

# THE LANCET



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## The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report

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### Executive summary

Malnutrition in all its forms, including obesity, undernutrition, and other dietary risks, is the leading cause of poor health globally. In the near future, the health effects of climate change will considerably compound these health challenges. Climate change can be considered a pandemic because of its sweeping effects on the health of humans and the natural systems we depend on (ie, planetary health). These three pandemics—obesity, undernutrition, and climate change—represent The Global Syndemic that affects most people in every country and region worldwide. They constitute a syndemic, or synergy of epidemics, because they co-occur in time and place, interact with each other to produce complex sequelae, and share common underlying societal drivers. This Commission recommends comprehensive actions to address obesity within the context of The Global Syndemic, which represents the paramount health challenge for humans, the environment, and our planet in the 21st century.

### The Global Syndemic

Although the Commission's mandate was to address obesity, a deliberative process led to reframing of the problem and expansion of the mandate to offer recommendations to collectively address the triple-burden challenges of The Global Syndemic. We reframed the problem of obesity as having four parts. First, the prevalence of obesity is increasing in every region of the world. No country has successfully reversed its epidemic because the systemic and institutional drivers of obesity remain largely unabated. Second, many evidence-based policy recommendations to halt and reverse obesity rates have been endorsed by

Member States at successive World Health Assembly meetings over nearly three decades, but have not yet been translated into meaningful and measurable change. Such patchy progress is due to what the Commission calls policy inertia, a collective term for the combined effects of inadequate political leadership and governance to enact policies to respond to The Global Syndemic, strong opposition to those policies by powerful commercial interests, and a lack of demand for policy action by the public. Third, similar to the 2015 Paris Agreement on Climate Change, the enormous health and economic burdens caused by obesity are not seen as urgent enough to generate the public demand or political will to implement the recommendations of expert bodies for effective action. Finally, obesity has historically been considered in isolation from other major global challenges. Linking obesity with undernutrition and climate change into a single Global Syndemic framework focuses attention on the scale and urgency of addressing these combined challenges and emphasises the need for common solutions.

### Syndemic drivers

The Commission applied a systems perspective to understand and address the underlying drivers of The Global Syndemic within the context of achieving the broad global outcomes of human health and wellbeing, ecological health and wellbeing, social equity, and economic prosperity. The major systems driving The Global Syndemic are food and agriculture, transportation, urban design, and land use. An analysis of the dynamics of these systems sheds light on the answers to some fundamental questions. Why do these



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## Key messages

The pandemics of obesity, undernutrition, and climate change represent three of the gravest threats to human health and survival. These pandemics constitute The Global Syndemic, consistent with their clustering in time and place, interactions at biological, psychological, or social levels, and common, large-scale societal drivers and determinants. Their interactions and the forces that sustain them emphasise the potential for major beneficial effects on planetary health that double-duty or triple-duty actions, which simultaneously act on two or all three of these pandemics, will have. To mitigate The Global Syndemic, the Commission proposed the following nine broad recommendations, under which sit more than 20 actions:

- Think in Global Syndemic terms to create a focus on common systemic drivers that need common actions.
- Join up the silos of thinking and action to create platforms to work collaboratively on common systemic drivers and double-duty or triple-duty actions.
- Strengthen national and international governance levers to fully implement policy actions which have been agreed upon through international guidelines, resolutions and treaties.
- Strengthen municipal governance levers to mobilise action at the local level and create pressure for national action
- Strengthen civil society engagement to encourage systemic change and pressure for policy action at all levels of government to address The Global Syndemic
- Reduce the influence of large commercial interests in the public policy development process to enable governments to implement policies in the public interest to benefit the health of current and future generations, the environment, and the planet
- Strengthen accountability systems for policy actions to address The Global Syndemic
- Create sustainable and health-promoting business models for the 21st century to shift business outcomes from a short-term profit-only focus to sustainable, profitable models that explicitly include benefits to society and the environment
- Focus research on The Global Syndemic determinants and actions to create an evidence base of systemic drivers and actions, including indigenous and traditional approaches to health and wellbeing

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systems operate the way they do? Why do they need to change? Why are they so hard to change? What leverage points (or levers) are required to overcome policy inertia and address The Global Syndemic? The Commission identified five sets of feedback loops as the dominant dynamics underlying the answers to these questions. They include: (1) governance feedback loops that determine how political power translates into the policies and economic incentives and disincentives for companies to operate within; (2) business feedback loops that determine the dynamics for creating profitable goods and services, including the externalities associated with damage to human health, the environment, and the planet; (3) supply and demand feedback loops showing the relationships that determine current consumption practices; (4) ecological feedback loops that show the unsustainable environmental damage that the food and transportation systems impose on natural ecosystems; and (5) human health feedback loops that show the positive and negative effects that these systems have on human health. These interactions need to be elucidated and methods for reorienting these feedback systems prioritised to mitigate The Global Syndemic.

## Double-duty or triple-duty actions

The common drivers of obesity, undernutrition, and climate change indicate that many systems-level interventions could serve as double-duty or triple-duty actions to change the trajectory of all three pandemics simultaneously. Although these actions could produce win-win, or even win-win-win, results, they are difficult to achieve. A seemingly simple example shows how challenging these actions can be. National dietary guidelines serve as a basis for the development of food and nutrition policies and public education to reduce obesity and undernutrition and could be extended to include sustainability by moving populations towards consuming largely plant-based diets. However, many countries' efforts to include environmental sustainability principles within their dietary guidelines failed due to pressure from strong food industry lobbies, especially the beef, dairy, sugar, and ultra-processed food and beverage industry sectors. Only a few countries (ie, Sweden, Germany, Qatar, and Brazil) have developed dietary guidelines that promote environmentally sustainable diets and eating patterns that ensure food security, improve diet quality, human health and wellbeing, social equity, and respond to climate change challenges.

The engagement of people, communities, and diverse groups is crucial for achieving these changes. Personal behaviours are heavily influenced by environments that are obesogenic, food insecure, and promote greenhouse-gas emissions. However, people can act as agents of change in their roles as elected officials, employers, parents, customers, and citizens and influence the societal norms and institutional policies of worksites, schools, food retailers, and communities to address The Global Syndemic. Across systems and institutions, people are decision makers who can vote for, advocate for, and communicate their preferences with other decision-makers about the policies and actions needed to address The Global Syndemic. Within the natural ecosystems, people travel, recreate, build, and work in ways that can preserve or restore the environment. Collective actions can generate the momentum for change. The Commission believes that the collective influence of individuals, civil society organisations, and the public can stimulate the reorientation of human systems to promote health, equity, economic prosperity, and sustainability.

## Changing trends in obesity, undernutrition, and climate change

Historically, the most widespread form of malnutrition has been undernutrition, including wasting, stunting, and micronutrient deficiencies. The Global Hunger Index (1992–2017) showed substantial declines in under-5 child mortality in all regions of the world but less substantial declines in the prevalence of wasting and stunting among children. However, the rates of decline in undernutrition for children and adults are still too slow to meet the Sustainable Development Goal (SDG) targets by 2030.

In the past 40 years, the obesity pandemic has shifted the patterns of malnutrition. Starting in the early 1980s, rapid increases in the prevalence of overweight and obesity began in high-income countries. In 2015, obesity was estimated to affect 2 billion people worldwide. Obesity and its determinants are risk factors for three of the four leading causes of non-communicable diseases (NCDs) worldwide, including cardiovascular diseases, type 2 diabetes, and certain cancers.

Extensive research on the developmental origins of health and disease has shown that fetal and infant undernutrition are risk factors for obesity and its adverse consequences throughout the life course. Low-income and middle-income countries (LMICs) carry the greatest burdens of malnutrition. In LMICs, the prevalence of overweight in children less than 5 years of age is rising on the background of an already high prevalence of stunting (28%), wasting (8·8%), and underweight (17·4%). The prevalence of obesity among stunted children is 3% and is higher among children in middle-income countries than in lower-income countries.

The work of the Intergovernmental Panel on Climate Change (IPCC), three previous *Lancet* Commissions related to climate change and planetary health (2009–15), and the current *Lancet* Countdown, which is tracking progress on health and climate change from 2017 to 2030, have provided extensive and compelling projections on the major human health effects related to climate change. Chief among them are increasing food insecurity and undernutrition among vulnerable populations in many LMICs due to crop failures, reduced food production, extreme weather events that produce droughts and flooding, increased food-borne and other infectious diseases, and civil unrest. Severe food insecurity and hunger are associated with lower obesity prevalence, but mild to moderate food insecurity is paradoxically associated with higher obesity prevalence among vulnerable populations.

Wealthy countries already have higher burdens of obesity and larger carbon footprints compared with LMICs. Countries transitioning from lower to higher incomes experience rapid urbanisation and shifts towards motorised transportation with consequent lower physical activity, higher prevalence of obesity, and higher greenhouse-gas emissions. Changes in the dietary patterns of populations include increasing consumption of ultra-processed food and beverage products and beef and dairy products, whose production is associated with high greenhouse-gas emissions. Agricultural production is a leading source of greenhouse-gas emissions.

#### **The economic burden of The Global Syndemic**

The economic burden of The Global Syndemic is substantial and will have the greatest effect on the poorest of the 8·5 billion people who will inhabit the earth by 2030. The current costs of obesity are estimated at about \$2 trillion annually from direct health-care costs and lost

economic productivity. These costs represent 2·8% of the world's gross domestic product (GDP) and are roughly the equivalent of the costs of smoking or armed violence and war.

Economic losses attributable to undernutrition are equivalent to 11% of the GDP in Africa and Asia, or approximately \$3·5 trillion annually. The World Bank estimates that an investment of \$70 billion over 10 years is needed to achieve SDG targets related to undernutrition, and that achieving them would create an estimated \$850 billion in economic return. The economic effects of climate change include, among others, the costs of environmental disasters (eg, drought and wildfires), changes in habitat (eg, biosecurity and sea-level rises), health effects (eg, hunger and diarrhoeal infections), industry stress in sectors such as agriculture and fisheries, and the costs of reducing greenhouse-gas emissions. Continued inaction towards the global mitigation of climate change is predicted to cost 5–10% of global GDP, whereas just 1% of the world's GDP could arrest the increase in climate change.

#### **Actions to address The Global Syndemic**

Many authoritative policy documents have proposed specific, evidence-informed policies to address each of the components of The Global Syndemic. Therefore, the Commission decided to focus on the common, enabling actions that would support the implementation of these policies across The Global Syndemic. A set of principles guided the Commission's recommendations to enable the implementation of existing recommended policies: be systemic in nature, address the underlying causes of The Global Syndemic and its policy inertia, forge synergies to promote health and equity, and create benefits through double-duty or triple-duty actions.

The Commission identified multiple levers to strengthen governance at the global, regional, national, and local levels. The Commission proposed the use of international human rights law and to apply the concept of a right to wellbeing, which encompasses the rights of children and the rights of all people to health, adequate food, culture, and healthy environments. Global intergovernmental organisations, such as the World Trade Organization, the World Economic Forum, the World Bank, and large philanthropic foundations and regional platforms, such as the European Union, Association of Southeast Asian Nations, and the Pacific Forum, should play much stronger roles to support national policies that address The Global Syndemic. Many states and municipalities are leading efforts to reduce greenhouse-gas emissions by incentivising less motorised travel and improving urban food systems. Civil society organisations can create a greater demand for national policy actions with increases in capacity and funding. Therefore, in addition to the World Bank's call for \$70 billion for undernutrition and the Green Climate Fund of \$100 billion for LMICs to address climate change, the Commission calls for \$1 billion to support the

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### Panel 1: The Lancet Commission on Obesity

The Lancet Commission on Obesity was formed following the publication of two *Lancet* Series on Obesity in 2011 and 2015. The Commission was under the auspices of *The Lancet*, the University of Auckland, George Washington University, and the World Obesity Federation. The Commission was comprised of 26 Commissioners and 17 Fellows from 14 countries. The disciplines and expertise of the Commissioners included global obesity, population health, nutrition (including undernutrition), food systems (including indigenous food systems), physical activity, political science and policy making, climate change, urban planning, epidemiology, consumer advocacy, human rights, international law, trade, health equity, social determinants, economics, marketing, agriculture, systems science, community interventions, implementation science, medicine, business, financing, and the experience of living with obesity.

The aims of the Commission were to:

- Identify the systemic commonalities in drivers and solutions across obesity, undernutrition, and climate change.
- Describe double-duty or triple-duty policies and actions to address The Global Syndemic, and ways to strengthen accountability systems for their implementation.

The Commission's work on The Global Syndemic came from two group model building sessions organised for the Commissioners, a review of existing conceptual and computational models, and three face-to-face meetings between February, 2016, and July, 2017. Additionally, consultation workshops were held around the world during 2017, to obtain feedback on the Commission's concepts. These workshops were hosted by the Australian National University, Canberra; Washington University, St Louis; The World Bank, Washington DC; Centre for Food Policy, City, University of London, UK; International Atomic Energy Agency, WHO, and UNICEF, Vienna, Austria; Endocrinology and Metabolism Research Institute of Tehran, University of Medical Sciences, Tehran, Iran; a satellite meeting at the International Congress on Obesity, Buenos Aires, Argentina; Huazhong University of Science and Technology, Wuhan, China; and the Center for Chronic Disease Control, Delhi, India.

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For the *Lancet* Commission on Obesity see <https://www.worldobesity.org/what-we-do/projects/lancet-commission-on-obesity>

For the EAT Forum see <https://eatforum.org/>

efforts of civil society organisations to advocate for policy initiatives that mitigate The Global Syndemic.

A principal source of policy inertia related to addressing obesity and climate change is the power of vested interests by commercial actors whose engagement in policy often constitutes a conflict of interest that is at odds with the public good and planetary health. Countering this power to assure unbiased decision making requires strong processes to manage conflicts of interest. On the business side, new sustainable models are needed to shift outcomes from a profit-only model to a socially and environmentally viable profit model that incorporates the health of people and the environment. The fossil fuel and food industries that are responsible for driving The Global Syndemic receive more than \$5 trillion in annual subsidies from governments. The Commission recommends that governments redirect these subsidies into more sustainable energy, agricultural, and food system practices. A Framework Convention on Food Systems would provide the global legal structure and direction for countries to act on improving their food systems so that they become engines for better health, environmental sustainability, greater equity, and ongoing prosperity.

Stronger accountability systems are needed to ensure that governments and private-sector actors respond

adequately to The Global Syndemic. Upstream monitoring is needed to measure implementation of policies, examine the commercial, political, economic and sociocultural determinants of obesity, evaluate the impact of policies and actions, and establish mechanisms to hold governments and powerful private-sector actors to account for their actions.

Similarly, platforms for stakeholders to interact and secure funding, such as that provided by the EAT Forum for global food system transformation, are needed to allow collaborations of scientists, policy makers, and practitioners to co-create policy-relevant empirical, and modelling studies of The Global Syndemic and the effects of double-duty and triple-duty actions. Bringing indigenous and traditional knowledge to this effort will also be important because this knowledge is often based on principles of environmental stewardship, collective responsibilities, and the interconnectedness of people with their environments.

The challenges facing action on obesity, undernutrition, and climate change are closely aligned with each other. Bringing them together under the umbrella concept of The Global Syndemic creates the potential to strengthen the action and accountabilities for all three challenges. Our health, the health of our children and future generations, and the health of the planet will depend on the implementation of comprehensive and systems-oriented responses to The Global Syndemic.

### Introduction

Obesity has risen inexorably worldwide in the past 4–5 decades and is now one of the largest contributors to poor health in most countries.<sup>1</sup> Despite nearly two decades of recommendations from authoritative national and international organisations, especially WHO, the implementation of effective obesity-prevention policies has been slow and inconsistent.<sup>2</sup> The Commission recognises that this patchy progress is intrinsic to the complexity of the obesity problem itself, and uses the collective term policy inertia to describe the combined effects of inadequate political leadership and governance to enact policies to respond to The Global Syndemic, strong opposition to those policies by powerful commercial interests, and a lack of demand for policy action by the public.<sup>3</sup> Although some high-income countries have experienced a plateau or slight decline in childhood obesity, no country has decreased the obesity epidemic across its population.

The *Lancet* Commission on Obesity (panel 1) developed a broader approach to obesity, on the basis of the concept that the obesity pandemic is one element of The Global Syndemic, which also includes undernutrition and climate change.

As originally defined, a syndemic is two or more diseases with three characteristics: they co-occur in time and place, they interact with each other at biological, psychological, or societal levels, and they share common underlying societal drivers.<sup>4</sup> Although the syndemic

## Panel 2: Definitions

The Commission used the following definitions in this report:

- Syndemic is two or more diseases that co-occur, interact with each other and have common societal drivers.<sup>4</sup> The Global Syndemic applies this concept to the pandemics of obesity, undernutrition, and climate change.
- Malnutrition in all its forms refers to an abnormal physiological condition caused by inadequate, unbalanced, or excessive consumption of macronutrients or micronutrients.<sup>5</sup> We operationalised malnutrition in burden of disease terms as the combined components of child and maternal malnutrition, high body-mass index (BMI), and dietary risks, representing a composite variable of dietary components associated with NCDs, such as diets low in whole grains, fruit, vegetables, nuts, and seeds and high in sodium, red meat, and sugar-sweetened beverages (Ashfin A, Institute for Health Metrics and Evaluation, Seattle, WA, USA, personal communication).<sup>6</sup>
- Undernutrition encompasses stunting (low height-for-age), wasting (low weight-for-height), underweight (low weight-for-age), and micronutrient deficiencies (eg, iron, vitamin A, and iodine). In this report, we use the term to refer to child and maternal undernutrition as part of malnutrition in all its forms.
- Obesity is defined as a BMI >30 kg/m<sup>2</sup>, but when we refer to obesity as part of The Global Syndemic, we use the term to encompass high BMI and NCD dietary risks that form part of malnutrition in all its forms.

- Obesogenic environments are the collective physical, economic, policy, and sociocultural surroundings, opportunities, and conditions that promote obesity.<sup>7,8</sup>
- Policy inertia is the collective term for the combined effects of inadequate political leadership and governance to enact policies to respond to The Global Syndemic, strong opposition to those policies by powerful commercial interests, and a scarcity of demand for policy action by the public.
- Double-duty or triple-duty actions refer to strategies that address two or three of the components of The Global Syndemic.
- Best buys refer to WHO's evidence-informed interventions (eg, sodium reduction) that are feasible and cost-effective for governments to implement and are likely to provide broad benefits to populations in reducing NCD risks.<sup>9</sup>
- People-first language emphasises the individual rather than the disease consistent with the terminology used for other diseases. An obese person is an identity, and infers that the person with obesity is responsible for their condition, whereas a person with obesity is a person with a disease.
- Sustainable food systems promote the global outcomes of human health, ecological health, social equity, and economic prosperity. They have a low environmental impact, support biodiversity, contribute to food and nutrition security, and support local food cultures and traditions.<sup>10</sup>

concept was originally used to describe the interaction of two or more diseases at the individual level, it provides a useful construct with which to consider the interaction of two or more pandemics, in this case, obesity, undernutrition, and climate change, with climate change being accorded pandemic status because of its projected effects on human health (panel 2).

Malnutrition in all its forms, which includes obesity, undernutrition, and dietary risks for non-communicable diseases (NCDs), is already the biggest cause by far of health loss globally (Ashfin A, Institute for Health Metrics and Evaluation, Seattle, WA, USA, personal communication). The increasing health effects of climate change in the future means that The Global Syndemic will remain the largest cause of poor health globally and in each country. Furthermore, The Global Syndemic disproportionately affects poorer countries and, in all countries, poorer populations. Poverty amplifies the effects of The Global Syndemic, and the Syndemic exacerbates and perpetuates poverty. Therefore, common actions to address poverty and The Global Syndemic are essential to improve population health and reduce social and health inequities.

The Commission developed a conceptual model for The Global Syndemic that represents an inside-out version of the socioecological model.<sup>11</sup> The natural systems upon which everything on the planet depends are at the centre,

and the layers of human systems overlay that with the most fundamental systems (eg, governance) on the inside and moving outwards from macro to micro systems. The Foresight Obesity Systems Map,<sup>12</sup> which was the first conceptual model to show obesity as a consequence of complex adaptive systems, has a structure centred on the individual, similar to the socioecological model. This structure is helpful in explaining differences between individuals but less helpful in explaining epidemics sweeping across entire populations.

The major governance levers of those in power in The Global Syndemic model were identified as policies, economic incentives or disincentives, and social norms. The Commission calls these deep drivers because they dictate the operating conditions for the major macro systems (ie, food and transportation systems, urban design, and land use) that create The Global Syndemic. The meso systems or settings (eg, schools, retail, workplaces, and communities) and micro systems or social networks (eg, families, friends, and workplace colleagues) are strongly influenced by the layers underneath. The underlying common causes of obesity, undernutrition, and climate change are explained through this conceptual framework.

After describing The Global Syndemic in systems terms, this report turns to potential systemic actions that could address multiple components of The Global Syndemic

### Panel 3: People's experience—a patient's experience

Many people with obesity experience bias from the medical community. I learned this difficult lesson when I was just 8 or 9 years old. The school nurse weighed each student publicly and said to me, "You're fat," followed by, "You need to lose weight." I wanted to crawl under my desk and hide from my peers. Being singled out for my weight, especially by a person of authority, was humiliating.

The bias continued into adulthood. Virtually every physician I saw told me to lose weight, but never offered any real help or support in meeting that goal. Nurses would remark "We don't have big gowns" in unkind tones that both blamed me for needing one and failed to comprehend the discomfort I felt at leaving my body exposed. A physical therapist once equated me to another mammal when she said, "Let's talk about the elephant in the room—your weight."

Worse yet, a physician unable to look past my weight missed an important diagnosis. Severe hip pain was hampering my ability to walk and exercise.

X-rays and MRIs showed no obvious problems, so I saw an orthopaedist. I started to describe my symptoms when he interrupted saying, "Let me cut to the chase. You need to lose weight." I told him that I had lost about 70 pounds, and he quickly said, "You need to lose more weight. Have you considered weight loss surgery?" He continued to lecture me about weight and, without examining me, concluded that my weight caused the pain. I left in tears feeling demeaned, ashamed, and abandoned. He later related his diagnosis to my primary care physician: "Obesity pain. I see it all the time."

