

## Oxford Handbooks Online

### **Malnutrition, Public Health, and Ethics**

Jessica Fanzo

The Oxford Handbook of Public Health Ethics

*Edited by Anna C. Mastroianni, Jeffrey P. Kahn, and Nancy E. Kass*

Subject: Philosophy, Moral Philosophy, Social and Political Philosophy

Online Publication Date: Feb 2019 DOI: 10.1093/oxfordhb/9780190245191.013.48

### **Abstract and Keywords**

A major challenge for society today is how to secure and provide plentiful, healthy, and nutritious food for all in an environmentally sustainable and safe manner, while also addressing the multiple burdens of undernutrition, overweight and obesity, stunting and wasting, and micronutrient deficiencies, particularly for the most vulnerable. There are considerable ethical questions and trade-offs that arise when attempting to address this challenge, centered around integrating nutrition into the food security paradigm. This chapter attempts to highlight three key ethical challenges: the prioritization of key actions to address the multiple burdens of malnutrition, intergenerational justice issues of nutrition-impacted epigenetics, and the consequences of people's diet choices, not only for humanity but also for the planet.

Keywords: malnutrition, stunting, wasting, overweight and obesity, micronutrient deficiencies, epigenetics, nutrition, food security, diet choices, public health ethics

---

## **Introduction**

There are numerous challenges involved in addressing the various forms of malnutrition around the world. This chapter will highlight some key ethical issues that arise in addressing the multiple burdens of malnutrition in food and public health systems and the stakeholders that interact within these systems. Following a brief discussion of the landscape of malnutrition, the chapter will focus on ethical issues that society presently faces in addressing the burden of malnutrition, including the complexities of working multisectorally, the responsibility of addressing both chronic malnutrition and overweight and obesity, and the convergence and divergence in addressing acute malnutrition. The chapter then looks to the past, focusing on the "blame" placed on mothers for affecting the health of their offspring through their past exposures. The final section looks to the

future and examines intergenerational justice issues related to how people's dietary decisions affect the planet and the most vulnerable.

# The Landscape of Malnutrition

## Defining the Different Forms of Malnutrition

Nutrition is an essential component of human health, as it is the basis of ensuring that nutrient needs, acquired through diets, are sufficiently met to sustain a healthy life. Approximately 45 percent of mortality of young children can be attributed to undernutrition (Pelletier et al., 1994). Diets are also the leading risk factor for adult morbidity and mortality due to noncommunicable diseases such as cardiovascular disease and stroke (Forouzanfar et al., 2015).

There are two overarching biological manifestations of malnutrition that can occur when nutrient needs are not met: undernutrition, which can manifest as either acute or chronic, and overweight and obesity. The causes of these two biological burdens are complex and can involve immediate causes, such as inadequate diets associated with macro- and micronutrient deficiencies, as well as communicable and noncommunicable disease burden. Underlying causes include women's status; functioning health and food systems; the environment, which includes sanitation, hygiene, and the natural environment; education and knowledge; and the political economy. These all play an important role in the manifestations of optimal nutrition (Acosta, and Fanzo, 2012; Reinhardt and Fanzo, 2014; UNICEF, WHO, and World Bank, 2015).

## Undernutrition: The Burden of Stunting and Wasting

Chronic malnutrition is defined as a form of growth failure that causes both physical and cognitive delays in growth and development. Compared to children who have been given ideal opportunities to grow and develop, a chronically malnourished child will be challenged to attain the same height, will likely not develop the same cognitive ability, and will have a higher risk of poor health outcomes throughout life (Reinhardt and Fanzo, 2014).

One manifestation of chronic malnutrition is stunting, a complex biological outcome that manifests within a child's body. Stunting, also known as linear growth failure, is defined as the inability to attain potential height for a particular age, and it is the most common measurement used to identify chronic malnutrition. Although stunting in children under five years of age has declined globally from 40 to 23 percent since 1990 (Black et al., 2013; UNICEF, WHO, and World Bank, 2017), an estimated 155 million children remain moderately or severely stunted (UNICEF, WHO, and World Bank, 2017). One could argue that a child who is stunted will never achieve the human capability of pursuing a "dignified and minimally flourishing life," as Martha Nussbaum (2011) has eloquently

## Malnutrition, Public Health, and Ethics

---

described it. Optimal nutrition provides for life; emotions; bodily health and integrity; and senses, imagination, and thought.

Acute malnutrition, most often demonstrated by wasting, is frequently seen in temporary or cyclical settings such as emergencies, seasonal variations, and highly infectious disease environments, and it is accompanied by a high risk of mortality. Fifteen percent of all child deaths are attributed to acute malnutrition, and unless provided with appropriate treatment, the fatality rate among children who are severely malnourished is eight times that of normal children (Bergeron and Castleman, 2012). Wasting is measured in children under five as weight for height. Wasting has decreased 11 percent since 1990 (Black et al., 2013), but 50 million children still suffer from it (UNICEF, WHO, and World Bank, 2017), and this figure is likely to rise in the context of climate change and conflict (FAO, 2017).

