The **adjusted baseline diet**: adjustments are made to reduce the current energy intake to 2 300 kcal/capita/day, while protein intake is increased to 69 g/capita/day. All foods are scaled proportionally to reflect current intake as per FBS, but no further increase of red meat consumption is allowed.
- The **optimized diet for an average individual**: is set to meet nutrient intake recommendations for the general population at the lowest possible cost, using the Cost of the Diet (CotD) linear programming software. Nutrient intake recommendations are based on nutrient reference values for a daily nutrient intake and represent the best available scientific knowledge of the daily amount of energy or nutrients needed for good health.
- The **EAT-Lancet diet**: the amounts of EAT-Lancet recommended foods are allocated to FBS categories in order to evaluate the climate impact. These amounts are then converted to their proportional food consumption as resulting from the National Socioeconomic Survey (SUSENAS) for Indonesia.

Compared to the adjusted baseline diet, the definition of "plant-forward diets" includes a **reduction of sugar intake** to less than **10 percent** of total energy per capita per day, and the consumption of at least five servings of fruits and vegetables per capita per day. "Plant-forward diets" include the following:

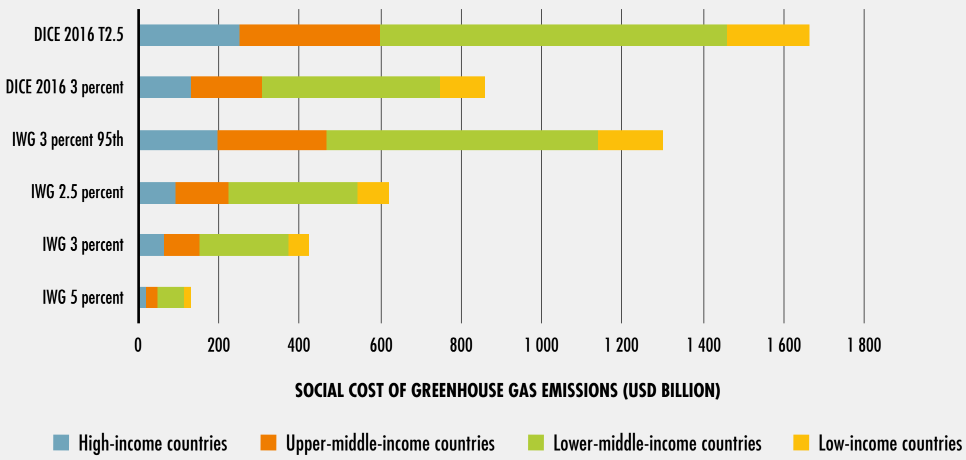
- The **no dairy** diet: the protein is derived from red meat, whose quantity does not change with respect to the adjusted baseline diet, as well as from poultry, aquatic animals, eggs, pulses and soy. These last five sources of protein are scaled as necessary to achieve the protein target.
- The **no red meat** diet: the protein is derived from dairy, poultry, aquatic animals, eggs, pulses and soy. All are scaled as necessary to achieve the protein target.
- The **pescatarian** diet: the protein is derived from dairy, eggs (whose quantity does not change with respect to the adjusted baseline diet), as well as from aquatic animals, pulses and soy. These last three sources of protein are scaled as necessary to achieve the protein target.
- The **lacto-ovo vegetarian** diet: the protein is derived from dairy, eggs, pulses and soy, all scaled as necessary to achieve the protein target.
- The **low food chain** diet: the protein is derived from insects (10 percent of what is »

FIGURE A8.2
ADOPTION OF ANY OF THE FOUR ALTERNATIVE HEALTHY DIETS COULD SIGNIFICANTLY REDUCE PROJECTED DIET-RELATED GHG EMISSIONS IN 2030



