

Preface

In September 2015, the General Assembly of the United Nations adopted the Sustainable Development Goals (SDGs). This was the first time that the UN had developed a set of Global Goals and not a series of goals only for low- and middle-income countries (LMICs) in contrast with the Millennium Development Goals (MDGs). The first two editions of this textbook, published in 2001 and 2008, were produced against the background of the MDGs and this was reflected in the title: *Nutrition and Health in Developing Countries*. In the 1990s, most development concepts and ideas were still based on a philosophy that problems in certain parts of the world were independent of the rest of the world. Despite the title, Semba and Bloem already embraced the complexity of the world of public health and nutrition, but the SDGs urged us to expand the scope of this third edition to the world as it is developing today, and include various new chapters and not include a revised version of some of the chapters of the second edition.

Climate change, pollution, hunger, food systems, Ebola and Zika viruses, etc., have taught us that the world is interconnected and interdependent. The security problems in the world, e.g., Syria and South Sudan, do not only lead to destroyed cities, infrastructure, high number of deaths, food insecurity etc., but also to increased migration of millions of people to Europe and other countries. What does this mean for public health specialists?

Students in the field of public health, nutrition, development practice, and related fields can no longer be trained and educated only in domestic or local problems whether they live in the US, Europe, Africa, Latin America, or Asia. For example, the influx of many immigrants have changed the morbidity ‘landscape’ in US and Europe, e.g. tuberculosis. The Zika virus epidemic shows that frequent travel of migrants from their home countries in Latin America contributes to the spread of the virus and complicates the management of the epidemic. The Ebola crisis of 2014/15 in West Africa led to global travel restrictions, which were impossible to control and maintain.

The evolving complexity and interconnectedness of our world requires a different approach of public health. In this edition we have therefore included a variety of topics which are related with public health but are often on their own the center of multiple other related areas, such as urbanization, supermarkets and food value chains. We realize that we can never be complete and fully comprehensive but are hoping that *Nutrition and Health in a Developing World* can help the next generation of public health and nutrition specialists to be trained in such a way that they will be able to contribute sound and in-depth knowledge of specific areas in health and nutrition while approaching problems in a multidisciplinary way through collaborating with other fields.

While the focus of public health is on populations, public health practitioners need to understand the etiology, treatment and political and social implications of health and nutrition problems in several domains, e.g., individual, household and community level, as well as at a systems level. Scientific progress, economic growth as well as various communication platforms in each domain influence what could be appropriate strategies for addressing the problem. For example, treatment availability

and accessibility has enormous consequences for how individuals and communities are responding to public health threats. In the case of the Ebola epidemic in West Africa in 2014/15, for which no treatment or vaccine was available, including a medical anthropologist on the team for containing the outbreak turned out to be essential. The infected and affected populations had started to distrust the health facilities since the disease also spread from there. Good understanding of the communities through anthropological assessments eventually enabled gaining control of the epidemic. Another example is perception of overweight and obesity by different populations in the world. In the past two decades, obesity has become a problem of lower socioeconomic strata in high-income countries but is still a problem of the middle-class in low-income countries. Perceptions are, however, changing and having a healthy lifestyle and not being overweight increasingly becomes the goal among more affluent populations in low- and middle-income countries. Historical perspective is also an important tool of the public health practitioner.

The major drivers of public health and nutrition problems in the next 15 years are (i) the implications of climate change, (ii) increase of inequity in the world, (iii) political instability between and within states, (iv) migration, (v) urbanization, and (vi) challenges to achieving sustainable food systems. We will observe both an increase of non-communicable diseases and infectious diseases and in the field of nutrition, undernutrition will remain a problem while the obesity epidemic will continue, increasing the double burden of malnutrition in many low- and middle-income countries. We have never seen such a complexity of health and nutritional problems in the world, and we have to propose, pilot, and find new solutions.

Nutrition and Health in a Developing World, Third Edition, starts with a historical overview of nutrition by Richard Semba. We have recognized that many students in public health and international nutrition are overwhelmed by the magnitude of the problems of undernutrition, infectious diseases, and poor infrastructure in LMICs. It is, however, not enough appreciated that the prevalence and etiology of nutritional deficiencies, including stunting, as well as of infectious diseases, including tuberculosis, in the early 20th Century in Europe and the US were very similar.