I delayed further treatment until the pain became intolerable. The second orthopaedist I saw realised that my once mild scoliosis had progressed; I now had a 60-degree curve in my spine, which led to my hip pain. Thankfully, this physician focused on the problem, not my weight. With a correct diagnosis, I obtained appropriate treatment.

People with obesity want and deserve the same care and compassion that those with other diseases receive. Health-care providers who overcome their biases can have a dramatic positive impact in lessening obesity's burdens, especially in the weight-management context. Because I have now received intensive science-based treatment from an obesity specialist—one who supports rather than judges me for my condition—I am managing my weight effectively.

Contributed by Patty Nece, attorney and board member for Obesity Action Coalition, and *Lancet* Commissioner, Washington, DC, USA.

through double-duty or triple-duty actions. With some modifications, the many current, evidence-based recommendations to address nutrition and physical inactivity could provide a basis for identifying and quantifying double-duty or triple-duty actions. A solution-oriented approach to The Global Syndemic demands use of system-dynamics approaches and tools to identify how actions can create virtuous feedback loops to produce better health and environmental outcomes, and how they can limit the damage and unintended consequences of the existing feedback loops that are creating the problems.

This report describes additional sources of actions to strengthen governance and accountability systems, address vested industry interests, leverage international human rights treaties, and activate community actions and social change. Vested interests constitute a major source of policy inertia that prevents change to the existing systems. For example, national food producers and transnational ultra-processed food and beverage

manufacturers often exert a disproportionate influence on legislators and the policy making process. Governments face the challenge of regaining control to protect policy making and prioritise the public good over commercial interests, and restructuring business models to minimise negative externalities that contribute to poor human health and damage environments. We assert that there is a right to wellbeing based on state obligations to ensure that all people, especially vulnerable populations, have access to healthy foods and healthy environments. Many initiatives to address The Global Syndemic can begin at the community level, where the systems under local control can be collectively reoriented to achieve better health and environmental outcomes. Nonetheless, community initiatives will need to be reinforced by a regulatory and policy framework, as well as economic incentives and disincentives, to provide healthy and affordable food and beverage choices and promote social and economic environments that encourage physical activity and healthy behaviours.

The Commission believes that the recognition of The Global Syndemic will foster a convergence of many interests, encourage the emergence of an effective social movement, and realign policy measures and governance to reduce obesity, undernutrition, and climate change. Comprehensive and systemic actions are urgently needed.

### The obesity pandemic

#### People's experiences

This report examines the complex systems that lead to unhealthy environments and recommends actions to address the underlying and basic drivers of The Global Syndemic. The Commissioners also believed it essential to include the stories of people who create these systems and people who are affected by them. For the boxes on people's experience used throughout this report, we focus on the experiences of the obesity component of The Global Syndemic.

Obesity affects people. Yet too often, the media images of people with obesity we see are of headless bodies, dehumanising them as individuals living in societies in which most of us are vulnerable to obesogenic environments.

One of the most pervasive challenges facing people with obesity is the bias and stigmatisation that accompanies the disease. The perceptions of obesity vary widely, depending on the country context. For example, in LMICs where undernutrition is a major threat to health, fatter babies and children are valued. Likewise, in countries with a high prevalence of HIV/AIDS, obesity can be an indicator that the person is disease-free. However, in most western cultures, obesity is seen as a personal failing rather than a predictable consequence of normal people interacting with obesogenic environments. People with obesity are often blamed for their disease by being prejudged as stupid, ugly, unhappy, less competent, sloppy, lazy, and lacking in self-discipline, motivation,

and personal control.<sup>13</sup> Medical providers and family are the most frequent sources of stigma, and the bias among physicians leads to a scarcity of preventive services, especially for women.<sup>13</sup>

Bias against people with obesity affects acceptance to institutes of higher education, hiring, and job advancement.<sup>14</sup> Bias might also account for the lack of recognition of obesity as a serious medical problem that deserves care (panel 3). Holding people responsible for their obesity distracts attention from the obesogenic systems that produce obesity. These systems and their drivers are deservedly the focus of the Commission's report.

The Commission also recognised that understanding the way people experience obesogenic environments is essential to modify the environments and foster meaningful change in people's lives.

Panel 4 provides a story from a deprived area of London, UK. This narrative illustrates that people might not necessarily want to feed their children fast food. Competing demands in people's lives often make processed fast foods from restaurants and takeaways the easiest, most convenient, and rational choice given one's reality, even though it is not the healthiest option. The Commission acknowledged the importance of involving people living with obesity in finding solutions that recognise the reality of their lives. It is also a way to mobilise and empower people who experience the problem but also want to change. Furthermore, an understanding of the perspectives and perceptions of the people who create obesogenic systems is needed. They do not intentionally set out to create unhealthy environments, so we need to clarify the incentives that drive their actions that have that effect. We also need to understand the experiences of people who are trying to change these unhealthy systems to identify the barriers they face, factors that facilitate action, and the lessons learned from their successes and failures. Throughout this report, The Commission gives voice to people who are confronted with these challenges.

### The obesity context

The obesity pandemic requires a wider perspective because it is a symptom of deeper, underlying systemic problems that require systemic actions. The Commission expanded the concept of the obesity problem into four dimensions: increasing obesity, policy inertia, lack of urgency, and action on obesity that is not joined up with action in other areas (eg, separate food agendas for health and environmental sustainability).

First, there has been an unabated rise in obesity prevalence in all countries in the past four decades, and no country has succeeded in reversing its obesity epidemic.<sup>1</sup>

Second, the patchy implementation of WHO's best buy policies, which have been endorsed by governments at successive World Health Assemblies over 15 years, is attributable to many actors.<sup>2,3,15</sup> Industries with vested

### Panel 4: People's experience—the bus driver mum's tale

It's the hours. If me and my husband worked fewer hours the kids would be eating more healthily. And I volunteer teaching children to cook healthily because others work even longer. A friend goes to the food bank. Her daughter is 14 and is size 20. She's petrified, on a zero-hour contract [a contract but with no guaranteed hours of work], and pays rent and bills before food. She has to leave kids' food in the fridge. Mums on benefits have more time for cooking with kids. Mine only put on weight when I started working full-time!

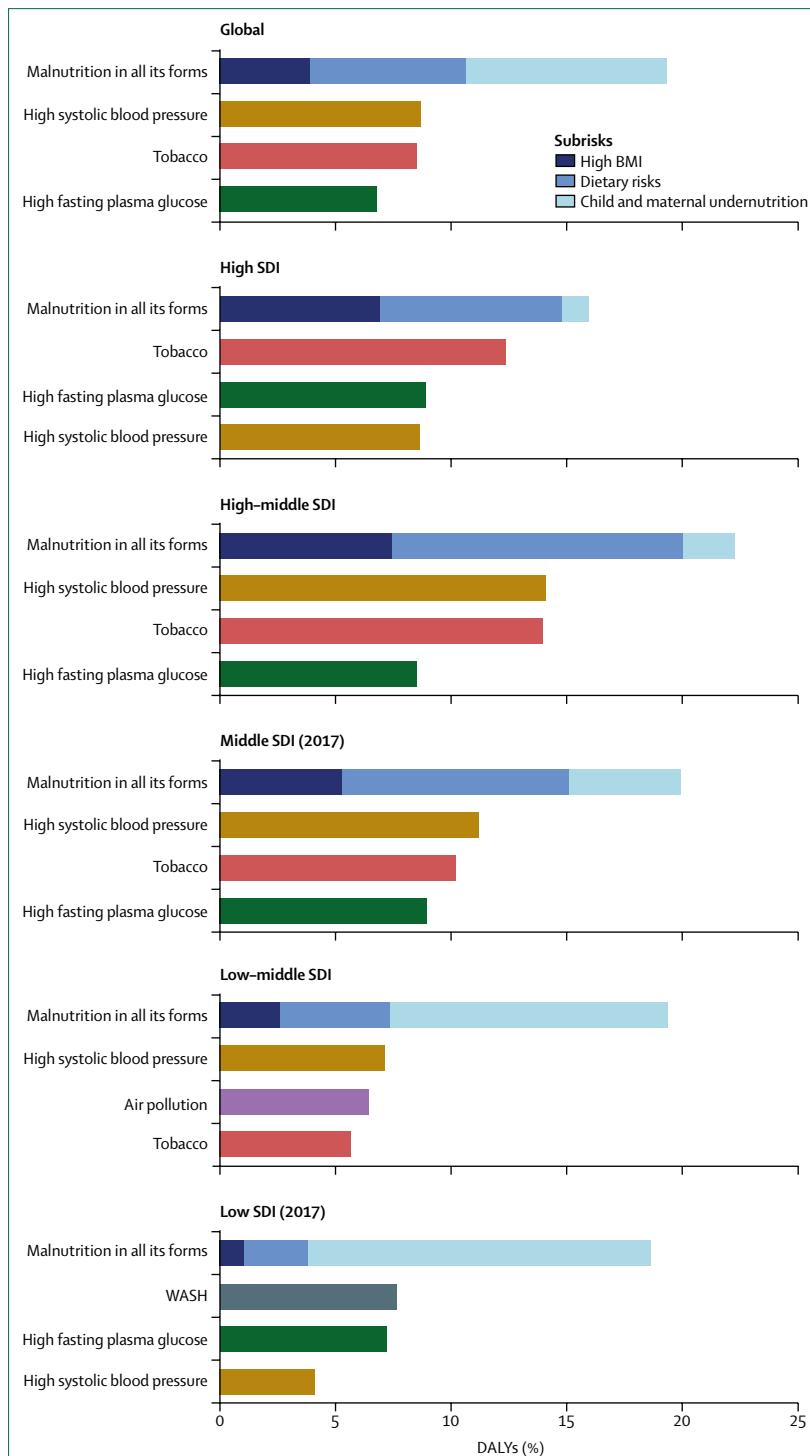
At the supermarket you shop big, saving every penny, and buy things that won't go off. It's all about affordability. It's not cheap to cook from scratch. As kids are growing up, fast food's everywhere. We see it every day—liquor for adults, fast-foods for meals, sweets for kids, and betting shops—it's not good. Fast foods taste nice, as a treat, but most should close down or sell healthy foods. In these lower-class urban areas, it's not so nice, more crime and drugs makes it hard to have a clear mind to think "I want healthy food" and for people to care about themselves. They know their audience and dump these foods here and there's no choice. Shops in affluent areas are not life-threatening and the nannies prepare the dinners. But when you're worrying every day and sometimes stuck indoors kids will get snacks. The kids come first, so some days I have nothing.

I cook healthy meals and joined Change4Life [a UK behaviour change programme] but everyone's busy. You need first hand advice, at the school or community. When you get the letter with child measurements, other parents think you're obese and neglecting your child. Others panic and might malnutrition the child. Schools should focus on all children. Obesity is scary, a health risk. If real food was cheaper, people would be healthier. It's all about making money. It's the economy, the government. Everything linked together. One big chain and we're in the middle. But how can I blame someone else for what I do?

Government gives the impression of helping but it's like what they've done for smoking. It's going to take years. They allow the food companies to produce unhealthy foods, it should be an offence. If I was prime minister there'd be community shopping with butchers, grocers, proper bakers, clubs with families eating together, different cultural foods for children and to bring community together. Yes, I'd be involved in policy making, people and community taking ownership through schools and children centres. But there's no time—that's why I'm talking to you! I should go into politics!

Contributed by Dr Sharon Noonan-Gunning, prepared from interviews with an ethnically diverse group of mothers in deprived parts of London, UK.

interests, such as transnational food and beverage manufacturers, are powerful and highly resourced lobbying forces that have opposed governments' attempts to regulate commercial activities or modify them through fiscal policies, such as imposing a tax on sugary drinks or changing agricultural subsidies. Politicians are either intimidated by industry opposition or they might hold beliefs that education and market-based solutions that are grounded in neoliberal economic and governance models are sufficient to reverse the obesity epidemic. Civil society organisations are generally supportive of WHO's best buy policies. Public opinion polls suggest support for these policies,<sup>16</sup> which has not translated into sufficient public demand for action to overcome the industry opposition and government reluctance. This insufficient public demand for action to address obesity contrasts markedly with the successful activist approach taken by campaigners to address HIV/AIDS, which is another highly stigmatised global health problem.<sup>17</sup>



**Figure 1: The burden of malnutrition in all its forms**

The percent contribution of malnutrition in all its forms (shown as the contributions of undernutrition, high body-mass index [BMI], and dietary risks) to disability-adjusted life years lost compared with the burden from the next three largest contributors. Results are shown for all countries and by groups of countries according to the sociodevelopment index (SDI). WASH=water, sanitation, and hygiene.

Third, obesity, by itself, has proven to be an insufficiently urgent problem for the implementation of specific policies, such as restricting the marketing of unhealthy foods and beverages to children and young people, let alone for the tackling of underlying systemic drivers, such as the commercial determinants of health.<sup>18</sup> This inertia exists despite the enormous health and economic costs and abundant media stories about obesity and diabetes in the last several decades.

Finally, obesity is often considered in isolation of, rather than in concert with, other major global challenges. In particular, the Commission asserts that obesity, undernutrition, and climate change have multiple common causes and mitigating actions.

#### *Malnutrition in all its forms*

Since its original publication on obesity in 2000,<sup>19</sup> WHO has progressively incorporated recommendations for action on obesity into many reports, action plans, targets, and monitoring plans to address NCDs, for which obesity is a major risk factor. Several recommendations, such as the restriction of children's exposure to advertising for unhealthy foods and non-alcoholic beverages and fiscal policies, were accepted in resolutions of the World Health Assembly in 2010, and received attention at each of the UN High-Level Meetings on NCDs from 2011 to 2018.<sup>20</sup> Targets of no increase in obesity and diabetes prevalence in adults above 2010 levels and no increase for overweight prevalence among children less than 5 years of age were set, although no targets were set for older children and adolescents.<sup>21,22</sup>

WHO has also published several reports on and targets for undernutrition. Although some progress has been made on reducing stunting and under-5 mortality, the reductions for these and other indicators of undernutrition will not reach the targets set by WHO.<sup>23,24</sup> One of the main outcomes from the WHO and Food and Agriculture Organization (FAO) Second International Congress on Nutrition in 2014 was to combine all nutritional problems as malnutrition in all its forms.<sup>25</sup> This concept and wording has flowed into the SDGs and a parallel global effort around the UN-declared Decade of Action on Nutrition (2016–25), which seeks specific commitments from countries to deal with their major nutrition issues.<sup>26</sup> The UN's 2015 SDGs included a goal for 2030 to end all forms of malnutrition (Goal 2.2),<sup>27</sup> and nutrition and health can contribute to and benefit from all goals in the SDG 2030 agenda (appendix p 2). Despite this high-level rhetoric, many LMICs have not yet reoriented their nutrition funding, development aid, professional capacity, institutions, and mindsets to encompass the challenges of obesity and the consequences of malnutrition in all its forms.

The Global Burden of Disease has recently assessed the burden of malnutrition in all its forms (panel 2; Ashfin A, Institute for Health Metrics and Evaluation, Seattle, WA, USA, personal communication). Globally and in the lower income countries, malnutrition in all its forms

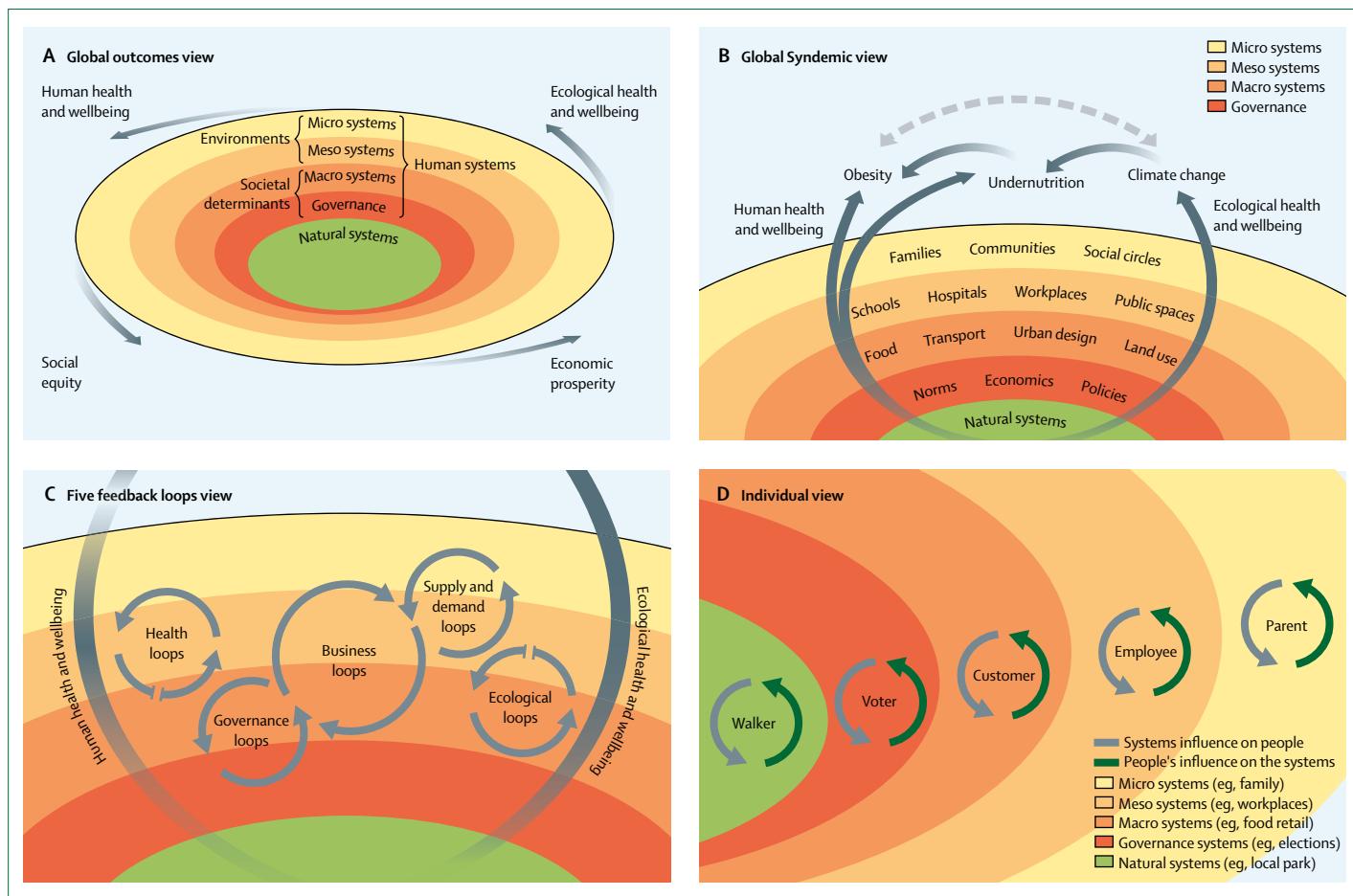


Figure 2: The Systems Outcomes Framework

The sequence of figures below shows progressively zoomed-in views from the global outcomes view of the consequences of intersecting natural and human systems (A); to The Global Syndemic view of the interaction and common drivers of obesity, undernutrition, and climate change (B); to the Five Feedback Loops view (C); and the individual view (D).

contributes as much disease burden as the next 2–3 leading categories combined (figure 1).

For countries with a low Socio-demographic Index, undernutrition incurs a much higher burden both in absolute terms and relative to the other leading contributors. The 2018 Global Nutrition Report found that, of 141 countries, 83 countries (59%) had double burdens of malnutrition (ie, high prevalence of two of three nutrition conditions: childhood stunting, anaemia in women, and overweight in women) and that 41 countries had triple burdens.<sup>28</sup> Therefore, within these countries, the political economy and food systems are the underlying causes of the high prevalence of both undernutrition and obesity, suggesting that common, underlying solutions could also exist. These solutions require a shift from the perception that undernutrition and obesity are simply a consequence of too few or too many calories, to understanding their co-occurrence and common drivers, and then to taking concerted action to address these drivers. The recognition that undernutrition and obesity are both due to poor diet quality and a low variety of

healthy foods is a more helpful perspective to resolve nutrition problems collectively.

#### The four major global outcomes

The conceptual and communications challenge of combining the major global problems of obesity, undernutrition, and climate change requires a coherent narrative to understand their common causes and solutions without compounding the existing complexities inherent in each of the problems themselves. The common narrative of The Global Syndemic, as outlined in the next section, seeks to bring the three pandemics together into a compelling story that creates an urgency for action that will overcome the existing policy inertia that has hampered progress on obesity, undernutrition, and climate change.

The backdrop for The Global Syndemic is the broader picture of global outcomes. The four major global outcomes of concern for people and the planet are the net results of the complex adaptive systems created by humans that interact with each other and the natural ecosystems (figure 2A). Human systems have been established to

See Online for appendix

achieve certain outcomes, such as economic prosperity. Due to the way that these systems have been designed, the inevitable overconsumption and inequitable distribution of resources has caused negative externalities and poor outcomes for the other three outcomes of social equity, human health and wellbeing, and ecological health and wellbeing. These global outcomes will be considered in more depth later in this report in relation to the different country contexts and their priorities for action.

### **Re-thinking obesity: The Global Syndemic and complex adaptive systems**

#### **The Global Syndemic**

The original concept of a syndemic was largely applied to diseases at the individual level—two or more diseases clustering in time and place, interacting with each other and having common, societal determinants.<sup>4,29</sup> A subsequent extension of the concept used syndemics to describe health problems that synergistically affect population health in the context of economic and social inequalities.<sup>30</sup> To date, the main applications of the extended syndemic concept have been in relation to HIV/AIDS and its associations with substance abuse and violence,<sup>4,31</sup> the clustering of hepatitis C, alcohol abuse, and hepatocellular cancer,<sup>31,32</sup> and poverty, depression, and diabetes among low-income populations.<sup>30</sup>

The Commission proposes that the definition of syndemics should be further extended to the pandemics of obesity, undernutrition, and climate change. We consider climate change a pandemic because of its dynamic nature, its rapid rise, and its predicted catastrophic impact on human health. The interactions between these pandemics occur at both the individual and population levels (figure 2B). The Commission calls these three pandemics The Global Syndemic to emphasise the major global importance of this cluster of pandemics, which are now, and will be into the foreseeable future, the dominant causes of human and environmental (ie, planetary) ill-health. Recognition that these synergistic pandemics constitute a syndemic provides a more comprehensive view of their interactions, and promises common systemic actions that can unite previously disparate stakeholders.