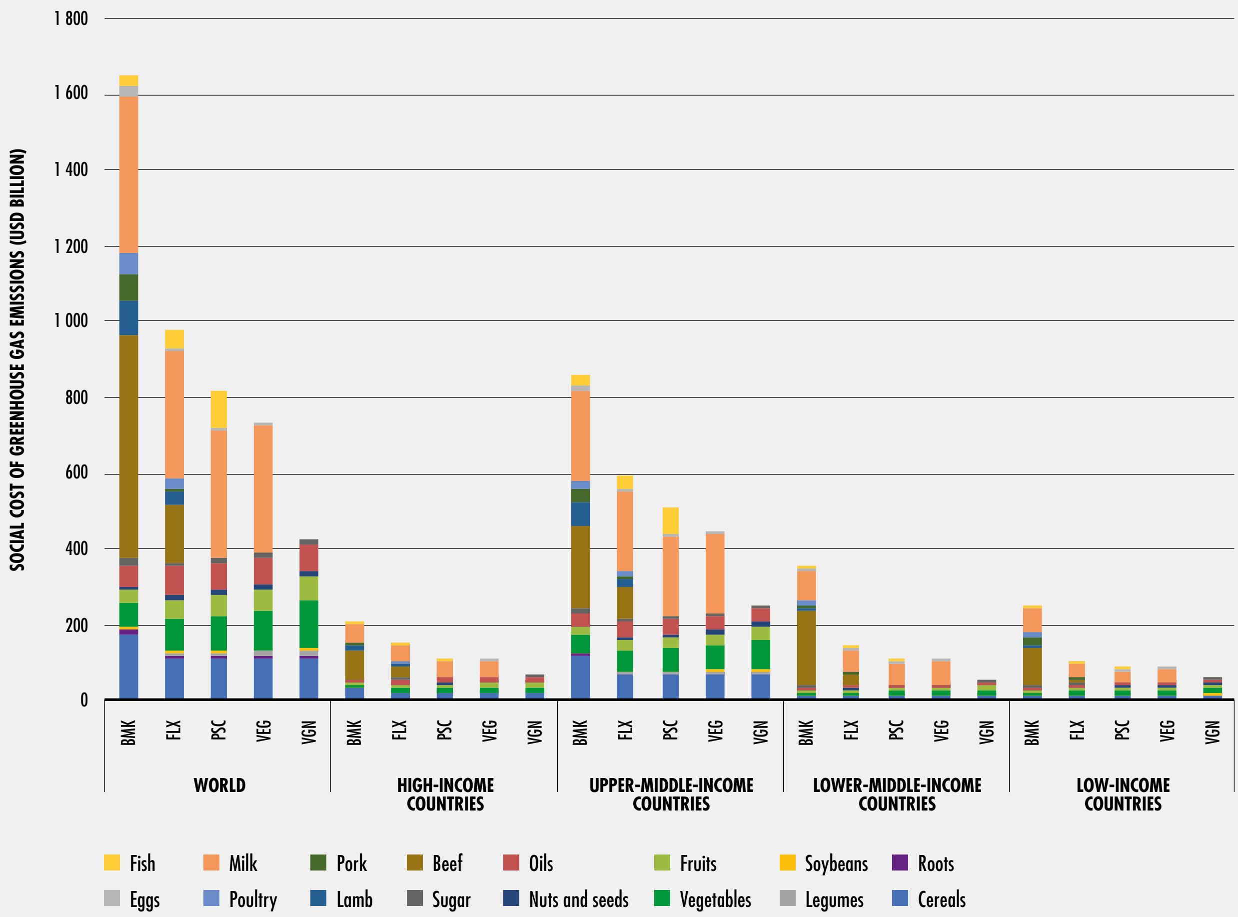
NOTES: The figure shows the greenhouse gas (GHG) emissions at the global level and by country income group in year 2030. Diet-related climate-change costs are shown under the benchmark scenario (BMK) as well as the flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN) scenario (see footnote y for more information).
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

FIGURE A8.3
THE SOCIAL COST OF GHG EMISSIONS UNDER CURRENT FOOD CONSUMPTION PATTERNS FOR DIFFERENT EMISSIONS-STABILIZATION SCENARIOS IN 2030 (USD BILLION)



NOTES: The figure shows the social cost of GHG emissions under current food consumption patterns (BMK) in year 2030 for the "Dice 2016 T2.5" emission scenario and five alternative climate scenarios: an unconstrained DICE scenario that discounts future climate damages by 3 percent (DICE 2016 3 percent), and four climate scenarios from the Interagency Working Group of the United States of America (IWG). These include integrated assessment models with estimates for four different discount rates: 5 percent (IWG 5 percent), 3 percent (IWG 3 percent), 2.5 percent (IWG 2.5 percent) and the 95th percentile of 3 percent (IWG 3 percent 95th).
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