We can still learn many lessons from the past but too often we are reinventing the wheel. An interesting example of Semba's chapter is how the ideas on the role of amino acids/proteins in malnutrition have changed in the past 50 years. In the late 1960s and early 1970s, there was a lot of interest in protein deficiency as one of the key determinants of undernutrition. Based on this interest, researchers from the Americas designed one of the most important studies in the nutrition field: The Institute of Nutrition of Central America and Panama's (INCAP) 1969–1977 nutritional supplementation trial. Four rural villages from eastern Guatemala were randomly selected to receive either a high-protein supplement (Atole) or an alternative supplement devoid of protein (Fresco) [1]. During the implementation of this study, the Lancet published an editorial in 1974, entitled “The protein fiasco” [2] which argued that when energy intake would be adequate, so would protein intake, and as a result, the UN stopped focusing on proteins and changed the focus to calories, which meant staple food in agricultural terms. The nutritionists changed their attention to micronutrients, particularly vitamin A, iron, iodine and zinc, including ourselves. The impact of the Guatemala trial was, however, quite impressive and has been extensively published. The long-term impact of “Atole”, as assessed among adults who had participated in the study during their early childhood, was not only a better nutritional and health status but it also had positive economic implications [3], and many of the recommendations made by the 2008 and 2013 Lancet nutrition series were based on the long-term results observed from the INCAP supplementation trial. This did not yet lead, however, to a renewed interest in proteins. In 2016, Semba and co-workers published a number of papers on the associations between stunting and lower levels of circulating amino acids, which is most probably the beginning of a renewed focus and interest on the role of amino acids, and protein quality, in malnutrition.

The second part—Contextualizing international nutrition—considering benefit-cost, evidence-base and capacity, consist of three chapters: Economics of Nutritional Interventions by Sue Horton;

Nutrition Evidence in Context by Saskia De Pee and Rebecca Grais; and Developing Capacity in Nutrition by Jessica Fanzo and Matt Graziose.

Since 2014, the International Food Policy Research Institute (IFPRI) has published the Global Nutrition Report (GNR), a new annual publication that started as a result of the Nutrition for Growth meeting in London in 2012. The GNR has shown that malnutrition in all its forms is a public health problem in almost all countries of the world. The 2015 GNR showed that the field has made progress but there is still a great need for more funding if the world intends to reach the nutrition goal of SDG2. Horton in her chapter argues that analysis of the economic costs of undernutrition can be used to advocate for more resources for nutrition investments, and to prioritize cost-effective programming.

Over the past two decades, more and more attention is given to evidence-based programs. While evidence-based programming is important, De Pee and Grais explain that for interventions that aim to change dietary intake using foods the evidence-based medical paradigm has several limitations. Their chapter is exemplary for the philosophy of *Nutrition and Health in a Developing World*. They argue that the choice of interventions should be guided by situation analysis of the most likely causes of the specific nutrition problems among different subgroups of the population, and a good understanding of what can be delivered and accepted by the target population. They recommend that researchers should use various designs to collect evidence on implementation and impact, with particular emphasis on characterizing and assessing the role of context, both for choice of interventions and for assessing their contribution to addressing malnutrition.

Since the increase of interest in nutrition in the world, various global nutrition experts were concerned about the lack of capacity and availability of trained professionals in nutrition at all levels. In 2014, we organized a workshop to discuss this topic in the context of the changing world in preparation for the SDGs. The chapter by Fanzo and Graziose reflects many of the discussions we had at this workshop. Capacity development will remain a critical feature of nutrition and development agendas in the coming decades and *Nutrition and Health in a Developing World* is an important contribution to achieving this goal.

The third part—Malnutrition, nutrients and (breast)milk explained—consists of 12 chapters: Malnutrition spectrum by Douglas Taren and Saskia de Pee; Child Growth and Development by Mercedes De Onis; Overweight and Obesity by Colleen Doak and Barry Popkin; Nutrient Needs and Approaches to meeting them by Saskia de Pee; Vitamin A by Amanda C Palmer, Ian Darnton-Hill and Keith P West, Jr; Iron by Melissa Young and Usha Ramakrishnan; Zinc by Sonja K. Hess; Iodine by Michael Zimmermann; Vitamin D by John M. Pettifor and Kebashni Thandrayen; Essential Fatty Acids by Ettie Granot and Richard Deckelbaum; Role of Milk in Nutrition by Benedikte Grenov, Henrik Friis, Christian Mølgaard and Kim F Michaelsen; The role of Breastfeeding in a developing world by Douglas Taren and Chessa Lutter.