#### *Obesity, undernutrition, and climate change cluster in time and place*

The prevalence of obesity has risen globally in the past four decades including an 8 times increase in girls to 5·6% and a 10 times increase in boys to 7·8% in 2016.<sup>33</sup>

The rise in obesity prevalence in adults in the same period has also been relentless, increasing to 14·9% in women and 10·8% in men, in the same time period.<sup>1</sup> In 2015, excess bodyweight was estimated to affect 2 billion people worldwide, and accounted for approximately 4 million deaths and 120 million disability-adjusted life-years.<sup>34</sup> The estimated costs of obesity are about US\$2 trillion annually,<sup>35,36</sup> representing 2·8% of the world's GDP.<sup>36</sup> The increase in the prevalence of obesity accounts for the

rapid increase in diabetes, which now affects almost 9% of the world's population.<sup>1</sup>

The Global Burden of Disease data suggest that, by 2025, nearly 268 million children and adolescents in 200 countries will be overweight, 124 million will have obesity, and almost three-quarters (72·3%) of NCD-related illness and deaths will occur in LMICs.<sup>34</sup>

The prevalence of undernutrition has been declining for decades, although it is still highly prevalent in many LMICs. The Global Hunger Index (1992–2017) showed substantial declines in under-5 child mortality in all regions of the world but less substantial declines in the prevalence of wasting and stunting among children.<sup>24</sup> In 2008, stunting, severe wasting, and intrauterine growth retardation were estimated to account for 2·2 million deaths and 21% of disability-adjusted life-years in children under 5 years of age.<sup>37</sup> In 2018, the Global Nutrition Report found that 155 million children were stunted and 52 million children were wasted.<sup>28</sup> 2 billion people have a micronutrient deficiency, and 815 million people are chronically undernourished. Undernutrition disproportionately affects children and adults in low-income countries, particularly those in eastern and middle Africa and south-central Asia.<sup>37</sup> Because the prevalence of undernutrition has been declining, the prevalence of child and adolescent obesity might exceed moderate and severe undernutrition by 2022.<sup>1</sup> Estimates of the costs to the global economy from undernutrition, micronutrient deficiencies, and overweight are up to \$3·5 trillion annually.<sup>23</sup>

Although malnutrition in all its forms is by far the largest cause of health loss in the world, it will be compounded by the health effects of climate change in the near future.<sup>38</sup> The health gains achieved in the past 50 years of global economic development could be reversed by 2050 due to the consequences of climate change.<sup>39</sup> Estimates of the future costs of climate change are 5–10% of the world's GDP, with costs in low-income countries in excess of 10% of their GDP.<sup>40</sup>

LMICs that produce the fewest greenhouse-gas emissions are more affected by climate change than those countries that produce the highest greenhouse-gas emissions. Furthermore, climate change will have a disproportionate effect on agricultural production and consequently human health in LMICs. The resultant population displacement might already account for increased global migration patterns in Africa and other regions.<sup>39</sup>

#### *Obesity, undernutrition, and climate change interact with each other*

Many interactions occur among the components of The Global Syndemic. The World Economic Forum's annual risk reports include the global risks of climate change, NCDs, food crises, failures of governance, and failures of urban planning.<sup>41</sup> The report's interconnections map shows the interdependency of these risks. The UN's

IPCC predicts that the biggest threat to health from substantial climate change will be undernutrition.<sup>42,43</sup> Phalkey and colleagues<sup>44</sup> provide an example of a causal loop diagram showing the systemic interconnections between climate change and food security (appendix p 3).

Climate change affects food systems in many ways. Small-scale, low-income farmers will likely be most affected, although environmental change will affect all producers exposed to storms, floods, drought, coastal erosion, warming oceans, and rising sea levels. A small degree of global warming might benefit some crops in some areas, taking into account the carbon fertilisation effects. However, global warming will lead to lower yields especially in tropical regions. Furthermore, climate change might reduce the protein and micronutrient content of plant foods.<sup>45</sup> Although not all crops are equally affected, elevated levels of carbon dioxide have been shown to decrease protein concentrations of wheat, barley, rice, and potato crops by 10–15% and soy by 1·4%.<sup>45</sup> These changes in nutrient value will further contribute to undernutrition, particularly in children. All of these changes will also increase the prices of basic food commodities,<sup>46–48</sup> and are expected to lead to increases in nutrient deficiencies and chronic undernutrition among the most food-insecure population groups.<sup>49,50</sup> Food insecurity could be exacerbated further by climate mitigation efforts associated with land sparing.<sup>50</sup>

Food production is one of the largest contributors to climate change. Agriculture directly contributes about 15–23% of all greenhouse-gas emissions, which is comparable to transportation. But when land conversion and the wider downstream food system processes, including food waste, are taken into account, the total contribution of food to emissions can be as high as 29%.<sup>51,52</sup> Livestock alone account for 12–19% of greenhouse-gas emissions.<sup>53</sup> The types of food produced have differing effects. Both meat and dairy products require more resources and generate larger emissions of methane than plant-based alternatives.<sup>54,55</sup> Additionally, non-seasonal fruits and vegetables produce substantial emissions when grown in greenhouses, preserved in a frozen state, or transported by air.<sup>54</sup> The energy required for the production, harvesting, transportation, and packaging of wasted foods also generates more than 3·3 billion tonnes of carbon dioxide annually, making food wastage the third top emitter after the USA and China.<sup>56</sup>

The globalisation of food systems has depended on cheap energy from fossil fuels for intensive large-scale agricultural production and long-haul transportation that has transformed the diets of the world's population. Increased urbanisation has exposed people in these environments to markets for mass-produced, processed food and beverage products.

The interactions between climate change and obesity are also numerous but less certain. Increasing ambient temperatures could contribute to obesity through reductions in physical activity.<sup>57</sup> Additionally, the effect of

climate change on fruit and vegetable production will make these products more expensive, and might prompt shifts in the eating patterns of populations towards processed food and beverage products that are high in, fats, sugars, and sodium.<sup>57</sup> Increased food and agricultural production to meet the needs of a growing population with a high prevalence of obesity will increase the food system's greenhouse-gas emissions. Another mechanism by which obesity could contribute to climate change is through the increased costs of fossil fuels related to transporting populations with a high prevalence of obesity.<sup>57</sup> This added contribution to greenhouse gases attributed to obesity is very small relative to other greenhouse-gas emissions<sup>54,58</sup> and emphasising this pathway risks placing further blame on people with obesity—not only for their own condition but also for climate change. Because periodic, but not severe, food insecurity is associated with increased risks of obesity in high income countries,<sup>59</sup> increased food insecurity could theoretically increase the prevalence of obesity.

Obesity and undernutrition also interact. Undernutrition in early life is a predictor for later obesity. Biological and social mechanisms that explain this relationship include the contribution of fetal and infant undernutrition, food insecurity, and poor diet quality characterised by a low variety of healthy foods.<sup>60</sup> Many middle-income countries, especially in the Middle East and north Africa, are facing a double burden of undernutrition and overweight or obesity. For example, Iran, Morocco, Oman, Saudi Arabia, Syria, and Tunisia are all in the top tertile of countries for both the prevalence of adult female obesity (>27% with body-mass index [BMI] >30 kg/m<sup>2</sup>)<sup>1</sup> and female child and adolescent underweight (>18% with a BMI Z score <1 standard deviation; appendix p 4).<sup>61</sup> Indeed, the co-occurrence of stunting (low height-for-age) and obesity (high BMI for age) is not uncommon within the same country, village, family, and even individual.<sup>23</sup> LMICs carry the greatest triple-burdens of malnutrition. In LMICs, the prevalence of overweight in children less than 5 years of age is rising on the background of an already high prevalence of stunting (28%), wasting (8·8%) and underweight (17·4%).<sup>36</sup> The prevalence of obesity among stunted children is 3% and can be more than 10% in some middle-income countries.<sup>62</sup> Countries cannot afford to prioritise their nutrition policies to focus only on reducing undernutrition while costly obesity-related NCDs, such as type 2 diabetes, are overwhelming their national health systems.

#### *Obesity, undernutrition, and climate change have common systems drivers*

The shared societal determinants for obesity and climate change have previously been noted in the published literature.<sup>63,64</sup> Both are driven by the high consumption of cheap energy sources (foods and fossil fuels) and car-oriented transportation systems. The consumptogenic economic systems that promote excessive and

unsustainable consumption patterns value GDP growth and overlook its role in damaging the health of people, the environment, and the planet.<sup>65</sup> In economic systems in which the vested interests of powerful transnational corporations produce financial benefits that are maximally privatised, the social and environmental costs or externalities fall to consumers, taxpayers, ratepayers, and future generations. The major risks to society and economic development in the future are heavily neglected.<sup>57</sup>

The balance of power between actors within the governance mechanisms determines how the levers of power are used. Those levers include policies (eg, laws and regulations), economic incentives and disincentives, and societal norms and expectations. Although governance occurs at all levels, macro-level governance (usually national governments) creates the operating conditions for the major systems that drive The Global Syndemic—the food, transportation, land use, and urban design sectors. These macro systems, in turn, flow through the meso systems or settings in which people interact, such as schools, workplaces, retail outlets, and community spaces. They, in turn, influence the micro systems or social networks, such as families and social groups, affecting their behavioural patterns.

The power balance within the governance structures determines, for example, whether agricultural subsidies support monoculture crops and beef and dairy farming over more sustainable agricultural systems with fewer environmental effects and greater health benefits, whether funding for transportation infrastructure prioritises roads over mass transit and active commuting, whether periurban horticultural lands are zoned for housing and industry, whether economic policies promote consumption-driven growth, whether regulatory systems allow or constrain marketing of unhealthy food and beverage products to children or breastmilk substitutes to mothers, and whether cultural and religious codes of dress and behaviour, especially for girls and women, constrain their ability to be physically active and fully engaged with society. The sociocultural nature of some of the systems is important to note. A population's values, beliefs, attitudes, religious expectations, and social practices shape the types of foods people eat, how they use food for hospitality, the status attributed to particular foods, and their vulnerability and exposure to targeted commercial marketing that exploits these attitudes and values.

Key aspects of the political economy have been recognised as the deep drivers that shape the very nature of the systems creating The Global Syndemic. For example, economic power has become increasingly concentrated into fewer and fewer transnational corporations, and this is certainly true in the food sector.<sup>66–68</sup> According to the former Director General of WHO, this “market power readily translates into political power”.<sup>69</sup> Specifically, the transnational corporations lobby for fewer regulations that apply to them (eg, no regulations

on marketing unhealthy food to children or warning labels on processed foods), promote regulations that apply to other sectors (eg, trade and investment agreements that bind governments to protect corporate investment interests), resist or reject taxes that apply to their products (eg, taxes on sugary drinks and energy-dense, nutrient-poor foods), and lobby policy makers for subsidies that benefit their businesses (eg, agricultural and transportation subsidies).<sup>68</sup> The fossil fuel and food industries that are responsible for driving The Global Syndemic receive more than \$5 trillion in annual subsidies from governments.<sup>70</sup>

### **Complex adaptive systems**

Close examination of the contributors to The Global Syndemic reveals the role of complex adaptive systems operating at each of its levels (figure 2B). Systems, such as health systems, schools, or families are complex because the inter-relationships are multiple, change over time, and involve several interacting, reinforcing, and balancing causal feedback loops, as well as the fact that non-linear associations exist between causes and effects. Reinforcement of feedback loops leads to virtuous or vicious cycles, depending on the outcome, although balancing feedback loops counteract the directions of change that form the basis of homoeostasis and policy resistance in complex adaptive systems. For example, a new food launched into the market might accelerate profits for its manufacturer, which in turn supports more marketing and wider distribution that make more profits in a reinforcing feedback loop. However, the product's growth in sales and profits are not infinite because market saturation and competition act as balancing feedback loops that counteract the reinforcing feedback loop driving the initial growth.<sup>71</sup> Understanding the dynamics of the major feedback loops within a system is, therefore, crucial to identifying how to reorient the systems towards better outcomes.

The systems are also adaptive. Any change in one part of the system will lead to changes in the implicit and explicit rules of the actors in other parts of the system, generating new, emergent dynamics. Changing the reimbursement structure within a health system, changing governance structures in a school, or changing the structure of a family through marriage or separation, for example, can lead to the adaption of actors by changing the rules in how they respond to each other and their environment, and push a system toward a new equilibrium or system instability.

Taking a system dynamics approach to The Global Syndemic provides new insights into three critical questions: why are systems, including food systems, the way they are? Why do they need to change? Why are they so difficult to change?<sup>72</sup>

### **Five sets of feedback loops**

The Commission considered that five crucial feedback loops (figure 2C) need to be assessed within the food,

transportation, urban design, and land-use systems as the drivers of The Global Syndemic: the business, supply and demand, governance, ecological, and health feedback loops. The feedback loops are described in more detail below with reference to the food system, but they also apply substantially to transportation systems, urban design, and land use.

The business feedback loops reflect the market-based food systems that combine the profit motives of businesses with the demands of their customers. Market-based food systems are remarkably robust enterprises for getting food from its source in farms or the sea to people in the centre of megacities or in remote rural outposts. The food value chain, rather than supply chain, better describes the system because as food travels one way from one private operator to another along the chain, money and profits flow back the other way as a set of intersecting positive feedback loops that ensure that the system incentivises the flow of food to people. The underlying imperative of adding value along the chain intrinsically leads to more processed and ultra-processed foods. Milk as a basic food has less added value (in profit terms) than baby formulas, yoghurts, and ice cream. These products fulfil consumers' desire for taste, variety, choice, and shelf life, and create greater profits for the food providers. Unfortunately, such a focus also results in a food supply that is high in ultra-processed foods and is associated with higher rates of chronic diseases.<sup>73–75</sup> Negative health and environmental outcomes are not factored into the current business model which has a major role in creating and sustaining The Global Syndemic. As we discuss later, new 21st century business models are needed to ensure that food systems contribute positively to all four global outcomes of health, sustainability, social equity, and prosperity.

The supply and demand relationship through market mechanisms efficiently matches food supply with consumers' wants and needs and their ability to pay. However, consumers themselves have biological, psychological, social, and economic vulnerabilities that industry exploits through food environments that influence people's preferences, which increases the demand for energy-dense and nutrient-poor food and beverage products and feeds back into increased supply.<sup>2</sup> Some government measures, including regulations for the marketing of unhealthy food and beverage products to children, front-of-pack warning labels, fiscal policies such as soda taxes, and consumer protection laws can help to constrain this supply-driven consumption of unhealthy foods. However, demand-driven consumption of unhealthy or environmentally damaging foods can occur if the foods are considered part of familiar or aspirational cuisines. For example, cheap, fatty mutton flaps exported from New Zealand or turkey tails from the USA have become part of the standard cuisine in some south Pacific countries,<sup>76</sup> which in turn affects supply and demand for those unhealthy products.<sup>77</sup>

Red meat consumption is widely consumed in high-income countries and, as countries develop economically, the demand for red meat as a high status food also increases.<sup>78</sup> Reducing the consumption of red meat is a cornerstone for healthy, sustainable diets, but achieving this will be formidable given the current supply and demand dynamics. Western-style fast foods might also be part of aspirational diets for some populations in low-income countries.<sup>79</sup> Dietary patterns are relatively conservative and tend to change slowly over decades, often with new generations, immigrant cuisines, or new information on the health effects of specific foods providing the stimulus for change.

Although correcting market failures due to negative externalities on health and the environment is a core task of governments, policy inertia affects their implementation, as has already been noted and is explained within the set of governance feedback loops. Powerful lobby forces often prevent government policy making for public good.<sup>68,80</sup> Although the collective voice of small farmers is a political force in some countries, the concentrated power of the large food corporations is the most powerful source of policy inertia for actions that create healthier food environments.<sup>68</sup> Additionally, the governance structures in many countries are weak or corrupt, making them even more susceptible to influence. Transparent and accountable governance structures are needed that are free from conflicting interests, inclusive of civil society groups, and responsive to the needs of citizens.

Feedback loops related to natural systems help explain why the business, supply and demand, and governance structures cannot be maintained under existing operating conditions. Current food systems are degrading the environment beyond the capacity of natural ecosystems to repair. The forces of over-extraction and pollution of natural environments are not balanced by built-in constraints on those business or consumer activities that damage the environment through greenhouse-gas emissions, pollution of waterways, deforestation, reduced food biodiversity, water over-extraction, soil degradation, or food waste.<sup>68</sup> Eventually, a degraded natural environment will have a negative feedback on businesses and consumers, but this is often a delayed effect on health (shown by the parallel lines across the arrow in figure 2B) that will be felt by future generations of land and business owners, consumers, and citizens.

Human health feedback loops also explain why the existing systems cannot continue. The development of the current food systems has substantially improved human health in the past century, but now, paradoxically, these same food systems have become a major contributor to the global epidemics of chronic diseases. Better nutrition and food security have helped increase life expectancy, but, at the same time, poor diets have become the biggest contributor to the global burden of disease (figure 1). The effects on health represent another major

negative externality of the food system, with delayed feedback from the health problem to the food system. For example, there has been a considerable delay between the recognition of the adverse health effects of sugary drinks and the creation of policies to reduce their consumption.

#### *Lever to convert policy inertia into policy traction*

These five sets of feedback loops need to be examined in more depth from a systems perspective to identify the types of levers that might create traction for implementing policies to reduce the ecological and health damage. Many of the systemic levers will be double-duty or triple-duty actions for mitigating obesity, undernutrition, or climate change.

The feedback loops that protect the environment need to be strengthened. Carbon pricing, pollution regulations, water levies, consumer education, and environmental food labelling are examples of such measures. The feedback loops that constrain the production and marketing of foods and beverages that promote ill-health also need to be strengthened. These efforts include taxation, front-of-pack signposts such as warning labels for products high in sugar and salt, and consumer education and social marketing campaigns. Other strategies include gaining commitments from food companies to create healthier food environments and holding them to account for fulfilling such commitments using monitoring and public ratings systems. At the same time, strategies that promote availability, accessibility, and affordability of healthy foods must be implemented across the food system. The imperative for food systems to provide the basis for healthy diets should be articulated in all policies that shape them, from agricultural production through to retail. Strategies to increase the demand for healthy foods, such as education, social marketing, government procurement, taxes, and subsidies can send the signals back through the value chain, creating alternative sources of value.

Strengthening governance, managing conflicts of interest, and creating social demand for change are all important strategies to counter the current detrimental influence of vested interests on public food policies. Additionally, new business models are needed to reduce the negative externalities created by incentives in the current economy. Corporate social responsibility efforts, which are too often marketing exercises, need to evolve into a stronger accountability model, in which targets and performance criteria are independently specified, monitored, and publicly shared.

Changes to fundamental values, guiding philosophies, and principles (eg, human rights, polluter pays, agriculture for better nutrition, and improved infrastructure for public and active transportation) will have more powerful, systemic effects than more visible changes (eg, school food programmes, food labelling, and pricing policies), because values that permeate the whole system create more fundamental and sustained changes.

#### *The role of individuals*

The idea that individuals personally carry the responsibility for their own health-related behaviours is common, especially in Western, individualistic societies. The recognition that people's health-related behaviours are heavily influenced by the environments around them is the first step in implementing effective policies to support health. For example, poverty severely restricts people's capacity to make healthy choices, and obesogenic environments dominated by fast food outlets and unsafe neighbourhoods severely restrict the healthy choices available. Affluence and health-promoting environments create a positive health effect.

As previously noted, the socioecological model concept of the person–environment interaction is centred on the individual. The model shows how individuals are products of their personal attributes and the environments and influences around them. In our framework, individuals populate all layers of the human systems and continuously interact with the natural ecosystems (figure 2D). They do not and cannot exist in isolation of the natural and human systems. By depicting individuals in this manner, the three parts of the person–environment interaction become more apparent. The first part is the personal agency individuals have in making their choices from the environments available. The second is the influence the environment has on those choices. The third is the influence that the individual has on changing the environments and systems around them.

People live in networks of influence. Their influence is greatest at the micro level with family and social circles, but people also interact in and influence many settings—eg, workplaces, schools, universities, shops, recreational settings, villages, and local communities. Even at the macro level, being a consumer, using mass media, or working in government or other macro systems provides an opportunity to create influence. Individuals also have a voice in governance, especially within democracies that are not overshadowed by money and corruption.

This depiction of individuals as network agents provides an important basis for action. The two things that flow across human networks to create change within a system are knowledge (an understanding about the nature of the problems and how to apply actions) and engagement (the energy, enthusiasm, and commitment for change).<sup>81</sup> For individuals, actively disseminating knowledge and engagement through networks is a central mechanism for reorienting existing systems, especially at the community level (discussed in the Community-based actions section).

One broad strategy for addressing The Global Syndemic is, therefore, to give people the capacity to take personal responsibility for their own health by reducing poverty, strengthening education, and reducing structural and social prejudice on the basis of gender, religion, and race. A second is to make the healthy and sustainable choices the easy and default choices through strong public-interest

policies. A third is to activate people's network agency so that society's human systems reorient to promote the four essential global outcomes: environmental health and wellbeing, human health and wellbeing, social equity, and economic prosperity.

#### *The nature of double-duty or triple-duty actions*

The 2015 Global Nutrition Report first used the term double-duty actions to describe programmes and policies that could potentially reduce the burden of both undernutrition and NCDs related to overweight, obesity, or diet.<sup>82</sup> This concept has been crucial in starting to bring together each form of malnutrition under the umbrella term of malnutrition in all its forms.<sup>83</sup> Examples of double-duty actions provided in the Global Nutrition Report included actions to promote breastfeeding in workplaces, urban planning for healthy food outlets and discouraging outlets for unhealthy food, ready access to clean water, and universal health care.