FIGURE A8.4
THREE-QUARTERS OF THE SOCIAL COST OF GHG EMISSIONS UNDER CURRENT FOOD CONSUMPTION PATTERNS COMES FROM MEAT AND DAIRY PRODUCTS IN 2030



NOTES: The figure shows the social cost of GHG emissions in 2030 by dietary pattern and food group for the world and by country income group. Dietary patterns include benchmark current food consumption patterns (BMK) and four alternative healthy diet patterns: flexitarian (FLX), pescatarian (PSC), vegetarian (VEG) and vegan (VGN) (see footnote y for more information).
SOURCE: Springmann, M. 2020. *Valuation of the health and climate-change benefits of healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2020*. Rome, FAO.

» currently from terrestrial animals), forage fish (70 percent of what is currently from aquatic animals), bivalve mollusks (30 percent of what is currently from aquatic animals), pulses and soy. The last two sources if protein are scaled as necessary to achieve the protein target.

- The **vegan** diet: the protein is derived from pulses and soy that are scaled as necessary to achieve the protein target.

ANNEX 9

GLOSSARY

Acute food insecurity
Food insecurity found in a specified area at a specific point in time and of a severity that threatens lives or livelihoods, or both, regardless of the causes, context or duration. Has relevance in providing strategic guidance to actions that focus on short-term objectives to prevent, mitigate or decrease severe food insecurity that threatens lives or livelihoods.

Affordability
Refers to the ability of people to buy foods in their local environment. In this report, it refers to the ability to buy the least cost version of the three diets presented in Section 2.1: the energy sufficient, the nutrient adequate, and the healthy diet. Affordability is determined in three ways: i) by comparing the cost of the three diets with the international poverty line set at USD 1.90 PPP per capita per day; ii) by comparing the cost of the three diets with country-specific average food expenditure; iii) by computing the percentage and number of people in each country who are not able to afford the three diets.

Animal source foods
All types of meat, poultry, fish, eggs, milk, cheese and yoghurt and other dairy products.

Anthropometry
Use of human body measurements to obtain information about nutritional status.

Chronic food insecurity
Food insecurity that persists over time mainly due to structural causes. Can include seasonal food insecurity found in periods with non-exceptional conditions. Has relevance in providing strategic guidance to actions that focus on the medium- and long-term improvement of the quality and quantity of food consumption for an active and healthy life.

Diet quality
Is comprised of four key aspects: variety and/or diversity (within and across food groups), adequacy (sufficiency of nutrients or food groups compared to requirements), moderation (foods and nutrients that should be consumed with restraint), and overall balance (composition of macronutrient intake). Exposure to food safety hazards is another important quality aspect.

Dietary diversity
A measure of the variety of food from different food groups consumed over a reference period.

Dietary energy intake
The energy content of food consumed.

Dietary energy supply (DES)
Food available for human consumption, expressed in kilocalories per person per day (kcal/person/day). At the country level, it is calculated as the food remaining for human use after deduction of all non-food utilizations (i.e. food = production + imports + stock withdrawals – exports – industrial use – animal feed – seed – wastage – additions to stock). Wastage includes loss of usable products occurring along distribution chains from farm gate (or port of import) up to retail level.

Double-duty actions
Double-duty actions include interventions, programmes and policies that have the potential to simultaneously reduce the risk or burden of both undernutrition (including wasting, stunting and micronutrient deficiency or insufficiency) and overweight, obesity or diet-related NCDs (including type 2 diabetes, cardiovascular disease and some cancers). Double-duty actions

leverage the coexistence of multiple forms of malnutrition and their shared drivers to offer integrated solutions.

Dietary energy intake
Energy content of food and beverages consumed.

Dietary energy requirements
The amount of dietary energy required by an individual to maintain body functions, health and normal activity. Dietary energy requirements are dependent upon age, sex, body size and level of physical activity. Additional energy is required to support optimal growth and development in children and in women during pregnancy, and for milk production during lactation, consistent with the good health of mother and child.

Energy-dense foods of minimal nutritional value
Food with a high content of calories (energy) with respect to its mass or volume

Flesh foods
Are meat, fish, poultry and liver/organ meats.