Deficiencies of essential vitamins and minerals (e.g., micronutrients such as iron, zinc, vitamin A, folate, iodine) continue to be widespread and have significant adverse effects on child survival and development, as well as on the health of adolescent girls and women. To date, while measuring the micronutrient status of populations poses challenges, there are an estimated 2 billion people with some form of micronutrient deficiency (IFPRI, 2016).

## Overweight and Obesity and Noncommunicable Diseases

Currently, a staggering 2.1 billion people suffer from overweight and obesity globally (Ng et al., 2014), and an estimated 42 million children under five years of age are overweight. Two-thirds of these children reside in low- and middle-income countries (LMICs) (Black et al., 2013; UNICEF, WHO, and World Bank, 2017). Overweight and obesity are increasing around the world (IFPRI, 2015).

These growing rates of overweight and obesity worldwide are linked to a rise in noncommunicable diseases (NCDs)—life-threatening conditions that are overburdening health systems—as overweight and obesity are major risk factors for NCDs. Like overweight and obesity, NCDs—mainly cancer, cardiovascular disease, chronic respiratory diseases, and diabetes—are increasing among populations almost everywhere. NCDs are currently the most common causes of death and disability worldwide, accounting for 68 percent of global mortality, or two out of every three deaths. Seventy-five percent of these deaths occur in LMICs (WHO, 2014). Cardiovascular disease (CVD) alone is a significant cause of premature death and the primary driver of morbidity for all NCDs, including in LMICs (Zoghbi et al., 2014). Thirty percent of NCD-related deaths in LMICs occur before the age of sixty (the productive age bracket), as compared to 13 percent in high-income countries (HICs) (Harikrishnan et al., 2014; WHO, 2010). One can argue that the higher death tolls found in LMICs are associated with poorly functioning health systems as well changing diets and lifestyles.

### Why Nutrition Matters for Public Health

In connection with a rise in obesity and NCDs, society is facing unprecedented changes in demography, epidemiology, and dietary transitions globally, regionally, and within nations that have significant impacts on nutrition and health outcomes. Diets are transitioning because of globalization, urbanization, and income growth. In some low-income countries (LICs), many of the poor eat grain- or tuber-dominated diets that are low in micronutrients, because this is what is accessible and affordable in rural places or urban slums. As household incomes rise, the consumption of both healthy and unhealthy foods generally increases. High-income households tend to rely less on staple grains and more on animal-source foods (including red and processed meats), fruits and vegetables, and foods high in sugar, salt, and saturated and trans fats, such as highly processed and packaged foods and sugar-sweetened beverages (Monteiro et al., 2004; Monteiro et al., 2013; Popkin, Adair, and Ng, 2012).

How does society begin to make a dent in the multiple burdens of malnutrition, including changes to diets and their subsequent health outcomes? Functioning, connected, and resilient public health and food systems are important contributors toward positive change. If food systems are insufficient or not functioning, effects on health can be deleterious. A food system that incorporates nutrition goals can improve the health of communities across the life cycle through positive changes in the way food is produced, processed, packaged, labeled, distributed, marketed, consumed, and disposed of (Pinstруп-Andersen, 2012). Similarly, the health sector should take responsibility for emphasizing, supporting, and ensuring the physical and mental health of food producers and consumers (Hawkes and Ruel, 2006).

## Reacting in the Present: A Moral Obligation to Act

### Beneficence: Justifying Priorities

What should be prioritized in addressing malnutrition, and what priority strategy is most important for public health in the immediate and long term? Many would argue that hunger and undernutrition should be a top priority, since it is the moral obligation of governments to ensure that their citizens do not go hungry and that children have the best chance of survival and growth in their early lives. Undernutrition is often framed as not being the fault of the individual, but rather a failure of the state or of international cooperation. In contrast, many see overweight and obesity as the fault of the individual and of people's inability to make rational food choices. In the United States, policy approaches to target overweight and obesity reflect larger societal views on personal responsibility and autonomy, though this perspective neglects the causal factors involved in overnutrition (Gostin, 2010).

Addressing the divergent forms of malnutrition is complex: both undernutrition and overweight and obesity require the engagement of multiple sectors and disciplines to reduce their respective burdens and ensure sustained change. Countries with significant levels of low birth weight and stunting are sensitive to the consequences of changing diets and activity patterns (Adair et al., 2013). At the same time, trends in obesity are crippling some of the poorest countries, even as they are still reeling from undernutrition, micronutrient deficiencies, and infectious diseases (Popkin, Adair, and Ng, 2012). Many countries struggle to deal with multiple forms of malnutrition at the same time (IFPRI, 2016).