The 2017 Global Nutrition Report proposed that triple-duty actions could have positive effects on all of the 17 SDGs.<sup>23</sup> Examples included: diversifying food production systems to provide a nutritious food supply, ecosystems benefits, and empowerment of women to become innovative food value chain entrepreneurs; increasing access to efficient cooking stoves to improve nutritional health, reduce respiratory disease from indoor smoke, preserve forests, and reduce greenhouse-gas emissions; and providing school meal programmes that could reduce undernutrition, prevent the risk of developing obesity, provide income to local farmers, and encourage children to stay in school and learn better when at school. As already noted, the SDGs are highly interconnected and many actions can have several benefits across SDGs. In this report, we use the concept of double-duty or triple-duty actions to discuss those actions that address two or three aspects of The Global Syndemic (appendix p 11).

Drivers have most in common at the governance and macro levels (figure 2B and 2C). Some triple-duty actions such as dietary guidelines and nutrition education to address obesity, undernutrition, and environmental sustainability, can be delivered at the meso level (eg, through schools) or micro level (eg, through social marketing), but they are developed primarily at the macro and governance levels. For example, when the USA and Australia tried to include sustainability in their national dietary guidelines, vested interests from food industries leaned heavily on their governments to eliminate sustainability from the terms of reference.<sup>84,85</sup> Brazil, which has a much more democratic governance structure for food policy development,<sup>86</sup> kept vested interests at bay and produced the first dietary guidelines with explicit sustainability recommendations.<sup>87</sup>

As articulated in the first *Lancet* Series on Obesity,<sup>88</sup> interventions that involve changing its societal determinants are much more difficult and have much

less direct evidence of their effects, but they are much more important than programmatic and educational approaches to complex problems. Because these societal determinants are the deep drivers of The Global Syndemic, the Commissioners believe that they should be central to the debate about solutions. The following actions would support policies on The Global Syndemic, but all require fundamental shifts in societal beliefs and priorities and will face repeated resistance: reducing the effects of vested interest lobbying on public policy development, internalising the costs of a product's effects on the environment and human health into its price, redistributing wealth to alleviate poverty, reducing corruption in governments, and elevating the education, power, and status of women. The certainty that any particular lever for system change will have the desired outcome is low within the hierarchies of evidence commonly used in health. However, if achieved, the effects can be expected to be felt across the spectrum of The Global Syndemic.

Many authoritative reports from WHO, other UN agencies, and groups of independent experts contain specific recommendations for actions on obesity and undernutrition by countries, international bodies, the private sector, development agencies, civil society, and academia. The same is not the case for reports on climate change. The most authoritative body for climate change, the UN's IPCC, has produced many reports that provide evidence-graded statements about the underlying science of the problems and potential actions, but lack recommendations for specific actors.

To test the idea of double-duty or triple-duty actions, we sourced the most recent, comprehensive authoritative reports on recommendations for action for nutrition and physical activity and assessed the potential that these recommended actions might have for climate change mitigation and adaptation (appendix p 13). These preliminary assessments, presented in the following sections, show the existing overlaps across nutrition, physical activity and climate change action areas, and therefore the value behind more combined efforts. If the deep drivers of The Global Syndemic are going to be changed, independent movements, such as those that address poverty reduction, environmental sustainability, climate change, food sovereignty, social equity, hunger prevention, liveable cities, safe neighbourhoods, healthy food environments, rights of the child, and good governance, will need to be more coordinated, more coherent in their communications about the multiple benefits, and more forceful in their demands for deep change.

#### **Food systems as syndemic drivers**

For all their past successes in feeding human populations and improving their health and life expectancy, the current food systems are becoming more industrialised, globalised, and dominated by large actors capable of economies of scale and of maintaining long supply chains.

**Panel 5: Red meat as a syndemic driver**

Global meat production has increased 4–5 times from 71 million tonnes annually in 1961 to 318 million tonnes in 2014, and is projected to increase further to 455 million tonnes in 2050.<sup>93</sup> This increase reflects growth in demand from both global population increase and an increase in per-capita consumption from 20 kg to 43 kg per person per year from 1961 to 2014, linked to growing incomes and changing dietary preferences.<sup>93</sup> This level of production and consumption of red meat is a substantial driver of The Global Syndemic.

Although animals are an integral part of many well-functioning agroecological systems and permanent pastures on which animals graze can be important carbon sinks, livestock production is a major contributor to climate change (19% of all greenhouse gasses<sup>94</sup>). The greenhouse gasses are related to methane emissions from enteric fermentation, nitrous oxide emissions from manure and fertiliser application, and the considerable inputs required to grow cereal and oilseed crops for use as livestock feed in industrial livestock farming.<sup>95</sup> Livestock also use approximately 70% of global agricultural land and are a prime driver of deforestation.<sup>93,95</sup> Intensive production systems also contribute substantially to localised pollution through effluents and air pollution.

The links between excess meat consumption and obesity and related NCDs are also well known. Excess meat consumption can contribute to obesity.<sup>96,97</sup> Red meat consumption (particularly processed meat) is associated with increased risk of NCDs including cardiovascular disease,<sup>98</sup> type 2 diabetes,<sup>99</sup> and some cancers.<sup>100</sup>

Animal-source foods, including meat, provide a rich source of highly bioavailable micronutrients, especially for young children, and make an important contribution to high quality diets when consumed in moderation.<sup>101</sup> In many regions, livestock production is also an important contributor to livelihoods, household income, and national wealth, and in semi-arid and arid areas there are often few other productive land uses. However, production of feed for livestock can divert food away from direct human consumption, and threaten food security and the livelihoods of populations displaced by the expansion of crop land for feed production, which is also an important cause of deforestation.

These systems are now also becoming the source of failures that are impossible to ignore. Although sufficient food is produced to meet the dietary energy requirements of the global population, undernutrition and micronutrient deficiencies still affect more than a third of the world's population.<sup>99</sup> Agricultural systems tend to favour energy-rich staple food production, without sufficient attention to nutrient-rich foods. In many regions, vegetables, fruits, and animal-source foods are often expensive or inaccessible, resulting in monotonous diets low in nutritional quality. Furthermore, ultra-processed foods are a key driving force in the global obesity pandemic; nearly 2 billion people are overweight or have obesity.<sup>34</sup> The food system is also driving unprecedented environmental damage, contributing up to 29% of anthropogenic greenhouse-gas emissions and causing rapid deforestation, soil degradation, and massive biodiversity loss.<sup>52,90</sup>

A fundamental reorientation of food systems is required—superficial repairs at the edges will not deliver the global outcomes needed for the 21st century.<sup>91</sup> Momentum at the global and local level is building for this fundamental change. Conceptualising the current food systems as a major driver of The Global Syndemic could contribute to that momentum by articulating common drivers and interactions of obesity, undernutrition, and

climate change and in the identification of double-duty and triple-duty actions that address them.<sup>23,92</sup>

Two aspects of the current food system, red meat and ultra-processed foods, are briefly described in panels 5 and 6 to illustrate the common underlying drivers of The Global Syndemic.

*Growing consensus on the need for healthy, sustainable food systems*

The number of authoritative reports that have called for fundamental changes to food systems to make them healthier, more sustainable, and more equitable is large and growing rapidly.<sup>23,68,91,109–114</sup> The timely and concurrent publication of several reports in the early years of the UN's Decade for Action on Nutrition has created an invaluable consensus that radical changes to the food system are urgently needed. The opportunities and recommendations arising from these reports to promote planetary health include developing sustainable and healthy cities, encouraging more resilient health systems and disaster preparedness, reducing food waste, preserving ecosystems, and redirecting harmful subsidies in the food, agriculture, fishery, and energy sectors.<sup>115</sup> Many of these recommendations relate directly to reduction of greenhouse-gas emissions and implementation of effective climate adaptations.

The primary collective authority for climate change are the parties to the UN Framework Convention on Climate Change (UNFCCC). This international agreement has a process to update the science through regular IPCC assessments and progressively gain commitments from Member States to reduce greenhouse-gas emissions. However, the IPCC does not make recommendations for specific actions, and, under the 2015 Paris Agreement that complements the UNFCCC, Member States or national governments are left to define their own targets and how they will achieve them. Furthermore, the incorporation of agriculture into government actions and targets has been highly contested and very sluggish.

*Double-duty or triple-duty actions for food systems*

A wide variety of food systems exist within which transformations are needed. They span the traditional food systems, with local production and markets, low-level processing, poor storage, low diversity, little marketing, and low quality and safety standards, through to the modern food systems, with global production sites, multiple access points, high-level processing, secure supply lines and storage, high diversity, abundant marketing, and high safety standards.<sup>91</sup> Transformation should be based on the principle that food systems, regardless of variation between countries and regions, must promote health, environmental sustainability, social and health equity, and economic prosperity.

As a starting point to identify double-duty or triple-duty actions to create healthy, sustainable food systems, we examined the degree to which existing recommendations

### Panel 6: Ultra-processed foods as syndemic drivers

The manufacture of ultra-processed foods and sugary drinks is based on inexpensive commodity ingredients such as sugar, flours, and oils, often with multiple preservatives, colourings, and flavourings. These products are typically energy-dense and nutrient-poor, and offer excessive amounts of energy, fat, sugar, or sodium.<sup>102</sup> Examples include snack products such as chips or crisps, ready-to-eat cereals, sugary drinks, and confectionery. By design, these products are highly palatable, cheap, ubiquitous, and contain preservatives that offer a long shelf life. These features, combined with aggressive industry marketing strategies, contribute to excessive consumption and make these products highly profitable for the food, beverage, and restaurant industry sectors that are dominant actors in the global food system.<sup>73,103</sup> The governance systems that created the operating conditions that favour large companies that produce ultra-processed food and beverage products include: subsidies for their commodity ingredients, deregulated business operating environments, weak or ineffective accountability systems for the human health and environmental externalities that result from their production and marketing, and industry's privileged access to policy makers and decision makers to maintain these business operating conditions. This constellation of policy incentives reinforces the existing food system that produces cheap products with high profit margins through long, complex global value chains.<sup>66</sup>

Although not all ultra-processed foods are unhealthy, a high intake of these food and beverage products is linked to poor diet quality, obesity, and diet-related NCD risks.<sup>73</sup>

These products (eg, cheap instant noodles and biscuits) might also contribute to undernutrition and micronutrient deficiencies by displacing more nutritious whole foods. The high consumption of commercial snack foods is common in the diets of infants of complementary feeding age in several LMICs.<sup>104</sup> For vulnerable groups, especially infants and children living on marginal-quality diets, ultra-processed food and beverage products can contribute to both obesity and stunting.<sup>62,105</sup>

Food processing is generally considered to have a relatively small environmental effect compared with other stages of the food supply chain, such as agricultural production or transportation. For example, in the UK, food manufacturing and packaging is responsible for 19% of total food chain greenhouse-gas emissions, with agricultural production (at the farm level) accounting for much of the remainder.<sup>106</sup> However, this figure overlooks the environmental effects generated across all stages of the food system by ingredients that are eventually used in ultra-processed foods. In Australia, ultra-processed food consumption is estimated to contribute more than a third of the total diet-related environmental effects; 35% of water use, 39% of energy use, 33% of carbon dioxide equivalents, and 35% of land use.<sup>107</sup> If dietary trends continue, per-capita greenhouse-gas emissions from empty calories are estimated to nearly double by 2050.<sup>108</sup> Therefore, reduction of ultra-processed food consumption is a priority for reducing the environmental effects of the food system.

for improving nutrition and physical activity could also support climate change mitigation or adaptation. The Commission identified 66 reports published by UN agencies and independent groups between 2007 and 2017, related to obesity, undernutrition, climate change, or physical activity. Of the most recent reports with high-authoritative impact (n=11), a subset of reports (n=5) presented 255 specific recommendations for governments (appendix p 13).

The individual recommendations for governments were extracted from the five reports and categorised into overarching domains for nutrition or physical activity. We used the domain structure of the two most recent high-level reports, the High-Level Panel of Experts on Food Security and Nutrition's Report on Nutrition and Food Systems 2017<sup>91</sup> and WHO's Global Action Plan on Physical Activity 2017.<sup>116</sup> Many of the recommendations were replicated across reports. Therefore, the main recommendations were condensed into 36 across 10 domains for nutrition and 74 across 16 domains for physical activity. Two commissioners with climate change expertise provided indicative ratings on the condensed set of recommendations according to their likely effects on mitigation of, or adaptation to, climate change (tables 1 and 2; appendix p 14).

Most of the nutrition recommendations had at least a small potential to affect climate change, and some offered substantial potential (table 1). The Commission found that reframing recommendations to create healthy and sustainable diets would considerably strengthen their ratings. The existing nutrition recommendations that we identified offer great opportunities to promote double-duty or triple-duty actions. However, the multiple benefit outcomes from implementing the recommendations must be more strongly emphasised by governments to promote climate change mitigation.

#### *Investment needed to improve nutrition*

Financial costs are often highlighted as a barrier to implementation of recommendations. The World Bank has estimated that an additional investment of \$70 billion over 10 years would be needed to achieve the WHO global targets for stunting, anaemia in women, exclusive breastfeeding, and upscaling the treatment of severe wasting by 2025.<sup>117</sup> These estimates show that achieving the task is possible by addressing the underlying determinants and implementing nutrition-specific programmes. Similar analyses from the World Bank could also include estimates of the resources required to achieve the WHO targets of no increases in adult and

|   | Potential climate change effect |            |  |  |
|---|---------------------------------|------------|--|--|
|   | Mitigation                      | Adaptation |  |  |
| <b>Strengthen the integration of nutrition within national policies, programmes, and budgets</b>  |                                 |            |  |  |
| Strengthen the integration of nutrition within national policies, programmes, and budgets   | 5                               | 5          |  |  |
| Improve nutrition literacy and the nutrition workforce capacity   | 4                               | 2          |  |  |
| <b>Strengthen global cooperation to end malnutrition and hunger</b>   |                                 |            |  |  |
| Increase official development assistance and avert famines by strengthening local food systems  | 4                               | 5          |  |  |
| <b>Address the effects of trade and investment agreements on food environments and diets</b>  |                                 |            |  |  |
| Ensure that trade and investment agreements favour more sustainable food systems  | 2                               | 2          |  |  |
| <b>Address the nutritional vulnerabilities of particular groups</b>   |                                 |            |  |  |
| Ensure that vulnerable and marginalised groups can achieve an appropriate and nutritious diet   | 2                               | 3          |  |  |
| <b>Improve nutritional outcomes by enhancing women's rights and empowerment</b>   |                                 |            |  |  |
| Ensure that laws and policies provide men and women equal access to resources   | 2                               | 2          |  |  |
| Strengthen rural women's participation at all levels of policy making for Food Security and Nutrition   | 2                               | 3          |  |  |
| Create an enabling environment for breastfeeding  | 2                               | 1          |  |  |
| <b>Recognise and address conflicts of interest</b>  |                                 |            |  |  |
| Ensure transparency and accountability mechanisms to prevent and address conflicts of interest  | 2                               | 2          |  |  |
| Protect nutrition sciences against undue influence and corruption   | 2                               | 1          |  |  |
| <b>Improve data collection and sharing of knowledge on food systems and nutrition</b>   |                                 |            |  |  |
| Promote research on food systems and food demand  | 2                               | 2          |  |  |
| Improve the availability and quality of multisectoral information systems that capture nutrition-related data   | 2                               | 2          |  |  |
| Invest in systems for knowledge sharing among stakeholders in the food supply chain   | 3                               | 5          |  |  |
| (Continued from previous column)  |                                 |            |  |  |
| <b>Enhance opportunities to improve diet and nutrition outcomes along food supply chains</b>  |                                 |            |  |  |
| Support the production of nutritious, locally-adapted foods   | 3                               | 3          |  |  |
| Protect and enhance nutritional value along food supply chains  | 2                               | 2          |  |  |
| <b>Improve the quality of food environments</b>   |                                 |            |  |  |
| Implement policies that make healthy foods more accessible and convenient and restrict advertising of unhealthy food                                  | 3                               | 2          |  |  |
| Regulate health claims on food and adopt a front-of-pack food labelling system  | 2                               | 1          |  |  |
| Strengthen national food safety standards and surveillance systems  | 1                               | 1          |  |  |
| Institute policies that implement the International Code of Marketing of Breast-milk Substitutes  | 1                               | 1          |  |  |
| <b>Create consumer demand for nutritious food</b>   |                                 |            |  |  |
| Develop guidelines for healthy and sustainable diets  | 2                               | 2          |  |  |
| Implement economic and social policies that increase demand for nutritious foods and lower demand for nutrient-poor foods                             | 3                               | 2          |  |  |
| Ensure that social protection programmes, such as school feeding, lead to improved nutritional outcomes   | 2                               | 1          |  |  |
| Promote food cultures, including cooking skills and the importance of food in cultural heritage   | 2                               | 2          |  |  |
| Key for rating of recommendations on mitigation and adaption: 1=no effect; 2=small effect; 3=moderate effect; 4=average effect; 5=substantial effect. |                                 |            |  |  |

**Table 1: Nutrition recommendations, drawn from High Level Panel of Experts Nutrition and Food Systems Report, scored for potential effects on climate change mitigation and adaptation**

childhood obesity, and address the climate change consequences of our current food system.

Estimating the potential costs and impacts of achieving obesity prevention policies is challenging, but the experience of Mexico is instructive. Bloomberg Philanthropies invested in civil society actions and research over several years to achieve greater public awareness of the need for policy actions for reduction of the prevalence of diabetes and its complications, to press for measures such as taxes on sugary drinks and junk food, and more generally for social change that supports action on food and obesity (panel 7). Mexico's approach of providing philanthropic funding to consumer and

health non-governmental organisations (NGOs), to create public pressure for healthy policies, and to researchers, to evaluate their impact, could be applied in many other countries with adequate civil society and academic capacity. An investment of \$1 billion from philanthropic and other sources could plausibly support 100 countries to apply Mexico's approach to hasten the global implementation of recommended food and nutrition policies to support obesity prevention. A focus on policies with double-duty or triple-duty actions would further facilitate a return on investment.

Substantial investment in civil society action would greatly encourage the achievement of the objectives of the Decade of Action on Nutrition and the SDGs, as well as offering an important counterweight to the enormous commercial investments focused on promoting sales of obesogenic products and opposing public policies for healthier food environments.<sup>119</sup> For example, Coca-Cola intends to invest more than \$10 billion to promote business growth in India, China, and the Philippines alone.<sup>120</sup>

|   | Potential climate change effect |            |
|---|---------------------------------|------------|
|   | Mitigation                      | Adaptation |
| <b>Implement communication campaigns to raise awareness of the benefits of physical activity</b>  |                                 |            |
| (Continued from previous column)  |                                 |            |
| Develop a national communication campaigns on the benefits of physical activity   | 2                               | 2          |
| Support partnerships between health and other sectors to promote physical activity  | 2                               | 2          |
| <b>Implement mass-participation initiatives and provide access to physical activity experiences</b>   |                                 |            |
| Implement accessible events, providing opportunities to be active in local public spaces  | 2                               | 2          |
| <b>Strengthen training of health and non-health professionals in opportunities to develop an active society</b>   |                                 |            |
| Include training on physical activity in professional development of staff in health and non-health sectors   | 2                               | 2          |
| Collaborate with road safety experts to strengthen stakeholders' understanding of approaches to improve road safety                                     | 3                               | 1          |
| <b>Promote active and public transportation through policies and infrastructure</b>   |                                 |            |
| Support community-influenced transportation and urban planning policy and regulations that promote active and public transportation                     | 4                               | 1          |
| Support evaluation of transportation and urban planning policies and interventions to assess effects on health and environment                          | 4                               | 1          |
| Promote policies that create highly connected, safe neighbourhoods that are accessible using active and public transportation                           | 3                               | 3          |
| Support the strengthening of road safety legislation and interventions  | 2                               | 1          |
| <b>Strengthen access to recreational spaces and facilities for all</b>  |                                 |            |
| Promote policies enabling access to open spaces and sports facilities   | 2                               | 2          |
| Evaluate effects of open spaces on health and environmental benefits  | 3                               | 3          |
| Implement marketing restrictions on unhealthy food and beverages in and around open public spaces and sports facilities                                 | 2                               | 1          |
| <b>Strengthen frameworks to promote physical activity in and around buildings and facilities</b>  |                                 |            |
| Support building designs and regulations prioritising universal access and physical activity among users  | 2                               | 2          |
| <b>Strengthen provision and enjoyment of physical education and active recreation</b>   |                                 |            |
| Strengthen national leadership, policy, and guidance to promote physical education and active recreation for children                                   | 2                               | 1          |
| Promote walk and cycle to school programmes   | 3                               | 2          |
| <b>Implement physical activity assessment, advice, and referral into health and social care services</b>  |                                 |            |
| Implement protocols in health and social care for patient assessment, brief advice, and referral for physical activity, including for vulnerable groups | 1                               | 2          |
| (Table 2 continues in next column)  |                                 |            |
| <b>Potential climate change effect</b>  |                                 |            |
|   | Mitigation                      | Adaptation |
| <b>Enhance provision of, and opportunities for, physical activity in wide-ranging work and leisure settings</b>   |                                 |            |
| Promote national guidance, and implementation of workplace health programmes to increase physical activity among employees                              | 1                               | 1          |
| Partner with government and the sports community to strengthen provision of universally accessible opportunities for active recreation                  | 2                               | 2          |
| Evaluate the effectiveness of fiscal instruments to promote physical activity   | 1                               | 1          |
| <b>Strengthen programmes to increase physical activity in the least active groups</b>   |                                 |            |
| Implement policies and programmes to increase physical activity among older adults, the least active, and disadvantaged groups                          | 1                               | 1          |
| <b>Implement whole-of-community initiatives to promote widespread participation in physical activity</b>  |                                 |            |
| Implement whole-of-community approaches to promote physical activity, and share guidance, resources, and experiences                                    | 2                               | 2          |
| <b>Strengthen leadership, governance, and policies to increase physical activity</b>  |                                 |            |
| Strengthen high level leadership, strategic planning, and guidance for physical activity  | 2                               | 2          |
| Strengthen action plans on physical activity and maximise cooperation across relevant sectors   | 2                               | 2          |
| <b>Enhance monitoring and accountability for physical activity</b>  |                                 |            |
| Strengthen comprehensive population surveillance of physical activity and its determinants  | 2                               | 2          |
| <b>Strengthen research and evaluation capacity and strengthen innovations for policy solutions to increase physical activity</b>                        |                                 |            |
| Provide funding for institutions to undertake physical activity research and evaluation   | 1                               | 1          |
| Strengthen knowledge sharing on physical activity to advance research, policy implementation, and resource use  | 1                               | 2          |
| <b>Escalate advocacy efforts to increase action at multiple levels, targeting key audiences</b>   |                                 |            |
| Strengthen collaborative partnerships to support engagement for increasing physical activity  | 2                               | 2          |
| <b>Strengthen financing mechanisms to support action and policies to increase physical activity</b>   |                                 |            |
| Develop long-term, dedicated financing mechanisms to support physical activity  | 2                               | 2          |
| Key for rating of recommendations on mitigation and adaption: 1=no effect; 2=small effect; 3=moderate effect; 4=average effect; 5=substantial effect.   |                                 |            |
| <b>Table 2: Abbreviated recommendations for physical activity and indicative potential for effect on climate change</b>                                 |                                 |            |