Food Insecurity Experience Scale
An experience-based food security scale used to produce a measure of access to food at different levels of severity that can be compared across contexts. It relies on data obtained by asking people, directly in surveys, about the occurrence of conditions and behaviours that are known to reflect constrained access to food.

Food security
A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization, and stability over time.

Food security dimensions
Refers to the four dimensions of food security:

a. Availability – This dimension addresses whether or not food is actually or potentially physically present, including aspects of production, food reserves, markets and transportation, and wild foods.

b. Access – If food is actually or potentially physically present, the next question is whether or not households and individuals have sufficient access to that food.

c. Utilization – If food is available and households have adequate access to it, the next question is whether or not households are maximizing the consumption of adequate nutrition and energy. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, dietary diversity and intra-household distribution of food. Combined with good biological utilization of food consumed, this determines the nutritional status of individuals.

d. Stability – If the dimensions of availability, access and utilization are sufficiently met, stability is the condition in which the whole system is stable, thus ensuring that households are food secure at all times. Stability issues can refer to short-term instability (which can lead to acute food insecurity) or medium- to long-term instability (which can lead to chronic food insecurity). Climatic, economic, social and political factors can all be a source of instability.

Food systems
The entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products. Food systems comprise all food products that originate from crop and livestock production, forestry, fisheries and aquaculture, as well as the broader economic, societal and natural environments in which these diverse production systems are embedded.

Healthcare
The organized provision of medical care to individuals or a community. This includes services provided to individuals or communities by health service providers for the purpose of promoting, maintaining, monitoring or restoring health.

Healthy diet

A balanced, diverse and appropriate selection of foods eaten over a period of time. A healthy diet protects against malnutrition in all its forms, as well as NCDs, and ensures that the needs for macronutrients (proteins, fats and carbohydrates including dietary fibres) and essential micronutrients (vitamins, minerals and trace elements) are met specific to the person's gender, age, physical activity level and physiological state. For diets to be healthy: 1) daily needs of energy, vitamins and minerals should be met, but energy intake should not exceed needs; 2) consumption of fruits and vegetables is at least 400 g per day; 3) intake of fats is less than 30 percent of total energy intake, with a shift in fat consumption away from saturated fats to unsaturated fats and the elimination of industrial trans fats; 4) intake of free sugars is less than 10 percent of total energy intake or, preferably, less than 5 percent; 5) intake of salt is less than 5 g per day. A healthy diet for infants and young children is similar to that for adults, but the following elements are also important: 1) infants should be breastfed exclusively during the first 6 months of life; 2) infants should be breastfed continuously until 2 years of age and beyond; 3) from 6 months of age, breast milk should be complemented with a variety of adequate, safe and nutrient-dense foods. Salt and sugars should not be added to complementary foods.

Hunger

Hunger is an uncomfortable or painful physical sensation caused by insufficient consumption of dietary energy. In this report, the term hunger is synonymous with chronic undernourishment.

Macronutrients

Are needed in larger quantities (in gram range) and are the major source of energy and bulk (volume) in our diets. They include carbohydrates, protein and fats. They are the only nutrients that contain energy from food, which is measured in calories. Getting sufficient energy is essential for everyone in order to maintain body growth and development and good health. Carbohydrates, protein and fats, in addition to providing energy, each have very specific functions in the body and must be supplied in sufficient amounts to carry out those functions.

Malnutrition

An abnormal physiological condition caused by inadequate, unbalanced or excessive consumption of macronutrients and/or micronutrients. Malnutrition includes undernutrition (child stunting and wasting and vitamin and mineral deficiencies) as well as overweight and obesity.

Micronutrients

Include vitamins and minerals and are required in very small (micro) but specific amounts. Vitamins and minerals in foods are necessary for the body to grow, develop and function properly and they are essential for our health and well-being. Our bodies require a number of different vitamins and minerals, each of which has a specific function in the body and must be supplied in different, sufficient amounts.

Moderate food insecurity

The level of severity of food insecurity, based on the Food Insecurity Experience Scale, at which people face uncertainties about their ability to obtain food and have been forced to reduce, at times during the year, the quality and/or quantity of food they consume due to lack of money or other resources. It thus refers to a lack of consistent access to food, which diminishes dietary quality, disrupts normal eating patterns, and can have negative consequences for nutrition, health and well-being.