As previously mentioned, the second Sustainable Development Goal includes nutrition and it is recognized that nutrition should be tackled through many different platforms. The Scaling up Nutrition (SUN) Movement, Committee of Food Security (CFS) and the International Congress of Nutrition (ICN2) are specific platforms of nutrition but there are other platforms, which are critical for sustainable progress in nutrition, e.g., on climate change, every woman every child, HIV AIDS, etc. To understand the importance of the strategies, which focus on the underlying and basic causes of malnutrition, analysis of the direct causes of the various forms of malnutrition is critical. This part of twelve chapters deals with the different forms of malnutrition and discusses specific nutrients and their deficiencies, i.e., one of the two direct causes of malnutrition.

Taren and de Pee describe the spectrum of malnutrition, ranging from undernutrition to overweight and obesity and at the level of individual nutrients from deficiencies to toxicity, and describe indicators of different aspects of nutritional status and their use at individual as well as population level. De Onis discusses child growth and reviews many concepts including indicators, growth standards, the magnitude and geographical distribution of suboptimal growth, its short- and long-term consequences, and interventions aimed at promoting healthy growth and development. In 2012, the World

Health Assembly (WHA) adopted global nutrition targets to measure progress at the country level, using many growth indicators, i.e., stunting, wasting, and overweight in children under age 5; low birth weight; and in addition anemia in women of reproductive age; and exclusive breastfeeding.

Doak and Popkin describe recent trends in obesity. An important observation is that there is a shift in low- and middle-income countries from the urban elite to the middle and lower classes. Particularly interesting is that they show that obesity trends are similar in urban and rural areas, and that more research is needed to understand these various trends in overweight and obesity. Simple conclusions that dietary patterns are changing to a more Western type diet are not anymore enough. Global trends are critical but context analysis is as critical. Most probably, the underlying causes of the obesity epidemic in the Middle East are not the same as in the US, for example. Doak and Popkin conclude therefore that the policies and programs that contribute to and may alter these patterns may be best understood by examining the situation in different settings around the world.

In the 1970s, nutritionists developed a causal framework of malnutrition, which has been extensively used and advocated by UNICEF and is well known as 'the UNICEF framework'. The Lancet series on Nutrition in 2013 adjusted it to a more comprehensive framework and many authors in *Nutrition and Health in a Developing World* have used this framework as the basis for their chapters. The framework uses a three-level causality model: immediate causes, underlying causes, and basic causes. Dietary intake and morbidity are considered as direct, or immediate, causes in this framework. De Pee in her chapter focuses on nutrient intake recommendations and how they can be achieved. The chapters by Palmer, Darnton-Hill and West, Young and Ramakrishnan, Hess, Zimmermann, Pettifor and Thandrayen, and Granot and Deckelbaum each focus on specific nutrients.

As mentioned above, the UNICEF framework of nutrition has been shown to be a useful tool in nutrition programming and analysis but it is critical to understand that interventions at the level of the basic and underlying causes eventually have to lead to an adequate intake of nutrients and a morbidity level that does not interfere with the uptake and utilization of the nutrients. Adequate intake of nutrients is, therefore, a prerequisite in the prevention of malnutrition in all its forms. De Pee's chapter is, therefore, not only very important for every student in the field of public health and nutrition but a critical read for everyone who works in the field of nutrition education. Behavior change and education programs in nutrition can only be successful if they eventually lead to consumption of a diet that provides the right types and amounts of nutrients. Dietary reference intakes have been established for normal, healthy people of different age, sex, physiological state and physical activity groups. People who suffer from malnutrition or frequent or chronic infections have higher nutrient needs, and for some of these groups specific intake recommendations have been proposed. De Pee concludes that meeting nutrient intake recommendations requires consumption of a diverse diet, which for many target groups also needs to include some fortified commodities.

While work on vitamins started early in the twentieth century, it was in the 1970s that the significance of micronutrient deficiencies and their consequences was really recognized. Vitamin A, iron, zinc, iodine, and vitamin D were considered the most important vitamins and minerals. Alfred Sommer, an ophthalmologist trained in epidemiology, was one of the pioneers in the field of vitamin A deficiency. He carried out several vitamin A surveys in Haiti, El Salvador, and Indonesia as the technical advisor to the American Foundation for Overseas Blind (now Helen Keller International). Sommer's findings that even mild vitamin A deficiency leads to an increased risk of childhood mortality and that a high dose of vitamin A could prevent mortality by on average 23% changed the field of micronutrient deficiencies. West's chapter is an excellent overview of the history of vitamin A deficiency and discusses the many strategies that can and are being used to combat this problem.