### Panel 7: Civil society support drove commitment for Mexico's sugary drinks tax

Mexico provides an example of how mobilisation of civil society can generate commitment to policy change—in this case the introduction of a national tax on sugary drinks. The Alliance for Healthy Food, a coalition of civil associations, social organisations, and professionals concerned about the epidemic of overweight and obesity in Mexico, had a key role in mobilising public support and government commitment to implementation of a tax on sugary drinks in 2014. The Alliance launched a multipronged communications campaign to raise public awareness of the risks of sugary drinks, engaged directly with members of Congress, and entered into dialogue with the Ministry of Finance. These efforts coincided with a policy window as Mexico's elected President and legislature supported the adoption of a sugary drinks tax to raise revenue within a broader fiscal reform agenda.<sup>125</sup>

The Alliance campaigned for a 20% tax on sugary drinks to decrease consumption. After fierce opposition from the food and beverage industry, Mexico's Government passed a 1 peso per litre sales tax on Jan 1, 2014, that effectively increased the cost of sugary drinks by 10%. The tax was part of a suite of anti-obesity measures implemented after 2014, which included standards for healthy school meals, front-of-pack nutrition labels on packaged foods, and a ban on certain junk food advertisements aimed at children. Efforts by the food and beverage companies substantially weakened the marketing and front-of-package labelling system that reduced the overall effectiveness of Mexico's obesity prevention policies. An evaluation of the average effect of the sugary drinks tax between 2014 and 2016, found that consumers reduced their sugary drinks purchases by 7·6%. The effect was greatest among low-income households that reduced their sugary drinks purchases by 11·7%.<sup>118</sup>

### *Voluntary, quasi-regulatory, and regulatory approaches to improving food systems*

Experience from public–private partnerships involving voluntary actions with weak monitoring and accountability structures indicates that these partnerships tend to lose the support of civil society and have limited impacts. One such example is an analysis of the UK Public Health Responsibility Deal (appendix p 17). The Partnership for Healthy America provides a demonstration of partnership arrangements with the food industry that have stronger accountability structures, through agreed targets for reductions in calories and the provision of healthier foods.<sup>121</sup> These agreements with industry incorporate an external, independent evaluation, and the outcomes of the partnership are included within Partnership for Healthy America's annual reports.<sup>122</sup>

In the UK, Public Health England has taken engagement with the food industry a step further by conducting a structured product reformulation for sugar. Through this process, the government sets targets to reduce total sugar volumes sold by food category (appendix p 22). Such quasi-regulatory approaches could be important steps in achieving healthier food environments, provided that governments are prepared to implement regulation when industry actions are inadequate.<sup>86</sup>

The best example of a strong regulatory approach comes from Chile, where the extraordinary commitment of politicians, led by Senator Dr Guido Girardi, has seen a step change in international best practice for a combined

portfolio of food labelling, taxation, and regulation of marketing (panel 8). Academia and civil society organisations have strongly supported these policies, but the hallmark of Chile's progress is its political leadership, which compares favourably with the progress seen in New York City during Michael Bloomberg's years as mayor.<sup>123</sup>

### **Transportation, urban design, and land use as syndemic drivers**

Transportation systems, urban design, and land use are interconnected systems that have an enormous effect on climate change and obesity through their effects on greenhouse-gas emissions, physical activity, and diet.

Transportation accounts for approximately 14% of greenhouse-gas emissions.<sup>124</sup> Car use has been associated with an increased risk of obesity,<sup>125</sup> and changes in commuting from cars to active or public transportation have been associated with reductions in BMI.<sup>126</sup> Furthermore, reduction in carbon dioxide emissions through reduced motor vehicle use and increased active travel (eg, bicycling or walking) exceeds the reduction in greenhouse-gas emissions that could be expected from increased use of lower emission motor vehicles.<sup>127</sup> Transportation systems and community designs that support active transportation, reduced car use, and access to healthful foods are triple-duty actions for The Global Syndemic.

Urban design and land-use planning involves shaping, building, or retrofitting the built environment, open spaces, residential and commercial buildings, and transportation systems at city and neighbourhood scales. Urban design relies on the use of tools, such as land-use zoning and planning layouts of streets, roads, transportation, public spaces, and residential and commercial areas. In recent decades there has been increasing recognition of the many ways in which urban planning and design can affect human health.<sup>128</sup> Additionally, the challenges of global environmental change make it essential that cities become more sustainable, and many overlaps exist between health and sustainability at the urban level.<sup>129</sup> Re-establishing the link between urban planning and public health is a high priority, although the evidence base for this association is overwhelmingly from high-income countries and it receives surprisingly little attention in LMICs.<sup>130</sup>

Urban and rural environments are changing rapidly. In 1990, an estimated 43% (2·3 billion) of the world's population lived in urban areas. By 2015, urban populations had grown to an estimated 54% (4 billion).<sup>131</sup> The changing economic and governance conditions in the past few decades have tended to increase segregation and inequities in cities and towns and made them increasingly dysfunctional living environments for many residents.<sup>132</sup> Although affecting all regions of the world to some degree, these processes have been most tangible in

### Panel 8: People's experience—the Chilean Senator's battle for food policies

Three-quarters of Chileans are either overweight or have obesity. As a physician and later in my role as Senator, since 2006, this health issue has been of great concern to me. Since assuming the Presidency of the Senate's Health Commission in 2011, I have sought to tackle this challenge head-on, by exploring a law capable of dealing with the—not always obvious—underlying causes, such as the marketing strategies promoting unhealthy foods.

Key to bringing this discussion into the Senate was forming a strategic alliance with the research community, spearheaded by Dr Ricardo Uauy, one of the world's leading nutrition specialists. This alliance provided the evidence base and credibility necessary to garner the support and momentum for change.

Before even contemplating any specific proposals, one of the first challenges encountered was how to define unhealthy food and identify its negative health impacts. Our second challenge was to harness this evidence to effectively demonstrate that there was a need for a law to tackle the issue. This was not without a great deal of resistance, of course. The food industry, marketing companies, and politicians of the opposition alike, all claimed that there was no valid basis for the law.

These challenges prolonged the process of passing of the law, so much so that it wasn't until after four years of Senate discussions, including on traffic light labelling of foods versus warning labels, that the law was finally approved in 2012.

The journey had only just begun—we still needed to obtain the signature of the President and define regulatory norms (including a nutrient profile system and warning label format).

The Chilean President at that time, Sebastián Piñera, faced enormous pressure from the food industry and subsequently

vetoed the bill. With several other Congressmen, we staged daily demonstrations, posters-in-hand emblazoned with messages including "Our President, selling out the health of our children", at the gates of the Presidential Palace. The pressure was fierce, and ultimately led to the reinstatement of the law. However, after a further year of discussion, the Ministry of Health proposed a weak set of regulatory norms inconsistent with the law's original aim.

In 2014, Michelle Bachelet became President, supported by the political coalition of which I am a part. She swiftly halted the approval of the regulatory norms proposed by the previous government, and formed a new Committee drawing on the participation of academia, government, and civil society to propose new regulatory norms consistent with the original spirit of the law. This was met by strong opposition from the Finance and the Agriculture Ministers and propagated by extensive media coverage. In response, a group of Senators pledged that they would leave the President's coalition if the law was not approved. This unwavering conviction finally secured the approval of the regulations in June, 2015, allowing for their gradual implementation over the 3 years that ensued.

I am pleased with the law and all that we have achieved, but conscious that its enforcement will require both continuous monitoring by society and accountability from policy makers. The rigorous evaluations underway will certainly improve the law's application, and I am thrilled that several countries are following Chile's lead towards better regulation.

Contributed by Senator Dr Guido Giradi, Chile.

megacities in LMICs, where "huge office complexes linked to world financial markets, gated residential estates for the wealthy, and luxurious leisure playgrounds for the rich and famous have taken centre stage in city building, under circumstances where the poor and marginalised are pushed aside, allowed to languish in poverty and destitution in impoverished ghettos in the 'in-between' places of the city".<sup>133</sup>

The appropriate planning, design, or retrofitting of built environments and transportation systems can facilitate and promote safe outdoor physical activity and active transportation. In addition to growing mass transit and safe commuter cycling, neighbourhood-scale interventions can promote physical activity. These interventions include designing new neighbourhoods with a fine-grained street network, a mix of land uses and destinations, a range of appropriate public spaces for recreation, upgrading pavements and public spaces (eg, better paving and the planting of trees), building bicycle lanes, and improving street lighting.<sup>134–136</sup> Neighbourhoods also need to be designed to be safe, through having eyes on the street for example, to ensure that outdoor spaces can be used without fear of crime and violence. In cities

that have low densities, densification and compaction of buildings can create mixed-used environments with a range of destinations to which people can easily walk and cycle. Cities such as Bogota, Colombia, and Curitiba, Brazil, are notable examples that have focused investment on public transportation, and have improved the living environment of low-income residential areas through participatory planning and budgeting processes, investment in neighbourhood parks, and the promotion of non-motorised transportation.<sup>137,138</sup>

A recent *Lancet* Series formalised these observations by concluding that eight regional and local interventions would promote walking, cycling, and public transportation and reduce car use.<sup>139</sup> These interventions included access to desirable destinations, decreasing demand for car use by reducing the availability and increasing the cost of parking, designing networks that encouraged walking and cycling, increasing residential density, increasing access to public transportation, increasing the attractiveness of active travel through the creation of safe neighbourhoods and safe affordable and convenient public transportation, and providing equitable distribution of employment across cities. Pavements, bike lanes,

## Panel 9: Food deserts and swamps

In some cities in high-income countries, residential segregation and land-use zoning can result in low-income people living in food deserts characterised by a relative lack of healthy and nutritious food options or food swamps characterised by an excess of fast food chains and food outlets selling processed foods.<sup>142,143</sup> For example, a study of two US localities found that obesity was more prevalent in areas with more fast food outlets and small grocery stores and less prevalent in areas with more supermarkets.<sup>144</sup>

Food deserts are rarer in cities in low-income countries, where traditional marketplaces and informal vendors have an important role in food systems, and land-use zoning has less influence on actual land use because a substantial proportion of land use is informal, resulting in slums and other informal settlements. Generally large numbers of informal food retailers exist in low-income areas, but they are still “poor, often informal, urban neighbourhoods characterised by high food insecurity and low dietary diversity, with multiple market and non-market food sources and variable household access to food.”<sup>145</sup> The net result is that, for most residents of low-income areas, getting sufficient and healthy food to eat is a constant struggle.<sup>146</sup>

The rapid growth of supermarkets in low-income countries might exacerbate this problem by competing with the small retailers and encouraging consumption of inexpensive processed foods.<sup>147-149</sup> Food system power asymmetries need to be addressed through policies and subsidies to empower small and medium farmers, local and regional markets, and short food chains. These producers and the diversity of their products are excluded from big food chains dominated by big food and supermarket corporations. Small and medium farmers and local and regional markets maintain food diversity (eg, vegetables, fruits, and grains) that are the base of traditional cuisines and diets. These forms of agriculture reduce the greenhouse-gas emissions and can reduce agrochemical use. The scarcity of infrastructure and oversight for markets and food vendors in low-income countries can also result in food contamination, with its associated health risks.<sup>150</sup> Finally, in both high-income countries and LMICs, urban sprawl in periurban areas can have a negative effect on food production, resulting in the loss of agricultural land and ground and water pollution.<sup>151</sup>

and streetscapes that include green canopy cover have a double benefit of making opportunities for physical activity more attractive and increasing uptake of carbon dioxide by plants and trees.

Urban and rural areas are closely interlinked in many ways and have several effects on one another, so interventions in urban areas need to be accompanied by interventions in rural areas. A high priority is the reduction of periurban sprawl, which can have negative effects on ecosystem services and the land available for agriculture.

### Urban design and food systems

In some cities in high-income countries, land-use zoning can create urban environments that promote food systems for healthy and sustainable diets. Strategies include the promotion of urban agriculture, government regulation of the location, nature, and size of food and restaurant outlets (although the evidence for the effectiveness of this intervention is mixed), and incentivising food retailers and restaurant outlets that sell healthy products to relocate to low-access areas.<sup>140</sup>

In LMIC cities, the high degree of informality leads to weak government regulatory approaches, such as land-use

zoning, and therefore less direct infrastructure provision and implementation of projects that shape urban environments. Upgrading market places, designing suitable spaces and providing appropriate infrastructure (eg, water supply and protection from the sun) for preparation and sale of street food, creating suitable spaces for urban agriculture, and providing access to resources for low-income households to become involved in urban agriculture are all ways to increase food security and promote healthier diets in cities in LMICs (appendix p 23).<sup>141</sup> The urban design contexts in high-income countries and LMICs develop differently in the creation of food deserts and food swamps (panel 9).

### Planning, development, and retrofitting

Ultimately, governance systems and processes need to become more collaborative to ensure that the views and interests of all key stakeholders are adequately included (discussed in the governance challenges section). Within governance processes, however, particular urban planning decisions contribute to reducing obesity and undernutrition while simultaneously strengthening climate change mitigation and adaptation. The *Lancet* Series on Physical Activity identified a critical need to improve decision making by policy makers, and made a number of recommendations for improving the translation of research into practice that could inform the decision-making process.<sup>152</sup> These recommendations included identification of policy-relevant research questions, development and implementation of policy-relevant research methods, dissemination of strategies to decision makers, and engagement in advocacy. Each recommendation included strategies and steps for implementation. In addition to these recommendations, several other crucial areas deserve attention. At the national level, in countries such as the USA, subsidies for fossil fuels keep petrol prices artificially low, thereby encouraging car use and providing no incentive to invest in active and public transportation. A second important challenge is how to incentivise developers to incorporate healthier and more environmentally-friendly designs in new developments. The third challenge is that the design of new communities and neighbourhoods rarely take into account the needs of marginalised populations. The absence of public transportation and the distance between where workers live and where their jobs are located leads to lengthy commutes and potentially underemployment. Holding governments accountable for decisions related to transportation, urban design, and land use will require greater awareness of the adverse health effects and environmental effects and the true costs of current practices.

### City leadership

Urban design and land use reflects the various underlying social and economic conditions and governance systems under which they have developed, resulting in very

different types of urban and rural environments in different parts of the world. For example, there are some compact and dense cities that are suitable for walking and cycling, sprawling cities dominated by freeways for cars, formal housing areas with good quality housing and services, overcrowded slums with a lack of basic services, high-density subsistence farming areas and low-density commercial farmland.

Most large cities are forced to address the pressing twin challenges of traffic congestion and air pollution and many are showing progressive leadership in these areas. Switching reliance on cars and trucks to more public transportation, active transportation, and rail freight will address the targeted issues of congestion and air quality as well as reduce greenhouse-gas emissions and increase physical activity. The next logical step is leadership on climate change itself, which many cities have done through the C40 initiative that now has 96 affiliated cities

covering 25% of the world's GDP,<sup>153</sup> and other platforms, such as WHO's Healthy Cities<sup>154</sup> that has more than 1000 affiliated cities. This collective leadership across cities will serve to activate national actions on climate change as well as fill the gaps in areas in which national actions are weak. Although evaluation of the attributable impacts of healthy city approaches is challenging,<sup>155</sup> such initiatives can create the collective momentum among leaders, translating, in theory, into societal and infrastructure change.

#### *Effects of physical activity recommendations on climate change*

WHO recently published a set of recommendations for increasing physical activity, many of which aimed to improve built environments, access to recreation, and other infrastructure to support active recreation and commuting for health (table 2; appendix p 24).<sup>156</sup> Most of the existing recommendations to increase physical

|  | Prevalence of female obesity* | Prevalence of underweight in 5–19 year old girls† | Carbon footprint (greenhouse-gas emissions in tonnes per capita per year)‡ | GDP per capita (constant 2011 international dollars)§ | Gini coefficient¶ |
|--|-------------------------------|---|--|---|-------------------|
| Andean Latin America                   | 24%                           | 7%  | 3.7  | \$10 407  | 45.2              |
| Caribbean                              | 28%                           | 17%   | 4.2  | \$5855  | 20.8              |
| Central Africa                         | 9%                            | 22%   | 3.9  | \$2815  | 42.0              |
| Central Asia                           | 20%                           | 14%   | 8.7  | \$10 824  | 17.8              |
| Central Europe                         | 21%                           | 15%   | 8.0  | \$21 738  | 30.4              |
| Central Latin America                  | 29%                           | 10%   | 4.8  | \$14 255  | 42.7              |
| East Africa                            | 8%                            | 19%   | 1.5  | \$2044  | 33.8              |
| East Asia                              | 8%                            | 20%   | 9.3  | \$12 737  | 41.2              |
| Eastern Europe                         | 25%                           | 16%   | 13.7   | \$20 894  | 34.3              |
| High-income Asia Pacific               | 4%                            | 13%   | 11.2   | \$37 526  | 31.0              |
| High-income English-speaking countries | 33%                           | 6%  | 18.5   | \$48 617  | 38.6              |
| Melanesia                              | 25%                           | 6%  | 1.8  | \$3 930   | 40.9              |
| Middle East and North Africa           | 34%                           | 18%   | 7.4  | \$17 573  | 27.0              |
| North Western Europe                   | 20%                           | 10%   | 10.1   | \$45 171  | 30.1              |
| Polynesia and Micronesia               | 53%                           | 1%  | 2.4  | \$29 61   | 17.7              |
| South Asia                             | 5%                            | 48%   | 2.2  | \$4 955   | 33.7              |
| South Western Europe                   | 23%                           | 7%  | 6.7  | \$33 426  | 34.5              |
| Southeast Asia                         | 8%                            | 32%   | 3.6  | \$9 404   | 37.8              |
| Southern Africa                        | 34%                           | 17%   | 8.2  | \$9 967   | 58.8              |
| Southern Latin America                 | 26%                           | 13%   | 6.5  | \$16 238  | 49.5              |
| Western Africa                         | 14%                           | 23%   | 1.6  | \$3 882   | 41.0              |

Figure 3: Key Global Outcome indicators by region

Colours represent the tertile: green=the most favourable tertile; amber=the middle tertile; red=the least favourable tertile. GDP=gross domestic product. \*Data collected from NCD Risk Factor Collaboration, for 2014.<sup>157</sup> †Data collected from NCD Risk Factor Collaboration, for 2014.<sup>158</sup> ‡Data collected from the World Bank, for 2014.<sup>159</sup> Carbon dioxide emissions are those from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. The World Bank source—Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States. Indicator code—EN.ATM.CO2E.PC. §Data collected from World Bank, for the latest year available 2014.<sup>159</sup> GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the US dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. ¶Data collected from the World Bank, for 2008–2015.<sup>160</sup> Gini coefficient measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus, a Gini index of 0 represents perfect equality, whereas an index of 100 implies perfect inequality.

activity for health might also have some benefits for climate change mitigation and adaptation. Apart from specific transportation infrastructure strategies, the estimated potential effect of each strategy is likely to be small. However, the collective effects could be substantial. If these strategies were consciously revised as double-duty actions, they could produce more substantial effects.

### Country contexts for action

Countries and regions operate under very different contexts in relation to their progress on achieving the global outcomes of economic prosperity, human health, social equity, and environmental sustainability (figure 2A; figure 3; appendix p 4), affecting their priorities in addressing The Global Syndemic.

### Economic prosperity

The focus of many countries is economic growth, and the top priority for low-income countries is reducing poverty. Many internal systems and development aid are focused on supporting businesses to create individual, community, and national prosperity. Although global indicators clearly show a rise in income, wealth, and living standards over time,<sup>161</sup> the major caveat is that increasing prosperity has been shared very unevenly, and in some areas, wealth creation has occurred at the expense of health loss (eg, economic activity from the tobacco, alcohol, and unhealthy food industries). Central to continuing improvements in prosperity is the creation of business models that incentivise restoration and sustainment of human and ecological health and wellbeing, because the dominant business models of the 20th century have been too destructive, especially in over-extracting the planet's resources and overwhelming its carrying capacity in many areas, including greenhouse-gas emissions. One of the future effects of climate change is the severe threat it poses to economic prosperity.

### Natural ecosystem health and wellbeing

In recent geological timespans, the global ecosystem has remained relatively stable, notwithstanding the semi-regular cycles of the ice age. However, when explorers inhabited virgin territories that had no previous experience of humans, such as the Americas, Australia, and New Zealand, pockets of population explosion, loss of habitat, and species extinctions rapidly followed.<sup>162</sup>

This disruption and overburdening of ecosystems is now occurring at a global scale, and human-induced climate change is accelerating at a rapid rate driven by increases in population numbers and consumption.<sup>163</sup> In general, the carbon footprint and GDP are inversely related to each other, and no country or region is in the best tertile for both indices (table 3; appendix p 4).