Multiple burden of malnutrition

The coexistence of forms of undernutrition (child stunting and wasting and vitamin and mineral deficiencies) with overweight and obesity in the same country, community, household or individual.

Nutrition security

A situation that exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment and adequate health services and care, in order to ensure a healthy and active life for all household members. Nutrition security differs from food security in that it also considers the aspects of adequate caregiving practices, health and hygiene, in addition to dietary adequacy.

Nutrition-sensitive intervention
An action designed to address the underlying determinants of nutrition (which include household food security, care for mothers and children, and primary healthcare and sanitation) but not necessarily having nutrition as the predominant goal.

Nutrition transition
As incomes rise and populations become more urban, diets high in complex carbohydrates and fiber give way to more energy-dense diets high in fats, sugars and/or salt. These global dietary trends are accompanied by a demographic transition that is a shift toward increased life expectancy and reduced fertility rates. At the same time, disease patterns move away from infectious and nutrient-deficiency diseases towards higher rates of childhood obesity, coronary heart disease, and some types of cancer.

Nutritional status
The physiological state of an individual that results from the relationship between nutrient intake and requirements and the body's ability to digest, absorb and use these nutrients.

Nutritious foods
Are those foods that tend to be high in essential nutrients such as vitamins and minerals (micronutrients), as well as proteins, unrefined fibre-rich carbohydrates, and/or unsaturated fats and are low in sodium, free sugars, saturated fats and trans fats.

Overweight and obesity
Body weight that is above normal for height as a result of an excessive accumulation of fat. It is usually a manifestation of expending less energy than is consumed. In adults, overweight is defined as a BMI of 25 kg/m^2 or more, and obesity as a BMI of 30 kg/m^2 or more. In children under five years of age, overweight is defined as weight-for-height greater than 2 standard deviations above the WHO Child Growth Standards median, and obesity as weight-for-height greater than 3 standard deviations above the WHO Child Growth Standards median.

Plant-forward strategies
Promoting diets where whole grains, fruits, vegetables, nuts and legumes comprise a greater proportion of foods consumed.

Predominantly staple-based diets
Diets where one or more staple foods supply a disproportionately large share of energy and are low in dietary diversity.

Prevalence of undernourishment
An estimate of the proportion of the population that lacks enough dietary energy for a healthy, active life. It is FAO's traditional indicator used to monitor hunger at the global and regional level, as well as Sustainable Development Goal Indicator 2.1.1.

Severe food insecurity
The level of severity of food insecurity at which people have likely run out of food, experienced hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk, based on the Food Insecurity Experience Scale.

Staple food
A staple food is one that is eaten regularly and in such quantities as to constitute the dominant part of the diet and supply a major proportion of the total energy.

Stunting
Low height-for-age, reflecting a past episode or episodes of sustained undernutrition. In children under five years of age, stunting is defined height-for-age less than -2 standard deviations below the WHO Child Growth Standards median.

Undernourishment
Undernourishment is defined as the condition in which an individual's habitual food consumption is insufficient to provide the amount of dietary energy required to maintain a normal, active, healthy life. For the purposes of this report, hunger is defined as being synonymous with chronic undernourishment.

Undernutrition
The outcome of poor nutritional intake in terms of quantity and/or quality, and/or poor absorption and/or poor biological use of nutrients consumed as a result of repeated instances of disease. It includes being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (suffering from wasting) and deficient in vitamins and minerals (micronutrient deficiency).

Wasting
Low weight-for-height, generally the result of weight loss associated with a recent period of inadequate dietary energy intake and/or disease. In children under five years of age, wasting is defined as weight-for-height less than -2 standard deviations below the WHO Child Growth Standards median.

NOTES

NOTES TO PART 1

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NOTES ON GEOGRAPHIC REGIONS IN STATISTICAL TABLES IN PART 1 AND ANNEX 1

Countries revise their official statistics regularly for past periods as well as for the latest reporting period. The same holds for statistics presented in this report. Whenever this happens, estimates are revised accordingly. Therefore, users are advised to refer to changes in estimates over time only within the same edition of *The State of Food Security and Nutrition in the World* and refrain from comparing data published in editions for different years.