While there is a moral imperative to ensure that no one goes hungry under the “right to food” mandate, prioritizing one form of malnutrition over another may not be possible, because the causes and consequences of all these burdens are interwoven. The idea would be to ensure that every approach provides a public health benefit for individuals and weighs the beneficence of priorities as well as the burdens of alternative priority settings. But the question remains: Who has the responsibility to ensure that everyone realizes the right to better nutrition?

### **Everybody’s Business, Nobody’s Responsibility: Cooperation across Sectors to Address Stunting**

The causes of chronic undernutrition are multidimensional, which creates many challenges in understanding the condition and finding solutions through interventions and policies (Fanzo and Pronyk, 2011). There is no single root cause of chronic malnutrition (UNICEF, WHO, and World Bank 2015). To ensure improvements in nutrition, multisectoral approaches are essential (Alderman et al., 2013). Addressing the burden of stunting is inextricably linked to wider progress in achieving the globally agreed-upon Sustainable Development Goals and the overall transformation and development of nations. Significant gains will hinge on concurrent steps to reduce poverty, improve access to education, empower women and girls, and facilitate access to basic infrastructure. Working on multiple fronts simultaneously has the potential to leverage synergies and catalyze gains that extend beyond those achieved through sector-specific programs working in isolation (Fanzo and Pronyk, 2011).

The heightened global awareness of nutrition points to the need for development institutions and governments to better understand the linkages between multiple sectors and nutrition. There is a need for coordination between multiple sectors and a variety of stakeholders in governments, nongovernmental organizations (NGOs), civil society, the United Nations (UN), the donor community, farmer and producer organizations, and the agribusiness, food, and beverage industries (Nisbett et al., 2014; Fanzo, 2015). The interconnections between national and international institutions that work on tackling malnutrition are complicated, with many different players that count nutrition and food security as part of their core directive (Nisbett et al., 2014).

Since 2005 or so, there has been a more substantive, unified advocacy response to ensure nutrition is a development priority—momentum spurred in part by many international organizations and governments partnering to draw greater investments and attention to nutrition. International organizations are prioritizing investments in nutrition programming and complementing them with increased governance and management of national multisectoral nutrition policies and strategies (SUN, 2013). With nutrition becoming increasingly recognized at the highest political levels, a collective and coordinated response by the international community, through multilateral mechanisms as well as bilateral channels, is an implied acknowledgment that food and nutrition security represents a global public good (Page, 2013).

### **Allocation Decisions to Address Malnutrition and Convergence of Actions**

The different manifestations of chronic and acute malnutrition have led to academic and programmatic specialization, as well as competition (Bergeron and Castleman, 2012). Yet the manifestations of acute and chronic malnutrition often coexist in the same locations and under similar circumstances, such as seasonal variation, poverty, humanitarian crises, urban slums, or neglected rural places. There is very little convergence in working together on double-duty screening methods, service provisions, program implementation, or funding.

Allocation decisions are often framed as a blatant choice between addressing underlying causes and chronic forms of malnutrition versus the more immediate causes and acute forms of malnutrition, with acute situations receiving the bulk of funding. These decisions are highly debated in the nutrition community, which is often then split into two major groups of practitioners that use different programmatic models to address malnutrition and compete for precious resources (Menon and Stoltzfus, 2012).

This division puts excessive pressure on governments to determine where and how they should act, and with whom they should align. In the absence of a consensus among experts, governments may lack the epistemic basis they need to fulfill their moral obligations (Fanzo, 2015). This debate arguably undermines the development of integrated efforts that build resilience due to the reinforced divergence in thought and action that comes from focusing on single topics or approaches, rather than providing a more comprehensive view to addressing the manifestations of malnutrition (Menon and Stoltzfus, 2012; Fanzo, 2015).

### **The Growing NCD Burden on Society's Watch**

Obesity has a complex etiology. It is not caused by one factor in isolation, and therefore the most effective interventions will be multisectoral. While many see overweight and obesity as the fault of the individual and of people's irrational food choices, this is not necessarily true, as there are other factors that play a significant role (Gostin, 2010). The food industry, and policies such as agriculture subsidies and trade policies—to name just

a few factors—all have a significant influence on dietary choices, and on the ability of various populations to access healthy food. There is an extensive literature demonstrating that the food environment—particularly at home, work, and school—influences health-related behaviors and health outcomes (Macintyre, Ellaway, and Cummins, 2002; Gittelsohn et al., 2009), and that this environment is increasingly obesogenic (Swinburn et al., 2011). Developmental programming plays a key role in obesity in adult life, which is discussed more fully in the next section.

Although overweight and obesity are major risk factors of NCDs, very few governments in LMICs recognize the issue and are taking action. A systematic policy review by Lachat et al. (2014) showed that in LMICs, where the burden of NCDs is high and rising, the gap between policy and burden is substantial. The review showed that although NCD strategies were found for 47 percent of LMICs (54 of 116), only a minority provided specific actions to promote healthier diets and physical activity.