The excellent Chapters by Young and Ramakrishnan, Hess, Zimmermann, and Pettifor and Thandrayen elucidate that the fight against micronutrient deficiencies is far from over. Although the scientific knowledge in this field is far greater than 50 years ago, micronutrient deficiencies remain public health problems and achieving an adequate intake, whether from the diet and/or supplements, i.e., through food or health systems, remains an important bottleneck.

Essential fatty acids play an important role in diverse biologic processes and metabolic pathways that are relevant to both health and disease. Granot and Deckelbaum provide an excellent overview and recommendations about the role of essential fatty acids during pregnancy, infancy and childhood, including in undernourished populations.

Since the development of ready to use therapeutic foods (RUTFs) for treating severe acute malnutrition, nutritionists have renewed their interest in the role of milk and its different components in the treatment and prevention of undernutrition. While the chapter by Kiess (in part VI) discusses the use of different ready-to-use foods in the context of the humanitarian crises, Grenov and colleagues particularly discuss the role of human and animal milks. Taren and Lutter discuss in their chapter the many benefits but also the programmatic obstacles of achieving good rates of appropriate breast-feeding practices.

The fourth part—Tuberculosis, HIV and the role of nutrition—has four chapters: Tuberculosis by Eyal Oren and Joann McDermid; HIV—medical perspective by Louise C. Ivers and Daniel Dure; HIV and Nutrition by Anupama Paranandi and Christine Wanke; Tuberculosis and Nutrition by Anupama Paranandi and Christine Wanke. Infectious diseases are increasingly a public health concern and in the second edition, we had covered diarrheal diseases, respiratory diseases, measles, malaria, HIV, and tuberculosis. For this edition, we have chosen to include only HIV and Tuberculosis because we believe that these two diseases are good examples of the philosophy of *Nutrition and Health in a Developing World*. These chapters, together with the chapters by Semba, and by Mehra, De Pee and Bloem (in Part VI) cover both HIV and TB from different perspectives, which can also be applied to other common diseases. We believe that many lessons learned from these chapters are applicable to other infectious diseases, e.g., Ebola, Zika, etc.

The fifth part—Nutrition and health in different phases of the lifecycle—has six chapters: Reproductive health by Satvika Chalasani and Nuriye Ortayli; Maternal nutrition and birth outcomes by Usha Ramakrishnan, Melissa Young, and Reynaldo Martorell; Small for Gestational Age: Scale and consequences for mortality, morbidity and development by Ines Gonzalez-Casanova, Usha Ramakrishnan, and Reynaldo Martorell; Developmental disabilities by Burris Duncan, Jennifer Andrews, Heidi Pottinger and F. John Meaney; Adolescent health and nutrition by Jee Rah, Satvika Chalasani, Vanessa M. Oddo and Vani Sethi; Nutrition in the Elderly from Low- and Middle-income Countries by Odilia Bermudez and Noel Solomons.

The development and pathology of nutrition and health problems are different in the various phases of the life cycle. The size of the human body increases rapidly during the first 1000 days, starting at conception, which is the best window for prevention of stunting. However, Ramakrishnan and colleagues show in their chapters that SGA is a key determinant of stunting that is associated with maternal nutritional status and needs to be tackled starting even before conception. Teenage pregnancies are very common in countries with a high prevalence of stunting and nutrition and health programs need to focus on this difficult to reach adolescent population. The chapter by Duncan et al. on developmental disabilities illustrates a new appreciation of how epigenetics, culture, and nutrition are interconnected to prevent and manage the health of a population that has been underrepresented on a global scale until the UN ratified The Convention on the Rights of Persons with Disabilities. Rah et al. discuss the period of adolescence, both from a biological and a social perspective and its implications for programming that aims to improve nutrition of adolescents for themselves as well as for the next generation. While many interventions during pregnancy aim to improve birth outcomes, Chalasani and Ortayli describe the impact of nutrition on the woman's own health. The nutritional status of the elderly has not received much attention but since life expectancy is increasing in all countries in the world, it is good to give more attention to this phase of the life cycle. Bermudez and Solomons have given an update on our current knowledge on this age group and the gaps.