### Human health and wellbeing

In the past century, almost all global indicators of human health, such as life expectancy, maternal and infant

mortality, and deaths from infectious diseases, have been heading in the right directions, albeit with a number of caveats. The first caveat is that improvements have been much more substantial for wealthy populations than poor populations. The second is that obesity and diabetes are major diseases that are still increasing in all countries. Finally, climate change and the loss of the ecosystems on which we depend are the largest health risk in the future.<sup>39</sup> South Korea and Switzerland are the only countries in the best tertile for both low prevalence of obesity and underweight (appendix p 4).

### Social equity

In the absence of robust democratising institutions, human societies tend towards inequalities of wealth and power, because the powerful tend to create and maintain societal conditions to support their power. The two World Wars and intervening Great Depression reduced the wealth inequalities somewhat.<sup>171</sup> But in the past 50 years of rapid globalisation, an increasing concentration of power and wealth in the hands of a small number of individuals and corporations has occurred. Since the 1980s, the rise of neoliberal governance approaches has been the dominant political and economic paradigm of democracies. Neoliberalism involves the government deregulation of markets, small government, and reduced social protections, and has resulted in a growth in asset wealth far exceeding rises in salaries and wages, causing a resurgence of increasing inequalities within and across countries.<sup>161,171,172</sup> Climate change has led to major weather events, crop failures, food insecurity, and other adverse health consequences. The effects of climate change will be more pronounced for poorer people living in LMICs, and will further escalate existing social inequities.

### Strengthening public sector governance

By governance we mean the organised efforts to manage the course of events in a social system.<sup>173</sup> Governance includes the totality of "political, organisational, and administrative processes through which stakeholders, including governments, civil society and private-sector interest groups, articulate their interests, exercise their legal rights, make decisions, meet their obligations, and mediate their differences".<sup>174</sup>

### Governance challenges

We present four key governance challenges for addressing The Global Syndemic. Effective governance will require coherent action across diverse sectors from global to local levels, strong commitment from all relevant stakeholders, sufficient capacities and resources to enable and sustain such action, and the attenuation of systematic power imbalances within food systems. These challenges are contextualised against a backdrop of contemporary changes in global, national, and local governance systems.

|  | Relevance to The Global Syndemic  | Issues  |
|--|---|---|
| <b>Leadership</b>  |   |   |
| Leaders of major movements or campaigns are typically highly committed and politically savvy individuals who galvanise community support, motivate and organize collective efforts, and counteract powerful opponents  | Strong leadership from academia, civil society, and government has already had important roles in generating support for government action on obesity prevention, community design, and climate change, and will continue to be needed even after initial successes become evident  | Tobacco, gun control, infant nutrition <sup>164,165</sup>                     |
| <b>Scientific evidence</b>   |   |   |
| Trend data and modeling can demonstrate the effects of a problem, generating attention and support for action. Research can demonstrate causes, point to potential actions, and reduce uncertainties that opponents might use to delay change. Legal research helps to avoid and overcome court challenges by opponents                                | Data and models demonstrating the harms associated with The Global Syndemic can be used in media and other advocacy communications to support demands for action. Evidence is needed to document outcomes from double-duty or triple-duty actions. Evidence opposing policy change generated by vested interests can intentionally confuse the picture  | Tobacco, alcohol <sup>164,165</sup>   |
| <b>Issue framing</b>   |   |   |
| Transition from a focus on individual behaviour to the environments in which the behaviour takes place. Individual responsibility remains in frame but becomes secondary to collective and environmental action  | The use of an obesogenic frame emphasises the role of the broader environmental determinants of obesity rather than blaming individuals with obesity. Broadening the frame of obesity to include transport, urban design, and climate change can create a broader base of support for policy change   | Tobacco, alcohol, gun control, traffic safety <sup>164-166</sup>              |
| <b>Focus on industry</b>   |   |   |
| Emphasis on the role of industry can encourage mobilisation and collective action. Industry often counteracts this process by giving a misleading impression that they are acting in the interests of public health  | Activism that takes a hard line against business models that market high-calorie, nutrient-poor foods and beverages is a necessary component of effective efforts to curb the obesity epidemic. The primacy of profits over health and a focus on costs that account for environmental impact of transport, land use, and food production could shift the focus from individual responsibility to corporate and government negligence   | Tobacco, gun control, traffic safety, infant nutrition <sup>164,166-168</sup> |
| <b>Population focus</b>  |   |   |
| Protection of vulnerable populations, particularly infants and children, resonates strongly with the public and with policy makers   | A focus on the effects of aggressive marketing of high-calorie, nutrient-poor foods and their contribution to childhood obesity can mobilise parents, civil society groups and legislators in support of policy change. Educating children about the effects of climate change on their current and future environment might influence adult behaviour, as has been the case with tobacco   | Tobacco, gun control, traffic safety, infant nutrition <sup>164,168,169</sup> |
| Among adults, an emphasis on special efforts to effect actions for populations living in poverty or with other social disadvantages, in addition to whole-of-population strategies, can allow for fairness arguments and moral power. This approach might mobilise certain special interest groups as well as the broader population                   | Socially disadvantaged communities are disproportionately affected by undernutrition, climate change, and increasingly by obesity. Fair and just opportunities for access to healthy food, options for physical activity, and a healthy environment are often less favourable in the physical and economic environments of these communities  | Tobacco, alcohol <sup>164</sup>   |
| Taxation of sugar drinks, elimination of subsidies for fossil fuels, and paying the true costs of petrol and meat might be perceived as regressive. The regressive nature of taxes can be countered by earmarking taxes to provide related services to low-income communities (eg, using tobacco tax revenues to pay for smoking cessation programmes) | Arguments that taxes on sugar drinks or high-calorie, nutrient poor foods are regressive are countered by their progressive effect on health, creating greater health gains for those with less income through larger gains in health-related behaviours, and by strategies that direct tax revenues to community benefits, such as providing potable water in schools, subsidising the purchase of healthy foods, increasing access to parks and recreational facilities, or increasing access to early childhood education. Paying the true costs of petrol and meat will increase their costs and reduce consumption | Tobacco, alcohol <sup>164</sup>   |
| <b>Interest groups and coalitions</b>  |   |   |
| Broad based coalition-building can happen at all levels to galvanise a community, overcoming competition between risk-factor or disease communities and combining forces to address issues of mutual interest  | Initiatives led by interest groups acting in coalitions have effectively succeeded in taxing sugary drinks and supporting controls on food marketing to children. Increasingly, groups are forming in which patient advocates work with health and research professionals around public education, protection from discriminatory policies, and advocacy for changes in health-care delivery systems  | Tobacco, alcohol, infant nutrition <sup>164-166,168-170</sup>                 |
| <b>Mass movements</b>  |   |   |
| Activists grouped en masse can cut through barriers to political action by seizing the attention of policymakers. Self-help groups of people directly affected by the issue are especially effective   | Focusing on obesogenic environments counters arguments about personal responsibility for obesity. Movements around community livability can include walking or cycling, which are double-duty actions for The Global Syndemic   | Alcohol <sup>166</sup>  |
| <b>Leveraging local control</b>  |   |   |
| National movements have usually begun at the local level. Government ordinances at the state or local level confer benefits on small communities along the way to broader social change  | In many cases local governments are adopting obesity prevention policies and taking regulatory actions to address obesogenic food environments. For example, California, USA, is maintaining fuel efficiency strategies that reduce greenhouse-gas emissions despite efforts of the federal government to loosen those standards. These strategies provide precedents for action that can be used by other localities   | Tobacco, alcohol, gun control <sup>164,169</sup>                              |

**Table 3:** Descriptions of complementary factors of current or past public health actions related to tobacco, alcohol, gun control, traffic safety, and infant nutrition and implications for making progress on obesity

#### Governance challenge 1: driving coherent action

Addressing the drivers of The Global Syndemic requires coordinated and sustained action within and across many sectors—health, agriculture, environment, finance,

transportation, economic development, and urban planning among others—from global to local levels.

Achieving coherence has presented a considerable challenge. WHO and other expert bodies identify a hybrid

approach to food and nutrition governance—multi-stakeholder or public-private partnerships—as a key mechanism for addressing the complexity of this challenge.<sup>175</sup> However, such arrangements have raised concerns regarding conflicts of interest, the conflation of private interests with citizen's interests and rights, and power asymmetries in decision making. Existing evaluations show mixed results, varying by issue, nature of the engagement, complexity of the governance structure, and diversity of partners and interactions.<sup>175,176</sup> Similar challenges exist at the global level (appendix p 32). Some actors have an explicit mandate to improve nutrition, whereas other actors do not. Some focus on undernutrition and food security, and others focus on obesity and diet-related NCDs. This institutional complexity increases the potential for divergent interests and world views, competition for resources, and duplication of efforts. It reflects broader contemporary changes in the global health governance system since the 1990s, particularly the substantial increase in the number and diversity of actors who are involved in global governance.<sup>177</sup>

At the country level, experiences suggest that a more state-anchored approach can drive multisector or multi-level actions that involve empowered government-coordinating agencies, well designed policies, and institutional systems. Successful efforts at reducing undernutrition in several countries have included governance bodies and coordinating agencies with sufficient authority, capacities, financial resources, and leadership, and line agencies (eg, health, agriculture, and education) responsible for implementation. The direct participation of high-level political champions and the existence of non-partisan parliamentary coalitions for nutrition have further strengthened and sustained responses across cycles of political change. Strong incentives have helped drive coherence, including inclusive governance bodies for civil society and stakeholder engagement, legislation that mandates cooperation, and shared indicators and targets that are sector-specific and time-bound. In some cases, performance-based or results-based budgeting has incentivised cooperation and improved transparency and accountability.<sup>178,179</sup> The UN Decade of Action on Nutrition (2016–25) provides an important umbrella framework to galvanise action, and the strengthened Committee on Food Security is a key forum to coordinate actions that address malnutrition in all its forms.

**Governance challenge 2: generating and sustaining commitment**  
 Commitment is the willingness for people and institutions to act until the job is done. Credible and sustained commitment from political leaders who champion policy initiatives, government officials who coordinate action, civil society groups who advocate for attention and resources, and affected community groups and individual citizens is crucial to drive coherent policy responses.<sup>180,181</sup> Interventions that target obesogenic food environments

and food systems are frequently and systematically undermined by the coordinated efforts of powerful food and beverage industry groups.<sup>181</sup> Rhetorical commitments to address undernutrition have not been supported by policies, coordinating structures, and financial resources owing to ineffective civil society pressure, limited visibility of the issue, and weak public demand.<sup>178,180</sup> In relation to undernutrition, policies that emphasise agricultural commercialisation, cash-cropping, and economic growth (ie, productivism) have impeded more balanced nutrition-sensitive policies that would promote dietary diversity and meet local nutritional needs.<sup>181,182</sup>

Even more challenging is the inclusion of food and agriculture within the commitments on climate change under the 2015 Paris Agreement. The collective efforts to increase trade through multiple rounds, from the General Agreement on Tariffs and Trade established in 1947 to the World Trade Organization, have struggled to include agriculture in the process to reduce tariffs, quotas, and subsidies. This same political struggle happened again in climate change commitments. The enormous political power of the food and agricultural system industries has consistently overwhelmed individual and collective government efforts to promote the public interest rather than commercial interests.

What can drive and sustain commitment across all actors? Studies have identified a web of drivers, including political champions (eg, heads of state, cabinet members, and parliamentarians) and non-partisan support (ie, multi-party or multi-faction) at the highest levels.<sup>178,181,183</sup> Mobilised civil society is also a considerable driver. Civil society coalitions, including non-government organisations and informal social movements, have had important roles in generating attention, informing policy processes, and sustaining political commitment for food policies.<sup>184</sup> These civil society actors have crucial roles in governance by raising public awareness, giving voice to politically marginalised groups, holding governments accountable for public policies,<sup>178,185</sup> and informing policy development, monitoring, and evaluation.<sup>178,183,184</sup> These roles are enhanced in the context of inclusive governance arrangements that connect such groups (including policy beneficiaries) with decision-makers, and by legal commitments in international human rights treaties endorsed by governments (discussed in the Right to wellbeing section). In short, an active civil society can have a key role in strengthening the accountability, inclusiveness, transparency, and responsiveness of governance systems. For example, the mobilisation of a cohesive civil society coalition was crucial in driving commitment for a sugary drinks tax in Mexico (panel 7).

**Governance challenge 3: mobilising capacities and resources for impact**

Governance for addressing The Global Syndemic will require commitment and coherence of action, but also

the capacity and resources to act. In many countries, weak organisational capacities—including the absence of trained professional and administrative staff, the high administrative burden of working with diverse stakeholders, weak budgeting and accounting systems, and poor technical capacities—have undermined planning activities, programming efficiency, and the accountability of governing institutions related to undernutrition.<sup>178,186</sup> Another crucial and overlooked aspect is strategic capacity—the soft-power and interpersonal skills required to drive collective action across diverse actor networks. Strategic capacity includes the capacity to build coalitions, manage conflicts, respond to emerging opportunities and threats, manage complex policy processes, and undertake strategic communication.<sup>178,184,187</sup> The absence of line items for undernutrition in government budgets, inadequate budgetary allocations, or the failure to use finances (particularly at subnational levels) has often resulted in policy failure.<sup>180</sup> Panel 10 presents a case study of Kisumu Kenya showing how capacity and resource limitations and the fragmentation of governance among large numbers of stakeholders can hinder urban food governance in developing countries.

The expansion of government budgetary commitments and establishing effective financing systems, through donor support and technical assistance, is important for empowering governing institutions and implementing agencies, mobilising human resources, and establishing entitlements among government officials, interest groups, and citizens that generate continued political support.<sup>178,196,197</sup> Such governance might also include policy mechanisms that provide technical and financial support for under-resourced subnational governments and other implementation partners.<sup>178</sup> As with Kisumu, collaborative governance arrangements can bring together a diverse range of stakeholders to pool resources and collaborate on developing holistic and inclusive strategies. Capacity-building initiatives might also include, interdisciplinary tertiary training and leadership programmes at country or regional levels.<sup>198</sup>

#### *Governance challenge 4: addressing power asymmetries in food systems*

The expansion in the size, reach, and concentration of transnational food corporations and their massively increased, well-coordinated, political and economic power constitutes a major challenge to governance.<sup>181,199</sup>

The large, powerful food and beverage corporations (Big Food) have used multiple strategies to obstruct obesity prevention. These strategies include adopting self-regulation to pre-empt and delay state regulation, public relations to portray industry as socially responsible, undermining and contesting the strength of scientific evidence, direct lobbying of government decision makers, and framing nutrition as a matter of individual responsibility (ie, norm promotion).<sup>181</sup> Big Polluters, such as the large, powerful fossil fuel and cattle corporations,

#### **Panel 10: Challenges of collaborative local governance—urban food systems in Kenya**

Urban governance in many cities throughout the developing world involves a wide range of actors, often with limited capacities and conflicting agendas, and with few processes for collaboration or reaching consensus.<sup>188</sup> The city of Kisumu in Kenya, Africa, offers an example. The rushed and partial decentralisation of public authority in Africa in the past few decades has often resulted in local governments that are “weak, disorganised, inadequately trained and staffed, and often under-resourced relative to their expected range of responsibilities.”<sup>189</sup>

The food retail sector in African cities operates independently of government control, adding to the governance challenge. The wide variety of food retailers include traditional market places, shops and kiosks, and street food vendors. Market places are a particularly important element of urban food systems in Africa and are an important site of urban governance. In Kisumu, most food is bought and sold in the city’s many urban markets, which provide employment for approximately 60% of the city’s labour force.<sup>190</sup>

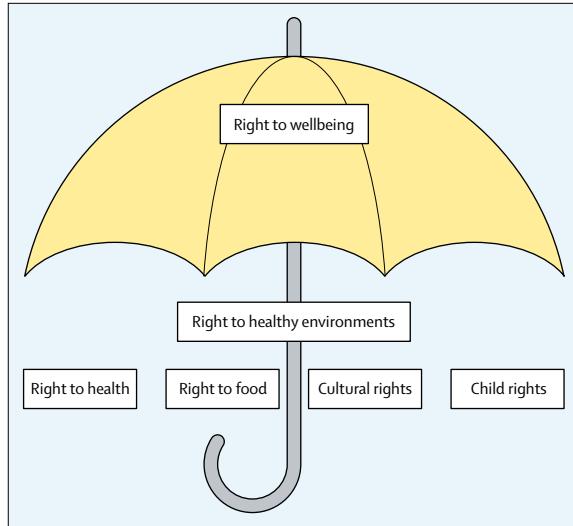
The municipality collects fees from traders but provides little in return.

Like other parts of Africa,<sup>191,192</sup> the number of supermarkets in Kisumu has increased rapidly. Although their governance will be of increasing importance, local government control over where supermarkets are located, their design, or what they sell has been limited. The implications of this transformation for urban food security are not well understood. However, the shift from local food production and an informal retail sector to formal supermarkets with international supply chains might result in decreased food security due to higher and less flexible prices and increased amounts of processed foods.<sup>148</sup>

The diversity of actors can be both a challenge for governance and an opportunity to mobilise additional skills and resources to address urban food and nutrition problems. In this regard, there have been repeated calls for collaborative governance—bringing multiple stakeholders together in common forums with public agencies to engage in consensus-orientated decision making<sup>193</sup>—and for the co-production of projects and policies by a range of urban governance actors.<sup>194</sup> In Kisumu, the Kisumu Action Team and Kisumu Local Interaction Platform have convened stakeholders to pool skills and resources and develop a number of ambitious strategies for Kisumu, such as upgrading market places and improving urban food security,<sup>195</sup> exemplifying the potential for stakeholders to begin to work together through collaborative governance.

have used these same strategies to undermine strong government commitment and public support for action on climate change.<sup>200</sup> Big Food’s obstructive power is enhanced in the context of hybrid governance arrangements that legitimise industry participation in public policy, and their financial resources and structural importance within national economies as suppliers of jobs and tax revenue. Furthermore, trade liberalisation, and with it greater international capital mobility, enables corporate actors to punish and reward governments for their regulatory decisions by relocating or threatening to relocate investments and jobs, or through threats of legal action under provisions for settlement in investor-state disputes in trade agreements.<sup>18,181,199</sup>

One strategy to address power asymmetries in the food system is to strengthen antitrust (ie, competition) laws to mitigate the economic and social harms of market concentration, and to define consumer welfare by something other than low prices.<sup>199</sup> Another strategy is to more strongly anchor food and nutrition governance within rather than outside of government, alongside inclusive



**Figure 4:** Intersection of human rights that comprise the overarching right to wellbeing framework

structures for meaningful civil society engagement and transparent processes for mitigating conflicts of interest related to private sector involvement.<sup>176,201,202</sup> Strategies for strengthening the role of small-sized and medium-sized food system actors in governance is receiving increasing recognition. This trend is illustrated by the growth of urban food governance initiatives, including inclusive structures (eg, food policy councils) and local government ordinances (eg, planning regulations) that support for-profit and for-community food system activities by these actors at subnational levels.<sup>203</sup>

#### Next steps for strengthening governance

Strengthened governance systems at global, national, and local levels are urgently needed to address The Global Syndemic. Governing effectively will require coherence of action across several sectors and levels of society, credible and sustained commitment by the diversity of actors who govern, and the capacities and financial resources to govern. It will also demand actions that address the skewed distribution of power within the food and transportation systems that favour the status quo. The fragmentation of responsibility among large numbers of governance stakeholders with conflicting agendas and division of interests represents a further challenge that could be addressed through collaborative governance.

The slow and patchy progress to date in controlling The Global Syndemic, especially the obesity and climate change components, indicates the urgent need for a fundamental change in today's governance systems. Arguably, the most important challenge is considering and redefining the fundamental goals of these systems. In this regard, the structures, practices, and beliefs that underpin capitalism in its present form (ie, extractive, materialist, and neoliberal) dominate the governance

system. Political economy drivers that prioritise endless growth, by default, increase consumption to the point of detrimental overconsumption. Governance activities that simply tweak the parameters of this system (eg, pricing interventions, consumer information initiatives, and industry-led responses) are positive but will do little to address these deeper drivers. To do so, we must collectively ask who does our food system and economy ultimately serve, and for what purpose? How do we firmly place human and ecological health and wellbeing (ie, planetary health) as the central goal of governance systems going forward?<sup>204</sup>

#### Right to wellbeing

The 193 UN Member States have the power and the duty to address the drivers of The Global Syndemic.<sup>205</sup> International human rights are a set of universal, indivisible, interdependent, and interrelated freedoms and entitlements created by international treaties and customary international law and enforced through national and international legal systems.

The Commission proposes that five interrelated human rights collectively constitute the right to wellbeing, an integrated framework that reflects the rights recognised by international law, including the right to health, the right to food, cultural rights, the rights of the child, and the implied right to a healthy environment (figure 4). The sections below describe Member States' legal obligations to respect, protect, and fulfil each of these rights, and explores the implications of adopting the right to wellbeing framework to address The Global Syndemic.