During the era of the Millennium Development Goals (MDGs), which ended in 2015, NCDs and overweight and obesity increased, slowly and insidiously, among populations almost everywhere. The overweight/obesity and diet-related NCD burden was substantively ignored during the MDG era. That has changed, however, as the new Sustainable Development Goals (SDGs) have been ushered in. Childhood overweight is a global tracking indicator of SDG2 (Zero Hunger) and a NCD reduction target is embedded in SDG3 (Good Health and Well-Being). However, there is no target or indicator to track overweight and obesity in adults, which is a missed opportunity (Fanzo, 2016).

## Learning from the Past: The Unknown Behaviors of Genes

### Epigenetics and the Fetal Origins Hypothesis: A Double Fate

The causes of undernutrition and overweight and obesity are similar and intertwined in many ways. Stunted growth in early life increases the risk of being overweight later in life. Similarly, factors such as poverty and lack of knowledge about adequate diets can be exacerbated by inappropriate marketing of unhealthy foods and beverages to children, which potentially leads to undernutrition as well as overweight and obesity (Popkin, Adair, and Ng, 2012). In addition to environmental factors, epigenetics may influence dietary patterns by creating links to the food-social experience of prior generations.

In addition to the health behaviors of adults, such as smoking, exercise, and diet, there are also earlier environmental factors that may affect the well-being of the fetus and have repercussions into adult life that may include obesity and NCD risk. There has been growing evidence linking low birth weight (LBW) to an increased risk for both cardiovascular disease and diabetes (Barker et al., 2002; Barker, 2006). Poor weight gain

## **Malnutrition, Public Health, and Ethics**

---

in the first two years of life and stunting in children and adults have also been correlated with adult diseases (Victora et al., 2008).

Nutrition and disease potential can also be influenced by epigenetics, which refers to the dynamic chemical modifications to DNA that occur (Esteller, 2008). In particular, altered maternal nutrition, including both undernutrition and maternal obesity, has been shown to lead to transgenerational transmission of metabolic disorders, such as NCDs, to the fetus and in the early-life period (Vickers, 2014; Aiken and Ozaane, 2013). Human studies have demonstrated an epigenetic link between alterations in the early-life environment and increased susceptibility to obesity and related metabolic disorders in later life (Wadhwa et al., 2009; Adair et al., 2013). Ongoing epigenetics research and research in the origins of health and disease offer opportunities to explain how the social environment, physical place, and resources available to people have enduring effects on their health.

Exposure to specific foods is seen as a point of potential intervention in the long-term health of individuals and populations. It is thought that the diet in prenatal and early postnatal life impacts obesity later in life, as well as adult-onset diseases such as diabetes and heart disease. Nutrition and food are among many environmental factors that can induce epigenetic changes in the organisms that are directly exposed, and in subsequent generations that inherit epigenetic traits (Kaushik and Anderson, 2016).

Not all nutrition-sensitive postnatal interventions have wholly positive outcomes such as energy-dense food safety nets and therapeutic foods. The current focus of some of these interventions is to improve weight gain among children born small for gestational age, or those who suffer from severe malnutrition. However, “rapid growth” during infancy is sometimes associated with increased risk of obesity, insulin resistance, and elevated blood pressure in childhood and adulthood (Ong and Loos, 2006). It is still not clear whether benefits of these interventions, which promote faster growth in LMICs, outweigh the possible long-term risks into adulthood (Adair et al., 2013).

### **Nonmaleficence and Justice: Framing the Science of Epigenetics**

Epigenetics raises issues of intergenerational justice and responsibility. Though not widespread, the tendency to frame the emerging epigenetic science as a way of holding mothers culpable for their offspring’s later disease risk is troubling (Winett, Wulf, and Wallack, 2016). The unintended consequences of “mother blame” or “community blame” for the fetal origins of disease could present ethical concerns, as opposed to understanding the disease burden through multiple factors beyond just individual decision-making to social, political, economic, and physical environments.



# Looking to the Future: Do People Have the Right to Eat Wrongly?

## The Inequities of Diets around the World

Both the types of foods people eat and the demand for new diets are in rapid transition. As countries get wealthier, the demand for animal-source foods, sugars, oils, and fats increases. As incomes rise, people spend less of their income on diets, and diets change toward more luxury foods and fewer staple grain foods. These transitions are driving a new demand for certain types of foods that are grown, processed, and consumed in particular ways (Keats and Wiggins, 2014; Houry et al., 2014; Reardon, Timmer, and Minton, 2012). As countries accumulate wealth, their citizens are shifting from plant-based diets rich in fruits, vegetables, and legumes to highly refined foods, meats, and dairy products, with the exception of a few poor countries that cannot afford such a shift (Popkin, Adair, and Ng, 2012; Wilkinson, 2009; Hawkes and Popkin, 2015). It should be noted that there are profound inequities, both globally and within countries, with respect to access to and affordability of nutritious foods. There is no ethically simple way to reconcile these competing demands in the face of growing economies, international trade, globalization, and urbanization (FAO, 2013).