Geographic regions

This publication follows the composition of geographic regions as presented by the Statistics Division of the United Nations Secretariat primarily for use in its publications and databases (https://unstats.un.org/unsd/methodology/m49). The assignment of countries or areas to specific groupings is for statistical convenience and does not imply any assumption regarding political or other affiliation of countries or territories by the United Nations. Please refer to the list to the right for the country composition of each region in Annex 1 tables as well as in Tables 1–4 in Section 1.1.

Countries, areas and territories for which there were insufficient or unreliable data for conducting the assessment are not reported and not included in the aggregates. Specifically:

- **Northern Africa:** In addition to the countries/territories listed in the table, PoU and food insecurity based on the FIES include an estimate for Western Sahara. Child wasting, stunting and overweight, low birthweight, adult obesity, exclusive breastfeeding and anaemia estimates exclude Western Sahara.
- **Eastern Africa:** With respect to the M49 classification, it excludes British Indian Ocean Territory, French Southern and Antarctic Territories, Mayotte and Réunion.
- **Western Africa:** With respect to the M49 classification, it excludes Saint Helena.
- **Asia and Eastern Asia:** With respect to the M49 classification, low birthweight, child wasting, stunting and overweight aggregates exclude Japan.
- **Caribbean:** With respect to the M49 classification, it excludes Anguilla; Aruba; Bonaire, Sint Eustatius and Saba; British Virgin Islands; Cayman Islands; Curaçao; Guadeloupe; Martinique; Montserrat; Saint Barthélemy; Saint Martin (French part); Sint Maarten (Dutch part); Turks and Caicos Islands; and United States Virgin Islands. In addition to these, anaemia estimates exclude Saint Kitts and Nevis. Adult obesity, child wasting, stunting and overweight, low birthweight and exclusive breastfeeding exclude Puerto Rico.
- **South America:** With respect to the M49 classification, it excludes Bouvet Island, Falkland Islands (Malvinas), French Guyana, and South Georgia and the South Sandwich Islands.
- **Australia and New Zealand:** With respect to the M49 classification, it excludes Christmas Island, Cocos (Keeling) Islands, Heard and McDonald Islands, and Norfolk Island.
- **Melanesia:** With respect to the M49 classification, anaemia, child wasting, stunting and overweight, low birthweight and exclusive breastfeeding estimates exclude New Caledonia.
- **Micronesia:** With respect to the M49 classification, adult obesity, anaemia, child wasting, stunting and overweight, low birthweight and exclusive breastfeeding estimates exclude Guam, Northern Mariana Islands, and US Minor Outlying Islands while anaemia estimates also exclude Nauru and Palau.
- **Polynesia:** With respect to the M49 classification, it excludes Pitcairn Islands, and Wallis and Futuna Islands. Adult obesity, child wasting, stunting and overweight, low birthweight and exclusive breastfeeding estimates exclude American Samoa, French Polynesia and Tokelau (Associate Member). In addition, anaemia aggregates also exclude Cook Islands, Niue and Tuvalu.
- **Northern America:** With respect to the M49 classification, it excludes Saint Pierre and Miquelon. Adult obesity, anaemia, low birthweight and exclusive breastfeeding aggregates also exclude Bermuda and Greenland. Aggregates for wasting and stunting are based only on data for the United States of America.
- **Northern Europe:** With respect to the M49 classification, it excludes Åland Islands, Channel Islands, Faroe Islands (Associate Member), Isle of Man, and Svalbard and Jan Mayen Islands.
- **Southern Europe:** With respect to the M49 classification, it excludes Gibraltar, Holy See and San Marino. However, low birthweight estimates include San Marino.
- **Western Europe:** With respect to the M49 classification, it excludes Liechtenstein and Monaco. However, low birthweight estimates include Monaco.

Other groupings

Least Developed Countries, Land Locked Developing Countries and Small Island Developing States groupings include the countries as presented by the Statistics Division of the United Nations (https://unstats.un.org/unsd/methodology/m49).

- **Small Island Developing States:** Estimates for child stunting, wasting and overweight, adult obesity, exclusive breastfeeding and low birthweight exclude American Samoa; French Polynesia; Puerto Rico; Anguilla; Aruba; Bonaire, Sint Eustatius and Saba; British Virgin Islands; Curaçao; Guam; Montserrat; New Caledonia; Northern Mariana Islands; Sint Maarten (Dutch part); and United States Virgin Islands. In addition, anaemia estimates exclude Cook Islands, Nauru, Niue, Palau, Saint Kitts and Nevis, and Tuvalu.