#### The right to health

Many international and regional human rights treaties recognise the right to health. This right requires Member States to respect, protect, and fulfil rights to access both preventive health and health-care services.<sup>206</sup> The former UN Special Rapporteur on the Right to Health has noted that Member States have a positive duty to regulate unhealthy food advertising and food companies' promotion strategies.<sup>205</sup> The right to health also involves addressing emerging social justice, food insecurity, water shortage, and climate change concerns.<sup>207</sup> Human rights treaty-monitoring committees are now giving increased attention to obesity and related NCDs when examining Member States' progress on implementing the right to health.<sup>208</sup>

To realise the right to health for all people, Member States must protect vulnerable groups with special needs, including children and adolescents.<sup>209</sup>

#### The right to food

State obligations to realise the right to food are also anchored firmly in international law. The 1948 Universal Declaration of Human Rights (Article 25)<sup>210</sup> and the 1966 International Covenant on Economic, Social, and Cultural Rights (ICESCR; Article 11) both recognise the

right to food.<sup>211,212</sup> The ICESCR also links the right to food to other human rights such as the rights to health, work, education, and social security.<sup>213</sup>

The UN Committee on Economic, Social, and Cultural Rights, which monitors the implementation of the ICESCR, notes that State obligations include ensuring “access to the minimum essential food, which is nutritionally adequate and safe, to ensure freedom from hunger to everyone”.<sup>214</sup> These obligations also include physical and economic access to adequate and culturally acceptable food at all times, produced and consumed sustainably to ensure access for future generations.<sup>215</sup>

In 2004, the FAO Member States adopted Voluntary Guidelines to support the progressive realisation of the right to adequate food in the context of national food security (Right to Food Guidelines).<sup>216</sup> Member States pledged to ensure that changes in the availability of and access to food would not negatively affect peoples' diet quality, and would support dietary diversity and healthy eating patterns, including the promotion of breastfeeding. The Rome Declaration on Nutrition, adopted at the Second International Conference on Nutrition in 2014, reaffirmed the right to adequate food and committed Member States to ending malnutrition in all its forms, noting the special needs of women and children.<sup>217</sup> The Declaration noted that sustainable, equitable, accessible, resilient, and diverse food systems foster the progressive realisation of the right to adequate food. Achieving this right will also require that Member States enable women to have access to productive resources to support economic livelihoods.<sup>218</sup> By early 2018, 30 countries had enacted legislation that explicitly recognised and protected their citizens' right to adequate food.<sup>211</sup>

#### Cultural rights

Cultural rights have been defined as “the rights of each person, individually and in community with others, as well as groups of people, to develop and express their humanity, their worldview and the meanings they assign to their existence and development through, inter alia, values, beliefs, convictions, languages, knowledge and the arts, institutions and ways of life”.<sup>219</sup>

Indigenous and tribal peoples who live in resource-limited regions of the world are disproportionately affected by The Global Syndemic.<sup>220</sup> The globalisation of diets and urbanisation might have broadened choices for affluent people who live in LMICs. However, the resulting environmental degradation and reduction of dietary diversity has led to an increased risk of obesity and related NCDs among indigenous people and the urban and rural poor.<sup>221</sup>

The right to equality between women and men is equally relevant to addressing The Global Syndemic. The UN Convention on the Elimination of All Forms of Discrimination Against Women affirms the right of women and girls to participate in physical education, recreational activities, and sports without discrimination.<sup>221</sup> However,

in some contexts, these opportunities are limited to boys and men, and justified by reference to religious or cultural traditions. Moreover, certain cultural practices that restrict what women and girls wear can prevent them from engaging in physical activity.<sup>222</sup>

#### *The Rights of the Child*

The UN Convention on the Rights of the Child (UNCRC) contains obligations for Member States to provide “adequate nutritious food and clean drinking water” (Article 24(2)c).<sup>223</sup> The Committee on the Rights of the Child, which monitors the implementation of the Convention, has commented that “Children's exposure to 'fast foods' that are high<sup>224</sup> in fat, sugar or salt, energy-dense and micronutrient-poor, and drinks containing high levels of caffeine or other potentially harmful substances should be limited”.<sup>223</sup> To fulfil these obligations, Member States must also regulate the actions of non-state actors that undermine healthy food environments for children.

#### *The right to healthy environments*

Although the right to a healthy environment is more often recognised in domestic legislation and constitutions, it remains an emerging concept in international human rights law.<sup>224</sup> This right is, in part, derived from the right to health: the ICESCR requires Member States to take steps that are “necessary for...the improvement of all aspects of environmental and industrial hygiene” (ICESR, article 12, paragraph 2(b)).<sup>214</sup> The UN Committee on Economic, Social, and Cultural Rights has noted that “the right to health embraces a wide range of socioeconomic factors that promote conditions in which people can lead a healthy life, and extends to the underlying determinants of health, such as...a healthy environment”.<sup>215</sup>

Sustainability is an integral concept for the right to a healthy environment. The right to a healthy environment includes the right to environments that promote healthy food, active living, and active transportation and that permit physical activity at workplaces and educational institutes, including usable green spaces. This right also requires a system of food production and consumption that mitigates the health inequities and the effects of climate change that exacerbate food insecurity in LMICs.<sup>52</sup>

#### *Implications of the right to wellbeing framework*

The right to wellbeing framework provides a useful basis for addressing The Global Syndemic. Adopting the right to wellbeing framework has four implications.

First, international, regional, and national mechanisms for monitoring human rights can hold Member States accountable for achieving results in addressing key aspects of The Global Syndemic. These mechanisms can assess progress in the establishment of appropriate legislative, policy, and institutional frameworks (structural

indicators), the delivery of resources (process indicators), and the achievement of results (outcome indicators). Second, the right to wellbeing framework requires Member States to design and implement policies with the participation of all beneficiaries. Participation ensures that local agri nutrition contexts will be considered, that actions will be demand-driven, and that country-led actions will not be equated with government-led action. It also identifies alternative solutions based on local knowledge and conditions.

Third, the right to wellbeing framework requires Member States to adopt gender-sensitive, non-discriminatory interventions that include infants, children, the elderly, and pregnant or lactating women. It also includes poor communities, especially poor women, in all countries and increasingly the middle class in emerging economies. A right to wellbeing approach might be of particular value for population-wide interventions to ensure that they are equally effective in reaching vulnerable people.

Fourth, the right to wellbeing framework recommends that particular attention is given to the governance of the transition towards environments that actively support health and wellbeing. International human rights bodies insist that Member States should adopt long-term strategies that progressively work towards the realisation of rights.<sup>225</sup>

The Commission recommends that all stakeholders should promote the right to wellbeing framework as part of an expanded response to The Global Syndemic.

### A Framework Convention on Food Systems

A global framework convention that sets out the agreed regulatory and policy framework for action to create healthier, more sustainable, and more equitable food systems would greatly enhance the implementation of national food policies to address The Global Syndemic. The WHO Framework Convention on Tobacco Control (FCTC) and the UNFCCC provide valuable models for a global approach to tackle the negative health and environmental effects of the food system because they are designed to address problems with multifaceted supply-side and demand-side drivers, and move beyond legal frameworks to provide specific policy guidance. Although food clearly differs from tobacco because it is a necessity to support human life, unhealthy food and beverage products (eg, energy-dense snacks, confectionary, and sugary drinks) are not a necessity. The commonalities of tobacco, unhealthy food and beverage commodities, and fossil fuels lie principally in the damage they induce and the behaviours of the corporations that profit from them. They also share common deep drivers and the need for a multifaceted policy response.<sup>226</sup> Thus, a Framework Convention on Food Systems (FCFS) would strengthen the ability of nations to act, reduce the power asymmetries created by Big Food, and ensure comprehensive action in line with the double-duty or triple-duty actions needed to

address The Global Syndemic. An FCFS would include policy actions to strengthen food systems for health and social equity, sustainability and prosperity. It would also strengthen the right to wellbeing and accountability systems for action.<sup>227</sup> Linking the powerful and diverse stakeholders around food systems into a common framework makes sound strategic sense. Such a strategy would enable national governments to strengthen the public health, social equity, and environmental protection purposes of food systems in relation to the current dominant commercial purpose. Many countries have been unable to achieve this goal because of the vested interest influence of transnational corporations and the trade agreements that reinforce this power imbalance.<sup>36,88,119</sup>

Hoffman and colleagues<sup>228</sup> proposed a set of four criteria to assess the value of developing a framework convention as an international policy instrument for a global health issue. The Commission believes that an FCFS would meet these criteria (appendix p 34). A two-step process is needed to develop a global treaty for food systems based on the FCTC model. First, an international agreement to address conflicts of interest must be instigated. The agreement could be based on Article 5.3 of the FCTC,<sup>229</sup> which explicitly excluded the tobacco industry from policy development and implementation. An article as strong as Article 5.3 must be adapted to tackle unhealthy food systems because the current principal attempt to address conflicts of interest, WHO's Framework for Engagement of Non-State Actors,<sup>230</sup> does not fully protect WHO and Member States.<sup>231</sup>

Three principles characterise the identification and management of conflicts of interest: (1) a fundamental and irreconcilable conflict exists between some food and drink industries' interests and those of public health and the environment; (2) parties, when dealing with these industries or those working to further their interests, should be transparent and accountable; and (3) no fiscal advantages or inducements to produce food and beverage products that damage human and environmental health should exist.

There is extensive backing for a Framework Convention approach to food and obesity among civil society organisations.<sup>232</sup> More than 200 local, national, and international organisations and experts wrote letters of support to the Directors General of WHO and FAO before the Second International Conference on Nutrition in 2014.<sup>233</sup> Additionally, the Pan American Health Organization's application of law to public health<sup>234,235</sup> can be used to showcase what works at the regional level to guide the development of a global treaty.

### Global to local implementation

Effective governance will be essential in addressing The Global Syndemic. Orienting governmental efforts to address the Syndemic effectively will require changing the food, transportation, land-use, and urban-design systems that contribute to The Global Syndemic by

addressing their deep drivers. The syndemic concept provides a unifying frame that could unite constituencies that are currently distinct.

As we have indicated, multiple recommendations from WHO have targeted undernutrition and obesity separately, although their uptake and implementation have been patchy. However, strategies at the national level could include government action on their national commitments to the Decade of Action on Nutrition or support for an FCFS. The World Trade Organization could support WHO's international standards and recommendations for food labelling and food marketing to children, to prevent each country having to defend legal challenges on the basis of restriction of trade and investment. The World Bank and other development agencies could provide technical assistance to countries to implement double-duty or triple-duty actions that address the Global Syndemic.

The recent withdrawal of the USA from efforts to limit greenhouse-gas emissions demonstrates the fragility of agreements that might change based on the politics of the countries involved. These observations suggest that effective strategies to address The Global Syndemic at the global level will be unlikely to succeed without a broader base of support. As with other social movements, such as for tobacco control and sugary drinks taxes, efforts to address The Global Syndemic are more likely to begin at the community, city, or state level, and subsequently build to a national or global level. For example, despite the Trump administration's decision to withdraw from the Paris Agreement on climate change, 2700 leaders from US cities, states, and businesses representing 159 million people and \$6·2 trillion in GDP have continued efforts to mitigate greenhouse-gas emissions.<sup>236</sup>

Linking those stakeholders working separately in obesity, undernutrition, and climate change is one of the major challenges to creating concerted local to global actions. Implementation at all levels will require the identification of actions common to two or more groups. By collaborating on creating double-duty or triple-duty actions, these stakeholders could start uniting and collectively giving greater impetus to achieving success for The Global Syndemic. A second challenge is how actions are framed. For example, in many LMICs, obesity in children might be considered a sign of health and a sign of wealth or status in adults. Other framing focused on the consequences and costs of diabetes might be more persuasive than a focus on obesity. Third, growth of social movements for systems change will require grass roots engagement around local solutions that engage people, such as reduced meat consumption, support for and use of active transportation systems, or zoning regulations for land use and urban design that are eco-friendly and promote equity.

### **Private-sector challenges**

The food supply chain is immensely complex, comprising the many businesses that bring food from farm to fork at

a local, national, and global level. Primary food producers, agricultural input industries, primary food and feed processing and trading industries, food manufacturers, food retailers and caterers, along with the supporting financial services, marketing industries, and distribution companies all contribute to shaping our diets.<sup>237</sup>

Interacting with such complexity is challenging for public health. Nonetheless, public–private partnerships with the food industry have been created for multiple purposes, including: promotion of healthy workplaces, development of food and drinks low in salt, sugar, and fats, support for local, less processed foodstuffs, environmental protection (eg, organic production and reduced food miles), and social benefits (eg, investing through corporate social responsibility).<sup>175</sup>

Although most food businesses are small-sized and medium-sized enterprises, the large food corporations and their industry–interest associations have a dominant political role and they are explicitly driven by a fiduciary duty to prioritise financial returns to investors. The greatest returns come from large-scale, ultra-processed products marketed around the globe. Mass-produced, long shelf-life food products are typically high in fat, salt, and sugar.<sup>74</sup> Although not all ultra-processed food products are bad for human health, almost all the foods that are linked to risks to health are included in the ultra-processed food category, as outlined by the NOVA classification.<sup>74</sup>

On these grounds, Freedhoff<sup>238</sup> argues that partnerships between the corporate food sector and the government are a risk to public health. There are many examples that support his conclusion,<sup>239</sup> and show that scepticism, particularly about the ultra-processed food companies, is well justified. The sugary drinks sector, for instance, spent almost \$50 million in 2016–17 to lobby against US government-led initiatives to reduce soda consumption.<sup>240</sup> Research funded by this sector is five times less likely to find an association between sugary drinks and obesity compared with other studies<sup>241</sup> and it has also been deliberately used to hide the causative role of sugar in coronary heart disease<sup>242</sup> and undermine the evidence base for policy making. Outlawed marketing practices in one country have been introduced or sustained in non-regulated countries.<sup>243</sup> A great deal of marketing activity exists in the global south, in countries, such as Nepal, Ghana, South Africa, and Mongolia, where marketing of sugary drinks can be found everywhere, including around schools or at the school entrances.<sup>244</sup> When concerns about these activities have been raised, companies have used public relations drives with marketing communications campaigns and front groups to deflect criticism,<sup>243</sup> rather than changing their course of behaviour.

Nonetheless, the private sector has to be part of the solution to The Global Syndemic,<sup>245</sup> because it is just too important and powerful for it to be otherwise. The question, then, is what is the best way to work with industry actors, whose products contribute to chronic diseases, and whose practices undermine policy responses

to NCDs, without jeopardising public welfare? How can the realignment of food systems with environmental and health interests become profitable?

### Reducing power imbalances and conflicts of interest

Approaches to redressing the power imbalances and conflicts of interest when engaging with large companies are varied and include the identification, management, and minimisation of conflicts of interest,<sup>246</sup> incremental statutory regulation,<sup>247</sup> legislation combined with industry action,<sup>86</sup> performance-based regulation,<sup>248</sup> benchmarking companies (eg, Access to Nutrition Index [ATNI]<sup>249</sup>), and the replacement of industry self-regulatory programmes with co-regulatory approaches.<sup>86</sup>

The key lesson to emerge from this range of options is that self-regulation is ineffective, because it preserves market interests and lacks the legislative or regulatory accountability systems required for effective implementation.<sup>250</sup> The marketing of breastmilk substitutes<sup>251</sup> and unhealthy food and beverage products to children<sup>252</sup> are clear examples of weak standards, poor industry adherence to voluntary codes, and the need for stronger regulatory, and monitoring systems. Similarly, the UK Public Health Responsibility Deal (appendix p 17) relied on industry's willingness to take voluntary actions but resulted in the avoidance of more effective strategies and a continuation of usual business.<sup>253</sup>

Quasi-regulatory approaches refer to policies in which government specifies the policy goal, manages the process, stipulates criteria and rules, does monitoring and evaluation, and provides a tangible threat of regulation, but the engagement of the food industry is voluntary and not compulsory.<sup>86</sup> The Health Star Rating system for front of pack labelling in Australia and New Zealand is an example of quasi-regulatory approach.<sup>254</sup> Experience with the Health Star Rating system is that it represents some progress and gives consumers interpretive information on the healthiness of the product if it is carrying the Health Star Rating logo. Nonetheless, industry has been very slow in labelling their products with Health Stars and ongoing problems exist with correcting anomalies and getting the right signals to consumers. It is probably inevitable that the conflicts of interest inherent in working with industry in developing quasi-regulatory policies, such as the Health Star Rating, result in long delays to full implementation, watering down of content, flaws in design, and ultimately reduced effects on outcomes.

Even where there has been effective policy implementation with strong accountability at the national level, as with the sugary drink taxes in Mexico, powerful lobbying by the beverage industries continues, requiring constant vigilance and defence. Such lobby pressure can unravel the progress made in policy enactment or implementation and changes of government often provide an opportunity for conflicted industries to slow down or kill a policy that threatens their profits. As has

been the case with the FCTC, and to some extent the International Code of Marketing of Breastmilk Substitutes, a set of policies enforced and applied at international level (as proposed for an FCFS) can reduce these threats.

Multilateral agencies, such as WHO, are also exposed to potentially conflicted interests, and statements about the need for partnerships and stakeholder engagement can raise alarm among public health professionals aware of the danger such collaboration can bring. The issue for WHO has been recognised for several years,<sup>176</sup> and WHO has reviewed its policies and developed a Framework for Engagement with Non-State Actors<sup>255</sup> and advice to Member States.<sup>246</sup>

Although these efforts are welcome, the resulting documents are criticised by NGOs working on food and nutrition policies for promoting the notion that engagement with the private sector will speed up action in areas such as NCD prevention. They say that this belief "is not supported by evidence—indeed such engagement is more likely to slow things down—especially when it comes to regulation. Voluntary promises attract much publicity, but unless backed up by regulation can be little more than diversionary public relations—here today and gone tomorrow. WHO must not allow itself to be used as a cover for corporations whose practices damage health and the environment".<sup>256</sup>

### Business models for the 21st century

The private sector has a central role in creating wealth, income and jobs, advancing innovation, and mobilising domestic resources. Globally, the economic power of corporations is increasing, driven by economies of scale and scope. Furthermore, today's globalised economy enables transnational corporations to take advantage of low-cost production opportunities, diverse revenue sources, and low tax jurisdictions.<sup>257</sup>

Given the enormous size and contribution of the corporate sector globally, it is critical that corporations are included in the collective work to address major societal issues, such as The Global Syndemic, in ways that ensure effectiveness and accountability for their actions. There needs to be widespread recognition that the current politico-economic systems and prevailing global regulatory structures have incentivised businesses to be the engines driving The Global Syndemic and allowed them to prevent policy action to reduce it. In economic terms, this situation represents a clear case of commercial success (wealthy corporations) but market failure (negative health and environmental outcomes).<sup>258</sup> In other words, the current systems allow or incentivise the privatisation of profits and the socialisation of the costs of The Global Syndemic.

### Drivers of corporate performance

Corporations, including those in the commercial food industry, have a business purpose that is focused

predominantly on short-term (typically quarterly) profit growth. For publicly listed companies, this is typically seen as the imperative to maximise shareholder value and encourage continued investment. The traditional corporate performance measures are based on financial indicators and regulated by corporate laws and accounting standards. Negative externalities resulting from company actions or the sale of their products and services are not included. As a result, corporations that contribute substantially to The Global Syndemic have operated without accountability.

The ongoing pattern of transfers of large amounts of public money to corporations in the form of subsidies and tax breaks and the large amounts of public money to pay for their damages needs to change. For example, global subsidies in 2015 from governments to the fossil fuel industries were about \$5·3 trillion each year (6·5% of global GDP)<sup>259</sup> and nearly half a trillion dollars go to agricultural subsidies in the top 21 food-producing countries every year.<sup>70</sup> Subsidies are predominantly for beef and dairy and a small number of grains, such as corn, wheat, and rice, that are used for animal feed or form the basis of most ultra-processed foods.<sup>260</sup> The costs of the environmental damage from these industries, through greenhouse-gas emissions, waterway degradation, and soil erosion, as well as the health costs from their products, will largely be paid by the taxpayers and ratepayers of current and future generations. The dynamics of the operating conditions for businesses, and corporations in particular, must be fundamentally transformed if we expect business to contribute to the solutions for The Global Syndemic.

#### *Measures of corporate performance*

No globally agreed framework for preparing and presenting environmental and social performance exists, and there is no agreement on domains to include or objective key metrics. The absence of appropriate metrics might reflect the many and varied social and environmental effects that corporations can have on society, making the acceptance of a consistent, comparable reporting framework difficult. Nevertheless, increasing attempts at measuring, monitoring, and benchmarking broad corporate performance across many domains include transnational corporations and financial investors monitoring and evaluating their contributions to the SDGs,<sup>261</sup> the UN Global Compact encouraging corporations to adopt and report on sustainable and socially responsible policies,<sup>262</sup> Sustainability Reporting Guidelines from the Global Reporting Initiative,<sup>263</sup> the Dow Jones Sustainability Indices,<sup>264</sup> and the World Benchmarking Alliance.

Crucially, corporate sustainability measures typically hold substantially less primacy than financial metrics in driving corporate behaviour and assessing corporate performance. In the current regulatory environment, corporations are only likely to seriously focus on

non-financial issues to the extent that they boost long run, sustained profits. Corporations often tend to report only the positive aspects of their environmental and social activities as part of Corporate Social Responsibility,<sup>265</sup> which has frequently been criticised as little more than public relations exercises aimed at favourably shaping perceptions of companies, rather than genuine efforts to disclose and be held accountable for their environmental and social impacts.<sup>266</sup>

#### *Business-driven mechanisms to re-orient markets and corporations*

Businesses could lead the way in re-orienting markets and corporations so that social and environmental aspects of corporate performance are given greater prominence, even equal to financial performance. A number of voluntary initiatives have been taken since the early 2000s to encourage corporations to contribute to sustainability, including The B Team,<sup>267</sup> Uncharted,<sup>268</sup> and Forum for the Future.<sup>269</sup>

Evidence is emerging that corporations that focus more on sustainability practices than just short-term profitability outperform their counterparts in the long term, both in terms of stock market and accounting performance.<sup>270</sup> However, this finding is not universal,<sup>271</sup> and these business practices are more likely to be sustainable from a commercial perspective if the regulatory environment and the market operating conditions are changed so that all players in the market operate under the same constraints.

Arguably, the single largest contribution that corporations could make to addressing The Global Syndemic is to stop investing enormous efforts and resources into opposing the enactment of regulations and fiscal policies for the public good.