One example of this inequity is with animal-source foods (ASFs). Although many countries are shifting from plant-based diets to more ASFs (Keats and Wiggins, 2014; Zeisel and Da Costa, 2009), access to ASFs by the poorest remains limited in both availability and accessibility. This limitation affects health because ASFs provide nutrients that are more difficult to obtain in adequate quantities from plant-source foods alone (Dewey and Adu-Afarwah, 2008; Black et al., 2013). Deficiencies of these nutrients lead to serious conditions, such as anemia, blindness, and even mortality. In contrast, overconsumption of processed meats and ASFs high in saturated fats contributes to increased risk of obesity and NCDs (You and Henneberg, 2016; Bouvard et al., 2015). The benefits of ASF consumption are nuanced: for vulnerable populations, ASFs can provide essential nutrients that are otherwise hard to obtain, but for others, consumption of these foods needs to be limited to mitigate the risk of obesity and NCDs.

## Justice: Those Who Suffer the Consequences of Diet Choices

The decision of what to eat is inextricably linked to the ethics of how that choice affects environmental sustainability and human well-being. The increased demand for certain resource-intensive foods, such as beef, has serious ramifications for both climate change and human health (Mearns and Norton, 2010). The production of foods from animal sources is resource-intensive and is the major contributor to greenhouse gas emissions from the agricultural sector (Walker et al., 2005; Garnett, 2009). Overconsumption of meat and an escalating demand for livestock have created ethical conflicts over ensuring animal welfare and limiting demands on the environment (Stokstad, 2010).

If certain resource-intensive foods are considered critically important for human health, then their distribution and access must be made equitable—an existing imbalance that needs to be addressed. There are also low-resource alternative sources that should be considered in filling nutrient gaps for all countries. These foods, such as farmed fish, mollusks, insects, and protein-rich plant food, make significant contributions to nutrition, while leaving a smaller footprint on the planet.

The dietary choices of people in high-income countries (HICs) have significant ramifications for less wealthy populations. The energy-intensive lifestyles and diets of those in HICs are significant anthropogenic contributors to climate change. However, economically poor households are likely to experience a disproportionate burden of the impacts of climate change (Olsson et al., 2014). The food security of those households will most likely not improve under climate variability, and diets will actually deteriorate along with nutrition outcomes. Those who are wealthier will suffer less, even though their choices have far-reaching consequences. Society must address the questions of justice that are central to the increasingly globalized nature of food choices.

From environmental and food security justice perspectives, addressing these ethical issues requires concerted efforts to reduce consumption of animal products in high-income countries, and to discourage consumption in growing economies with populations that are finally wealthy enough to increase meat and dairy in their diets. Some have argued that a 30 percent reduction in production and adult consumption levels of animal-source foods would meet national greenhouse gas emission targets and would simultaneously reduce years of life lost from heart disease by 15 percent (Wilkinson, 2009). The question remains of how to encourage such changes in a way that does not infringe on personal liberties.

## Conclusion

Addressing all forms of malnutrition, along with the causes and consequences of dietary and lifestyle choices, requires more accountability. How does society achieve meaningful accountability—and accountability to whom and for what? While some would argue it is clear that people need to be thinking “intergenerationally” about their decisions because of the effects on future risks, others argue that there are many more pressing issues, and that prioritizing requires trade-offs. Still others would argue that there is a moral obligation to address undernutrition immediately, especially acute malnutrition in humanitarian situations, and think later about development, epigenetics, and dietary impacts on future planetary and human health. Society has a moral obligation to consider these concerns across different time frames, because these issues mattered in the past, they matter now, and they will matter in the future.