The sixth part—Tackling health and nutrition issues in an integrated way in the era of the SDGs—consists of four chapters: Evaluation of nutrition sensitive interventions by Deanna Olney, Jef Leroy and Marie T. Ruel; Integrated approaches to health and nutrition: Role of communities by Olivia

Lange, Divya Mehra, Saskia de Pee and Martin W. Bloem; Nutrition in humanitarian crises by Lynnda Kiess, Natalie Aldern, Saskia de Pee and Martin W. Bloem; and Ending AIDS by 2030: Partnerships and Linkages with SDG2 by Divya Mehra, Saskia de Pee and Martin W. Bloem.

The SDGs show that many problems are interdependent and this is particularly valid for health and nutrition problems. Olney and colleagues describe the importance of nutrition-sensitive interventions and emphasize that good designs of evaluations of these programs are critical for understanding their contribution to improving nutrition and being cost-effective. The health field has since Alma Ata recognized the importance of communities, and in the 80s and 90s, many community-based programs were developed with the purpose to have lower cost, effective programs. As mentioned previously, an understanding of community dynamics was critical in the 2014/15 Ebola outbreak. Mehra and colleagues in both chapters have examined the many aspects of communities and how public health specialists have to understand not only the supply but also the demand side to ensure effective delivery and uptake of services. Communities are dynamic, not only the geographically defined communities but also the virtual communities. Emergencies are a good example of the need for a deep understanding of these affected communities and Kiess and colleagues explain the many determinants and solutions for malnutrition in humanitarian settings.

The seventh part—Trends in urbanization and development, impacts on the food value chain and consumers, and private sector roles—consists of five chapters: Urbanization patterns and strategies for ensuring adequate nutrition by Sunniva K. Bloem and Saskia de Pee; Urbanization, Food Security and Nutrition by Marie T. Ruel, James Garrett, Sivan Yosef and Meghan Olivier; The Impact of Supermarkets on nutrition and nutritional knowledge: a food policy perspective by Peter Timmer; Value chain focus on food and nutrition security by Jessica Fanzo, Shauna Downs, Quinn Marshall, Saskia de Pee and Martin W. Bloem; Role of foundations and initiatives by the private sector for improving health and nutrition by Kalpana Beesabathuni, Kesso Gabrielle van Zutphen and Klaus Kraemer.

The Sustainable Development Goals have recognized that more and more people are moving from rural areas to cities. This has led to SDG 11: Make cities inclusive, safe, resilient, and sustainable. While currently half of humanity already lives in urban areas, by 2030, almost 60% of the world's population will live in cities. This speed and scale of urbanization has been unprecedented. Originally, in high-income countries, cities developed close to and were linked to rural areas with high levels of agricultural produce. In many LMICs, however, many cities have grown independently and largely disconnected from rural areas and agricultural produce, with many already facing the double burden of malnutrition. The role of the private sector in health and nutrition is different in the rural areas as compared to urban areas, and disparities vary widely within cities. Health care in cities is often privatized and the role of the food industry is much larger as most people participate in the market economy. The chapters by Bloem and De Pee, Ruel and colleagues, Timmer, and Fanzo and colleagues, examine various components of urbanization. The rise of supermarkets as part of a modern value chain has raised many concerns but is a development that the global community has to deal with. Recently, a couple of countries have developed new nutrition policies and included dialogue with the private sector as a key strategy. Beesabathuni and colleagues argue that the private sector and foundations should and can play a critical role in the prevention and control of malnutrition and describe interesting examples.

Two of us have worked for an extensive time for the United Nations and one of us has spent a quarter of a century in academic research developing undergraduate and graduate education programs in public health and medicine and we feel that human rights should be the basis for every public health strategy. One of the components of a human rights approach is research. Doherty and Chopra have presented the history of ethics particularly in research in the last chapter of the book. Human rights should be at the basis of every health strategy.

We wish to thank our Series Editor, Adrienne Bendich, and the colleagues of Springer, Connie Walsh and Samantha Lonuzzi, for their encouragement, interest, and hard work to complete this

volume. Adrienne's dedication, keen interest and deep knowledge of nutrition and health as well as her trust in the editors are very encouraging and inspiring. Additionally, we extend our gratitude and thanks to all the chapter authors for their extensive, thoughtful and analytical reviews and for their dedication to supporting the next generations who will continue to work to improve the lives of people throughout this developing world.

As editors, we hope that *Nutrition and Health in a Developing World* will instill curiosity, a desire to develop in-depth expertise, and appreciation for the need to approach public health and nutrition problems from multidimensional angles and with a multi-sectoral team. With that, public health professionals and others working to improve the world's development should be confident and well equipped to design comprehensive and effective policies, programs, and research across various sectors to reach the Sustainable Development Goals by the year 2030.

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