High-income, upper-middle-income, lower-middle-income and low-income countries include the countries as presented by the World Bank classification for the 2019–2020 fiscal year (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519). For anaemia in women and low birthweight, the World Bank classification for the 2017–2018 fiscal year was used.

Low-income food-deficit countries (2018): Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic People's Republic of Korea, the Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, the Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, India, Kenya, Kyrgyzstan, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Nepal, Nicaragua, the Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, the Sudan, the Syrian Arab Republic, Tajikistan, Togo, Uganda, the United Republic of Tanzania, Uzbekistan, Viet Nam, Yemen and Zimbabwe.

Composition of geographic regions

AFRICA

Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Western Sahara.

Sub-Saharan Africa

Eastern Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Uganda, United Republic of Tanzania, Zambia and Zimbabwe.

Middle Africa: Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, and Sao Tome and Principe.

Southern Africa: Botswana, Eswatini, Lesotho, Namibia and South Africa.

Western Africa: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

ASIA

Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

Eastern Asia: China, Democratic People's Republic of Korea, Japan, Mongolia and Republic of Korea.

South-eastern Asia: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste and Viet Nam.

Southern Asia: Afghanistan, Bangladesh, Bhutan, India, Iran (Islamic Republic of), Maldives, Nepal, Pakistan and Sri Lanka.

Western Asia: Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates and Yemen.

LATIN AMERICA AND THE CARIBBEAN

Caribbean: Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

Latin America

Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Panama.

South America: Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay and Venezuela (Bolivarian Republic of).

OCEANIA

Australia and New Zealand: Australia and New Zealand.

Oceania excluding Australia and New Zealand

Melanesia: Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu.

Micronesia: Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru and Palau.

Polynesia: American Samoa, Cook Islands, French Polynesia, Niue, Samoa, Tokelau, Tonga and Tuvalu.

NORTHERN AMERICA AND EUROPE

Northern America: Bermuda, Canada, Greenland and United States of America.

Europe

Eastern Europe: Belarus, Bulgaria, Czechia, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia and Ukraine.

Northern Europe: Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, and United Kingdom of Great Britain and Northern Ireland.

Southern Europe: Albania, Andorra, Bosnia and Herzegovina, Croatia, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, Serbia, Slovenia and Spain.

Western Europe: Austria, Belgium, France, Germany, Luxembourg, Netherlands and Switzerland.

THE STATE OF THE WORLD

2020 THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD

TRANSFORMING FOOD SYSTEMS FOR AFFORDABLE HEALTHY DIETS

Updates for many countries have made it possible to estimate hunger in the world with greater accuracy this year. In particular, newly accessible data enabled the revision of the entire series of undernourishment estimates for China back to 2000, resulting in a substantial downward shift of the series of the number of undernourished in the world. Nevertheless, the revision confirms the trend reported in past editions: the number of people affected by hunger globally has been slowly on the rise since 2014. The report also shows that the burden of malnutrition in all its forms continues to be a challenge. There has been some progress for child stunting, low birthweight and exclusive breastfeeding, but at a pace that is still too slow. Childhood overweight is not improving and adult obesity is on the rise in all regions.

The report complements the usual assessment of food security and nutrition with projections of what the world may look like in 2030, if trends of the last decade continue. Projections show that the world is not on track to achieve Zero Hunger by 2030 and, despite some progress, most indicators are also not on track to meet global nutrition targets. The food security and nutritional status of the most vulnerable population groups is likely to deteriorate further due to the health and socio-economic impacts of the COVID-19 pandemic.

The report puts a spotlight on diet quality as a critical link between food security and nutrition. Meeting SDG 2 targets will only be possible if people have enough food to eat and if what they are eating is nutritious and affordable. The report also introduces new analysis of the cost and affordability of healthy diets around the world, by region and in different development contexts. It presents valuations of the health and climate-change costs associated with current food consumption patterns, as well as the potential cost savings if food consumption patterns were to shift towards healthy diets that include sustainability considerations. The report then concludes with a discussion of the policies and strategies to transform food systems to ensure affordable healthy diets, as part of the required efforts to end both hunger and all forms of malnutrition.

ISBN 978-92-5-132901-6 ISSN 2663-8061

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CA9692EN/1/07.20