### References

- Acosta, A. M., and Fanzo, J. 2012. "Fighting Maternal and Child Malnutrition: Analysing the Political and Institutional Determinants of Delivering a National Multisectoral Response in Six Countries. A Synthesis Paper." Report prepared for DFID (Sussex, UK: Institute of Development Studies).
- Adair, L. S., Fall, C. H., Osmond, C., Stein, A. D., Martorell, R., Ramirez-Zea, M., et al. 2013. "Associations of Linear Growth and Relative Weight Gain during Early Life with Adult Health and Human Capital in Countries of Low and Middle Income: Findings from Five Birth Cohort Studies." *Lancet* 382(9891): 525–534.
- Aiken, C. E., and Ozanne, S. E. 2013. "Transgenerational Developmental Programming." *Human Reproduction Update* 20(1):63–75. <http://dx.doi.org/10.1093/humupd/dmt043>.
- Alderman, H. H., Elder, L. K., Goyal, A., Herforth, A. W., Hoberg, Y. T., Marini, A., et al. 2013. *Improving Nutrition through Multisectoral Approaches* (Washington, D.C.: World Bank Group). <http://documents.worldbank.org/curated/en/625661468329649726/Improving-nutrition-through-multisectoral-approaches>.
- Barker, D. J. 2006. "Adult Consequences of Fetal Growth Restriction." *Clinical Obstetrics and Gynecology*, 49(2): 270–283.
- Barker, D. J., Eriksson, J. G., Forsén, T., and Osmond, C. 2002. "Fetal Origins of Adult Disease: Strength of Effects and Biological Basis." *International Journal of Epidemiology* 31(6): 1235–1239.
- Bergeron, G., and Castleman, T. 2012. "Program Responses to Acute and Chronic Malnutrition: Divergences and Convergences." *Advances in Nutrition: An International Review Journal* 3(2): 242–249.
- Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., et al. 2013. "Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries." *Lancet* 382(9890): 427–451.
- Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., et al. 2015. "International Agency for Research on Cancer Monograph Working Group Carcinogenicity of Consumption of Red and Processed Meat." *Lancet Oncology* 16(16): 1599–1600. [http://dx.doi.org/10.1016/S1470-2045\(15\)00444-1](http://dx.doi.org/10.1016/S1470-2045(15)00444-1).
- Dewey, K. G., and Adu-Afarwuah, S. 2008. "Systematic Review of the Efficacy and Effectiveness of Complementary Feeding Interventions in Developing Countries." *Maternal and Child Nutrition* 4(Suppl. 1): 24–85.
- Esteller, M. 2008. "Epigenetics in Cancer." *New England Journal of Medicine* 358(11): 1148–1159.

## Malnutrition, Public Health, and Ethics

---

Garnett, T. 2009. "Livestock-Related Greenhouse Gas Emissions: Impacts and Options for Policy Makers." *Environmental Science & Policy* 12(4): 491–503.

Fanzo, J. 2015. "Ethical Issues for Human Nutrition in the Context of Global Food Security and Sustainable Development." *Global Food Security* 7(2015): 15–23.

Fanzo, J. 2016. "Non-communicable Diseases, Food Systems and the Sustainable Development Goals." *Sight and Life* 30(1): 34.

Fanzo, J., and Pronyk, P. M. 2011. "A Review of Global Progress toward the Millennium Development Goal 1 Hunger Target." *Food and Nutrition Bulletin* 32(2): 144–158.

FAO (Food and Agriculture Organization of the United Nations). 2013. *The State of Food and Agriculture* (Rome, FAO). <http://www.fao.org/publications/sofa/the-state-of-food-and-agriculture/en/>.

FAO (Food and Agriculture Organization of the United Nations). 2017. *The State of Food Security and Nutrition* (Rome, FAO).

Forouzanfar, M. H., Alexander, L., Anderson, H. R., Bachman, V. F., Biryukov, S., Brauer, M., et al. 2015. "Global, Regional, and National Comparative Risk Assessment of 79 Behavioural, Environmental and Occupational, and Metabolic Risks or Clusters of Risks in 188 Countries, 1990–2013: A Systematic Analysis for the Global Burden of Disease Study 2013." *Lancet* 386(10010): 2287–2323.

Gittelsohn, J., Song, H. J., Suratkar, S., Kumar, M. B., Henry, E. G., Sharma, S., et al. 2009. "An Urban Food Store Intervention Positively Affects Food-Related Psychosocial Variables and Food Behaviors." *Health Education and Behavior* 37(3): 390–402.

Gostin, L.O., ed. 2010. *Public Health Law and Ethics: A Reader* (Berkeley: University of California Press).

Harikrishnan, S., Leeder, S., Huffman, M. M., Jeemon, P., and Prabhakaran, D. 2014. *A Race against Time: The Challenge of Cardiovascular Disease in Developing Economies* (New Delhi, India: Centre for Chronic Disease Control). <http://www.ccdcindia.org/wp-content/uploads/2015/12/A-RACE-AGAINST-TIME.pdf>.

Hawkes, C., and Popkin, B. M. 2015. "Can the Sustainable Development Goals Reduce the Burden of Nutrition-Related Non-communicable Diseases without Truly Addressing Major Food System Reforms?" *BMC Medicine* 13(1): 143.

Hawkes, C., and Ruel, M. T. 2006. *Overview: Understanding the Links between Agriculture and Health; Focus 2020* (Washington, D.C.: International Food Policy Research Institute).

IFPRI (International Food Policy Research Institute). 2015. *Global Nutrition Report 2015* (Washington, D.C.: IFPRI).

## Malnutrition, Public Health, and Ethics

---

IFPRI (International Food Policy Research Institute). 2016. *Global Nutrition Report 2016* (Washington, D.C.: IFPRI).

Kaushik, P., and Anderson, J. T. 2016. "Obesity: Epigenetic Aspects." *Biomolecular Concepts* 7(3): 145-155.

Keats, S., and Wiggins, S. 2014. *Future Diets: Implications for Agriculture and Food Prices* (London: Overseas Development Institute).

Khoury, C. K., Bjorkman, A. D., Dempewolf, H., Ramirez-Villegas, J., Guarino, L., Jarvis, A., et al. 2014. "Increasing Homogeneity in Global Food Supplies and the Implications for Food Security." *Proceedings of the National Academy of Sciences* 111(11): 4001-4006.

Lachat, C., Nago, E., Roberfroid, D., Holdsworth, M., Smit, K., Kinabo, J., et al. 2014. "Developing a Sustainable Nutrition Research Agenda in Sub-Saharan Africa—Findings from the SUNRAY Project." *PLoS Medicine* 11(1): e1001593.

Macintyre, S., Ellaway, A., and Cummins, S. 2002. "Place Effects on Health: How Can We Conceptualise, Operationalise and Measure Them?" *Social Science and Medicine* 55(1): 125-139.

Mearns, R., and Norton, A., eds. 2010. *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World* (Washington, D.C.: World Bank Group).

Menon, P., and Stoltzfus, R. J. 2012. "Building Convergence in Science, Programs, and Policy Actions on Child Undernutrition: Symposium Rationale and Overview." *Advances in Nutrition: An International Review Journal* 3(2): 224-226.

Monteiro, C. A., Moubarac, J. C., Cannon, G., Ng, S. W., and Popkin, B. 2013. Ultra-Processed Products Are Becoming Dominant in the Global Food System. *Obesity Reviews* 14(S2): 21-28.

Monteiro, C. A., Moura, E. C., Conde, W. L., and Popkin, B. M. 2004. Socioeconomic Status and Obesity in Adult Populations of Developing Countries: A Review. *Bulletin of the World Health Organization* 82(12): 940-946.

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., et al. 2014. "Global, Regional, and National Prevalence of Overweight and Obesity in Children and Adults during 1980-2013: A Systematic Analysis for the Global Burden of Disease Study 2013." *Lancet* 384(9945): 766-781.

Nisbett, N., Gillespie, S., Haddad, L., and Harris, J. 2014. "Why Worry about the Politics of Childhood Undernutrition?" *World Development* 64: 420-433.

Nussbaum, M. C. 2011. *Creating Capabilities* (Cambridge, Mass.: Harvard University Press).

Olsson, L., Opondo, M., Tschakert, P., Agrawal, A., Eriksen, S.H., Ma, S., et al. 2014. "Livelihoods and Poverty." In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, et al., 793–832. (Cambridge: Cambridge University Press).

Ong, K. K., and Loos, R. J. F. 2006. "Rapid Infancy Weight Gain and Subsequent Obesity: Systematic Reviews and Hopeful Suggestions." *Acta Paediatrica* 95(8): 904–908.

Page, H. 2013. *Global Governance and Food Security as Global Public Good* (New York: NYU Center on International Cooperation).

Pelletier, D. L., Frongillo, E. A., Jr., Shroeder, D. G., and Habicht, J. P. 1994. "A Methodology for Estimating the Contribution of Malnutrition to Child Mortality in Developing Countries." *Journal of Nutrition* 124(10): 2106S.

Pinstrup-Andersen, P. 2012. "The Food System and Its Interaction with Human Health and Nutrition." In *Reshaping Agriculture for Nutrition and Health*, edited by S. Fan and R. Pandya-Lorch, 21 (Washington, D.C.: International Food Policy Research Institute).

Popkin, B. M., Adair, L. S., and Ng, S. H. 2012. "Global Nutrition Transition and the Pandemic of Obesity in Developing Countries." *Nutrition Reviews* 70(1): 3–21.

Reardon, T., Timmer, C. P., and Minten, B. 2012. "Supermarket Revolution in Asia and Emerging Development Strategies to Include Small Farmers." *Proceedings of the National Academy of Sciences* 109(31): 12332–12337.

Reinhardt, K., and Fanzo, J. 2014. "Addressing Chronic Malnutrition through Multi-sectoral, Sustainable Approaches: A Review of the Causes and Consequences." *Frontiers in Nutrition* 1: 13.

SUN (Scaling Up Nutrition). 2013. *Progress Report* (Geneva: CFS).

Stokstad, E. 2010. "Could Less Meat Mean More Food?" *Science* 327(5967): 810–811.

Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., et al. 2011. "The Global Obesity Pandemic: Shaped by Global Drivers and Local Environments." *Lancet* 378(9793): 804–814.

UNICEF (United Nations Children's Fund), WHO (World Health Organization), and World Bank. 2015. *UNICEF-WHO-World Bank Joint Child Malnutrition Estimates* (New York: UNICEF).

UNICEF (United Nations Children's Fund), WHO (World Health Organization), and World Bank. 2017. *UNICEF-WHO-World Bank Joint Child Malnutrition Estimates* (New York: UNICEF).

## Malnutrition, Public Health, and Ethics

---

Vickers, M. H. 2014. "Early Life Nutrition, Epigenetics and Programming of Later Life Disease." *Nutrients* 6(6): 2165–2178.

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., et al. 2008. "Maternal and Child Undernutrition: Consequences for Adult Health and Human Capital." *Lancet* 371(9609): 340–357.

Wadhwa, P. D., Buss, C., Entringer, S., and Swanson, J. M. 2009. "Developmental Origins of Health and Disease: Brief History of the Approach and Current Focus on Epigenetic Mechanisms." *Seminars in Reproductive Medicine* 27(5): 358–368.

Walker, P., Rhubart-Berg, P., McKenzie, S., Kelling, K. and Lawrence, R. S. 2005. "Public Health Implications of Meat Production and Consumption." *Public Health Nutrition* 8(4): 348–356.

Wilkinson, J. 2009. "The Globalization of Agribusiness and Developing World Food Systems." *Monthly Review* 61(4): 38.

Winett, L. B., Wulf, A. B., and Wallack, L. 2016. "Framing Strategies to Avoid Mother-Blame in Communicating the Origins of Chronic Disease." *American Journal of Public Health* 106(8): 1369–1373.

WHO (World Health Organization). 2010. *Global Status Report on Noncommunicable Diseases 2010* (Geneva: WHO).

WHO (World Health Organization). 2014. *Global Status Report on Noncommunicable Diseases 2014* (Geneva: WHO).

You, W., and Henneberg, M. 2016. "Meat Consumption Providing a Surplus Energy in Modern Diet Contributes to Obesity Prevalence: An Ecological Analysis." *BMC Nutrition* 2(1): 1.

Zeisel, S. H., and Da Costa, K.-A. 2009. "Choline: An Essential Nutrient for Public Health." *Nutrition Reviews* 67(11): 615–623.

Zoghbi, W. A., Duncan, T., Antman, E., Barbosa, M., Champagne, B., Chen, D., et al. 2014. "Sustainable Development Goals and the Future of Cardiovascular Health: A Statement from the Global Cardiovascular Disease Taskforce." *Journal of the American Heart Association* 3(5): e000504.

## Further Reading

Barker, D. J., Godfrey, K. M., Gluckman, P. D., Harding, J. E., Owens, J. A., and Robinson, J. S. 1993. "Fetal Nutrition and Cardiovascular Disease in Adult Life." *Lancet* 341(8850): 938–941.

## Malnutrition, Public Health, and Ethics

---

- Carletto, G., Ruel, M., Winters, P. and Zezza, A. 2015. "Farm-Level Pathways to Improved Nutritional Status: Introduction to the Special Issue." *Journal of Development Studies* 41(8): 945-957.
- FAO (Food and Agriculture Organization of the United Nations) and WUR (Wageningen University and Research Center). 2013. *Edible Insects: Future Prospects for Food and Feed Security*. FAO Forestry Paper 171 (Rome: FAO).
- Field, J. O. 1987. "Multisectoral Nutrition Planning: A Post-mortem." *Food Policy* 12(1): 15-28.
- Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., et al. 2010. "Food Security: The Challenge of Feeding 9 Billion People." *Science*, 327(5967): 812-818.
- Harris, J. L., Pomeranz, J. L., Lobstein, T., and Brownell, K. D. 2009. "A Crisis in the Marketplace: How Food Marketing Contributes to Childhood Obesity and What Can Be Done." *Annual Review of Public Health* 30: 211-225.
- HLPE (High Level Panel of Experts on Food Security and Nutrition). 2017. *Nutrition and Food systems* (Rome: Committee on World Food Security).
- Levine, R., and Kuczynski, D. 2009. *Global Nutrition Institutions: Is There an Appetite for Change?* (Washington, D.C.: Center for Global Development).
- Rothstein, M. A., Cai, Y., and Marchant, G. E. 2009. "The Ghost in Our Genes: Legal and Ethical Implications of Epigenetics." *Health Matrix* 19(1): 1.
- Van Huis, A., Van Itterbeeck, J., Klunder, H., Mertens, E., Halloran, A., Muir, G., et al. 2013. *Edible Insects: Future Prospects for Food and Feed Security* (New York: Food and Agriculture Organization of the United Nations).
- Wallack, L., and Thornburg, K. 2016. "Developmental Origins, Epigenetics, and Equity: Moving Upstream." *Maternal and Child Health Journal* 20(5): 935-940.
- Weiss, E. B. 1989. "Climate Change, Intergenerational Equity and International Law: An Introductory Note." *Climatic Change* 15(1-2): 327-335.

### **Jessica Fanzo**

Jessica Fanzo, PhD, Bloomberg Distinguished Associate Professor of Global Food & Agricultural Policy and Ethics, Nitze School of Advanced International Studies (SAIS) and Berman Institute of Bioethics, Johns Hopkins University, Baltimore, Maryland