#### *Government-driven mechanisms to re-orient markets and corporations*

Government intervention through financial incentives, such as taxes on unhealthy foods or subsidies for renewable energy, can help redress negative externalities. The increasing application of taxes on sugary drinks (now enacted in >30 jurisdictions globally)<sup>272</sup> is an encouraging example of this type of intervention. Governments can also intervene through other regulatory measures that are designed to limit the sale of products with negative externalities, such as restrictions on advertising unhealthy foods to children. However, corporations continue to strongly oppose these types of government intervention, and commonly exert their significant political influence to prevent further regulation.<sup>119</sup>

Thus, governments have a crucial role in creating the market operating conditions that favour corporations that seek to work for people and the planet, as well as profits. Previous efforts by the Western Australian Government, which outlined a sustainability strategy for the state, including measures to galvanise industry to support

For the World Benchmarking  
Alliance see <https://www.worldbenchmarkingalliance.org/>

### Panel 11: Towards a sustainable economic model: a global summit

Although the quest for growth and profit has generated enormous prosperity and development gains globally, the current global regulatory environment does not adequately account for negative externalities. Inadequate controls are causing massive harm to planetary health. Previous efforts to reduce this harm have focused on mitigation. The Framework Convention on Tobacco Control, for example, has successfully regulated and contained the market for tobacco. The Global Syndemic could be greatly reduced through a similar approach. However, the sheer scale of the problems presented by climate change suggests that post-hoc interventions and running repairs are unlikely to suffice.

In any case, prevention might be more cost-effective than treatment. Debate is urgently needed about how our economic systems, and the regulatory environments that govern them, can be adjusted to make them healthier and more sustainable, rather than waiting for inevitable problems to emerge and then trying to fix them.

To this end, a Global Summit is needed, convened by global business organisations, such as the World Economic Forum, the World Bank, and key philanthropies. This Summit should bring together experts in commerce, economics, public health, philosophy, theology, indigenous culture, human rights, and others. The challenge is daunting and immediate answers are unlikely, but the conversations must begin, and such a Summit could begin to frame the questions.

sustainability, provide an illustrative example of how this might be operationalised.<sup>273</sup> Crucially, the globalised economy and the transnational mobility of large corporations means that initiatives and regulations at the national level are unlikely to be sufficient to address The Global Syndemic. Instead, changes to the global regulatory environment, including international trade and investment agreements, are needed (see the A Framework Convention on Food Systems section). However, the strong influence of transnational companies on the development and implementation of these agreements, and their strong interest in maintaining the status quo, is likely to be a key barrier to progress.<sup>274</sup>

#### *Investor-driven mechanisms to re-orient markets and corporations*

The investment community, and sustainable investment practices in particular, represent another potential avenue for changing corporate behaviour.<sup>275</sup> Responsible and ethical investing includes a range of strategies to consider financial return as well as social and environmental impact as part of investment decisions. Strategies might include divestment practices that seek to avoid harm, such as excluding certain types of companies from investment portfolios (as is occurring for tobacco companies), as well as more proactive practices, such as social impact investing that seeks to generate positive social impact from investment decisions alongside financial return. Sustainable investments are showing strong growth and have recently experienced superior returns, prompting increasing interest in the future of investment.<sup>276</sup> However, it will take substantial cultural and social change processes to reorient the current strategies and considerations of the vast majority of investors so that sustainability factors are comprehensively considered. A substantial change is only

likely to occur with strong leadership from global economic institutions and organisations, such as the World Economic Forum and the World Bank, and accompanying changes to the regulatory framework in which markets operate. The Commission considers that these global institutions also have an important role to play in convening the leading economic thinkers for the 21st century to articulate the new economic paradigms, pathways, and policies for better outcomes for people, the planet, and prosperity (panel 11).

#### *Small and medium enterprises*

Many of the debates about new business models centre on the major actors and their undue influence on governance at the national and global levels. However, it is important to reiterate that the vast majority of the private actors who grow, process, distribute, and sell food are small-sized or medium-sizes enterprises that have little sway over the conditions they operate under. Many are struggling to make a profit and they see the positive and negative sides of unhealthy foods (panel 12).

If people working in the food system are struggling to just make a living, the extra effort and risk of shifting their business towards healthier foods is a luxury they cannot afford.

#### *Civil society-driven mechanisms to re-orient markets and corporations*

Civil society can potentially send strong, transformative signals to industry if a large enough group of consumers create a step change in demand for healthy, sustainable products and a rejection of unhealthy products. This occurs rarely but is not impossible with the viral spread of information through social media.

Civil society organisations can also exert leverage for accountability by being part of the monitoring and benchmarking systems.<sup>277</sup> For example, the ATNI reports have assessed the nutrition-related policies, practices, and disclosures of many transnational food and beverage companies;<sup>249</sup> and Oxfam has released the Behind the Brands report that has monitored the agricultural system policies of many of the same food and beverage companies. However, these tools have not yet been broadly applied across different markets and sectors to monitor other food system actors, such as transnational food retailers and chain restaurants, and do not address all relevant aspects of the corporate political activity and impact on obesity and undernutrition.<sup>278</sup>

#### **Mobilising civil society**

##### **Learning from previous social change**

In this section, we focus on lessons from public health actions that have been addressed through social change processes. Many of these apply to The Global Syndemic, but a number of examples relating to obesity illustrate the potential of these approaches for broader application. Changing obesogenic environments is central to

For Behind the Brands see  
<https://www.behindthebrands.org/>

reducing obesity. Accomplishing this task will require broad and sustained changes in policies, beliefs, and practices within and across several societal sectors. A focus on the underpinning systems and institutional drivers of unhealthy environments also recognises the challenges individuals, families, communities, and populations face in achieving a healthy weight while exposed to a constant barrage of appealing inducements to overeat and live sedentary lives.<sup>279</sup> The potential for population-wide, long-lasting changes in the behaviour of individuals in the absence of widespread environmental changes has serious limitations.<sup>19</sup>

Social change efforts that focus on obesity alone might reinforce negative attitudes about people with obesity, which are common in many countries and, perhaps paradoxically, might increase with the rise in the prevalence of obesity.<sup>280</sup> Combining obesity prevention efforts with efforts to address undernutrition and climate change as part of The Global Syndemic will help avoid that risk. The concept of stealth interventions<sup>281</sup> was proposed to show that other social movements for action on climate change, sustainability, liveable communities, safe streets, social justice, human rights, animal rights, and food sovereignty have the potential to contribute to obesity prevention. Awareness that social pressure for change on one issue can benefit others can broaden the base of support for change.

#### *Social change and public health*

Complex social, environmental, and health challenges have been addressed successfully through social change processes, leading to cultural shifts in values and to public policy actions that have changed population behaviours. Case studies of tobacco control, alcohol, infant nutrition, gun control, and traffic safety offer insights into how pressure has been applied to achieve government actions affecting relevant personal behaviours (table 3). These changes have often been the result of collective actions that fostered the transformation of social institutions and the redistribution of power and resources, while challenging widely held beliefs and social norms over years or decades.<sup>282</sup> Social movements and civil society networks often form around shared values, interests, and principled ideas that evolve over time and lead to common agendas and unified actions.<sup>168,283</sup> Movements and networks are more likely to grow when they frame problems in ways that resonate with their supporters and external audiences.<sup>284</sup> Effective framing can convey the nature and severity of a given problem, the costs of ignoring it, and the benefits of taking action (appendix p 35). Some frames might have broad cross-cultural resonance (eg, minimising harm to children), whereas others might align more with the dominant beliefs and cultural symbols of a given locality, such as reclaiming local food sovereignty, rebuilding indigenous food systems and cultural practices, and rejecting the invasions of foreign fast food chains.<sup>168</sup>

#### **Panel 12: People's experience—an Indian shop owner's challenge in selling healthier foods**

We started this shop around 27 years ago. I used to assist my father as a child, during school days. I was always keen that my father stocked all the latest items, like wafers, chocolates, cold drinks, and sweets. I knew whatever came to the shop, I too would get my share from it. Most of my school friends loved coming to our shop as we had so much variety for kids. After graduating I took over this shop, as by then we had expanded and my father started managing a nearby bakery.

Like my father, I too make sure we keep the latest products in the shop, as I am aware that my customers, especially kids, have an eye on everything new that comes to the market. For instance, some companies came up with the concept of selling chocolates inside fancy toys. Also, wafer companies include stickers of famous cartoon characters, which children like to collect. Companies selling sweet drinks give free mugs if you buy a bigger one, which can attract children. Keeping these products in the shop ensures good sales and profits for us. In fact, some companies give us incentives if we exceed a monthly sales target.

I am educated and aware that, though these taste good, most are unhealthy because they are processed and high in sugar and fat. I started realising more when my own kids started demanding these often. I have grown up eating these products because it was readily available to me, but now me and my wife have a tough time convincing our kids to eat home cooked healthy food, fruits, and vegetables. My daughter is becoming more health conscious as she is growing up, but my son prefers eating wafers, pastas, and pastries over home cooked food.

If I have to choose between healthy and unhealthy options, I would say I will go with a mix of both. In fact, we have been selling theplas [healthy flat breads popular in Indian cuisine made with fresh fenugreek leaves], phaphras [made of gram or chickpea flour and carom seeds], and these masala oats products, which are a hit among our female customers. I cannot exclusively sell healthy varieties, as there are not sufficient takers. To make profit, I have to ensure that we store everything preferred by customers. If customer demand for healthy food rises, shop owners will make a shift in that direction.

Contributed by Raji Devarajan, Public Health Foundation of India and Centre for Chronic Disease Control, New Delhi, India from interviews with shop keepers in Delhi.

Although some cultures tolerate or hold positive attitudes about larger body sizes, negative attitudes about people with obesity predominate in many societies. In such contexts, people with obesity can be subjected to ridicule, discrimination, or other forms of social disapproval, such as blaming them for having the condition despite the now well-established recognition that obesity is a disease.<sup>285</sup> Commentary in the media can readily reinforce weight bias. Social marketing and other campaigns need to be well researched and evaluated so that they similarly do not exacerbate social bias,<sup>286</sup> but the evidence from confronting social marketing campaigns in Australia, which show graphic images of intra-abdominal fat, is that they can be effective in stimulating behaviour change without exacerbating social bias against people with obesity.<sup>287</sup>

#### *Strategic considerations*

The strategies employed by some large food and beverage corporations to oppose public health policies focused on obesity prevention—eg, fiscal policies, front-of-pack labelling, and regulating food and beverage

marketing aimed at children—are similar to those used by the tobacco industry, which have served to create a battle between the health community and large corporations. Although it is important to hold these corporations accountable and regulate their practices, these actors should be distinguished from small-sized and medium-sized food companies that could collaborate in the social change process. The heavy-handed lobbying tactics by the processed food and beverage industries against the prevention efforts of communities and governments means that those companies are seen as the enemy and the social movements around obesity prevention draw energy from this demonisation. This dynamic has been particularly visible when sugary drinks taxes are proposed. Thus, the practices of this sector of the food industry become seen as primary causes of obesity and the primary obstacle to the development of health-promoting food policies.<sup>167,288</sup> Nevertheless, food industry behaviours that support food as foundational to culture, social interactions, and health and wellbeing, in addition to contributing to economic prosperity, should be celebrated. A syndemic approach that articulates and drives shifts in food systems on the basis of issues complementary to obesity, such as climate change, will be part of these solutions.

Although the potential to achieve synergy among different causes often works when those involved can find common ground to support each other,<sup>289</sup> some linkages encounter ideological or tactical conflicts. For example, in low-income countries, the coexistence of obesity and undernutrition and their relevance to food systems facilitates common actions addressing both problems. However, anti-hunger advocates might have alliances that facilitate receipt of unhealthy food donations from many of the same food companies that are viewed as problematic by advocates in the obesity arena. Acceptance of the principle that charitable food should be healthy food would resolve this conflict. Another example of such a conflict is obesity-related initiatives that depend on the promotion of bottled water over sugary drinks, whereas environmentalists are opposed to the promotion of bottled water on ecological grounds. Both groups might find common ground by supporting government action to ensure the availability of safe drinking water for the public good.

#### *Mobilising demand for change*

In the broadest sense, social change might result from many interacting forces: the adoption of new technologies, changes in government and policy agendas, long-term changes in societal conditions (eg, economic growth), short-term events (eg, natural disasters), and related shifts in belief systems, values, and norms. However, change might also be provoked by spontaneous social movements or through more structured collective actions directed by civil society organisations that

incidentally or deliberately alter social dynamics.<sup>290</sup> Social change is more likely to be sustained when governments adopt comprehensive policies and establish institutions that enshrine the goals of collective action.<sup>291</sup> Fostering and sustaining changes is of paramount importance for securing long-term improvements in the health and wellbeing of communities.

Huang and colleagues<sup>292</sup> emphasised the importance of a combined top-down and bottom-up framework for effective social change in which public pressure drives both public-sector and private-sector policy actions across non-regulatory, regulatory, and legislative spheres and stimulates new types of innovation (appendix p 36). Mobilisation through a bottom-up approach can be achieved through collective actions and political movements to develop effective strategies and reprioritise resources to address The Global Syndemic.

Collective actions are actions taken in concert or in a coordinated manner to protect a public good.<sup>293</sup> Such actions require a critical mass of highly engaged and resourceful people, group heterogeneity, interdependence of actors, and a direct relationship between the level of contribution and pursuit of a well-defined public good.<sup>294</sup> These actions might take the form of social movements and involve coalitions, networks, and other structures that emerge among individuals and organisations concerned about a societal issue.

To date, no transformative social movement exists that addresses obesity. The lack of common strategies might divide advocates. For example, the groups that promote breastfeeding have little in common with physical activity advocates. Additionally, stigmatisation and self-blame might contribute to the challenges of forming patient advocacy groups. However, several councils or coalitions have emerged recently in which patient advocates work together with health and research professionals to educate the public about obesity, support policies that ensure payment for science-based treatments, and advocate for the elimination of weight bias and discrimination.

#### *Political movements*

Major, concerted efforts in the form of coordinated campaigns directed by consumer advocacy groups (eg, non-governmental or civil society organisations) that include engagement of consumers can be viewed as political movements. Political movements create political pressure, move public opinion, and lobby on behalf of public health. Examples of these movements include tobacco control campaigns, automotive safety, mandatory use of bicycle helmets, and banning asbestos, DDT, and other harmful chemicals in the environment. This type of advocacy in the area of obesity is most well-developed in relation to food and beverage corporations whose business model is in direct opposition to measures recommended for obesity prevention.<sup>167,288</sup> The movement calls for policy change and is empowered by medical and public health

sciences and civil society organisations to confront corporate power and its deep economic resources.

The four essential strategies used by political advocacy movements are generalisable to a focus on obesity. These strategies include: (1) building strength from scientific evidence; (2) exposing the human drama of the situation, including economic costs and how the problem will worsen in the future to create urgency for change; (3) exposing the principal causes of the problem (eg, changes in the food supply and patterns of food marketing for certain products) to foster a strong public voice; and (4) presenting specific and feasible actions. Proposed actions for obesity prevention typically include regulations to protect children from marketing of unhealthy foods, creating healthy food environments in schools, fiscal measures, clear front-of-pack labelling for consumers, and improved access to fresh, healthy, affordable food.<sup>295</sup> A successful political movement must include a wide variety of civic groups from very different fields, such as those working on nutrition, children's rights, and environmental protection, those representing small farmers, and those fighting hunger. Because science and scientific integrity are fundamental to the fight against obesity, the movement must also include academic societies, individual researchers, and health professional associations. Legislators and stakeholders from civil society must also be mobilised in the effort to win the debate in terms of public opinion.

#### **Panel 13: People's experience—making local change happen**

20 years ago I was Secretary of Health for Sorocaba, a city of approximately 500 000 inhabitants, when I participated in a presentation of Agita São Paulo from the Government of the State of São Paulo. The programme emphasised the benefits of moderate physical activity, such as 30-minute walks, at least five times a week.

Recognising the benefits of the programme on chronic disease prevention and control, and physical, mental, and quality-of-life improvement, I implemented a programme to encourage physical activity in Sorocaba. I started by encouraging patients using primary health care to walk. I asked all Basic Health Units (Unidades Básicas de Saúde; UBS) to create walking groups with training of physicians, nurses, and nursing assistants. The groups had one or two employees from UBS. We also set up treatment protocols for hypertension and diabetes, where all patients were advised to walk at least five times a week. Patients with depression were also targeted.

As we did not yet have lanes specifically designed for walking on our streets, I asked a group of physical education teachers to identify paths along flat, well-signposted paths, offering groups more comfort and safety in walking. Walking groups leaders were trained to provide recreational and motivational tasks in addition to physical activity. The walking groups grew. Some had hundreds of participants, who became friends, improving their social wellbeing. Parties, requests for participation in civic

Social change and political leaders with roles in civil society, policy, and the private sector should mobilise active participation of all strata of targeted societies, including the impoverished and disadvantaged, who are likely to be more severely affected by The Global Syndemic.

#### *Implications*

Effective and sustainable social change efforts target key mediators of change and can be driven by a combination of collective actions, taken at various levels, to generate and voiced demand from within civil society to influence governance structures, industries, and cross-sector collaborations (panel 13). Thus decreasing the prevalence of obesity requires a focus on building momentum for social change for goals, such as reducing undernutrition and mitigating climate change, that share common policy inertia challenges.

#### **Cultural influences and indigenous approaches**

Progress will not be made on The Global Syndemic unless sociocultural contexts are taken into account. We examine this first from the perspective of the sociocultural determinants of obesity and then more broadly examine how The Global Syndemic affects indigenous and traditional people (hereafter called traditional peoples) and how their heritage knowledge can be a force for renaissance in their own communities and provide the

parades, and excursions to other cities were among the activities carried out by the walking groups. Significant improvements were perceived by the health professionals involved, especially among the elderly, who improved their skills, were happier, and reduced their medications.

Improved control of hypertension and diabetes reduced hospitalisations for diabetes and stroke, according to data from the Federal Government.

These results led the groups to request the construction of walking trails, parks, and green areas in the city, demonstrating that if people feel they can improve their quality of life, they will start demanding it.

We have a 24-hour walk every year on the path that goes around Sorocaba. Thousands of people participate, with groups including municipal secretariats, military youth, firefighters, universities, and other institutions.

The Agita São Paulo programme, which trained thousands of health professionals, promoted a social movement where people became aware of importance of physical activity for a healthy life. The programme contributed to the reduction and control of chronic diseases at practically zero cost to the population through physical activity.

Contributed by Dr Vitor Lippi, medical doctor and current Federal Deputy at the National Congress.

foundations for global 21st century thinking for addressing The Global Syndemic.

#### *Sociocultural determinants of obesity*

The enormously wide variations in obesity prevalence between countries relate closely to the wide differences among cultures. Despite many visible differences between cultures that relate to obesity, such as cuisines, use of food in social exchanges, perceptions of body size, fashion, and value placed on physical activity, surprisingly little research has been done on these determinants compared with research on genetic, metabolic, and behavioural determinants. There are also less visible, latent characteristics of cultures, which have been developed and measured for about 90 countries.<sup>296</sup> Significant associations exist between these quantitative dimensions of culture and the trajectories of BMI over 40 years.<sup>1</sup> Preliminary ecological analyses suggest that a higher BMI is significantly associated with societies that have a greater awareness of and intolerance of inequalities (lower power distance), a more individualistic than collective world view, less tolerance of the unknown and the different (higher uncertainty avoidance), a more conservative and traditional orientation (higher short-term orientation), a more competitive, money-based orientation (higher masculinity), and a greater fulfilment of leisure and pleasure with less restraints (higher indulgence). Together, the six cultural dimensions explain more than 50% of the variance in mean BMI between countries over the 40 years. Much more research is needed to explore these cultural dimensions and to develop a coherent theory about how cultural factors modify the effects of globally acknowledged drivers of obesity among different nations.

Several international comparative studies of the differences in body size perception have been done (appendix p 37), and the effects of acculturation processes on the bodyweight of immigrants has also received some attention.<sup>297</sup> In general, when migrants from lower-income countries move to higher-income countries, they acculturate to the host culture, and their risk of obesity increases.<sup>298</sup> The added effects that colonisation and societal marginalisation have had on indigenous populations also predisposes them to greater obesity.<sup>299–301</sup> Many other dimensions of culture warrant much greater research attention, such as cultural attitudes to food, the effects of religion, media influences, cultural parenting styles, and societal values placed on physical activity and sports participation.

#### *Indigenous and traditional peoples and The Global Syndemic*

The UN estimates that more than 370 million self-identified indigenous and tribal peoples live in some 90 countries representing as many as 5000 diverse cultures. Even though they constitute only 5% of the world's population, they account for 15% of the global poor.<sup>302,303</sup> With reduced opportunity for viable incomes,

they collectively represent the severe effects of global poverty and disparities, including high rates of obesity and undernutrition and loss of their traditional territories and lifestyles due to climate change.<sup>302,303</sup> Traditional peoples are of special interest not only because they are disproportionately experiencing The Global Syndemic, but also because they have traditional knowledge, understandings, and practices that might contribute to addressing these challenges for their own people and more broadly.

Traditional peoples are custodians of many traditional knowledge bases, including knowledge of the world's invaluable biodiversity of plants and animals in the ecosystems that are the foundation of global food systems, medicines, and ecosystem knowledge.<sup>302</sup> However, worldwide these peoples have experienced dispossession and destruction of their traditional lands and territories.<sup>304</sup> The most severe effects of climate change are documented for lands occupied and depended upon by traditional peoples. Examples include diminishing levels of sea ice in Inuit territories of the circumpolar Arctic that reduce traditional food acquisition, extreme desertification and drought in sub-Saharan and east African regions that compromises herd viability of pastoralists, and rising sea levels in the coastal zones of Pacific Island nations that flood traditional farm areas.<sup>303</sup> Traditional peoples living in high-income countries also have high rates of obesity and NCDs compared with other ethnic groups in those countries. In LMICs, traditional peoples also have higher rates of undernutrition and stunting,<sup>299</sup> in addition to obesity and NCDs.

#### *Learning from traditional peoples' approaches for systemic action*

Traditional peoples' knowledge contains many of the keys to understanding how to address The Global Syndemic. Custodianship of the environment, nurturing, and sustainably using nature's resources and ecological relationships between communities and their environments create a collective responsibility for the common wealth that the planet provides. The renaissance of traditional peoples' concepts, knowledge, and practices around the world could provide a powerful global resource and a basis for 21st century thinking to replace the extractive, polluting, individualistic, and materialistic concepts that are driving The Global Syndemic. Individuals and communities are already drawing upon these traditional approaches to improve the health of themselves, their communities, and their environments (panel 14).

The documentation and application of this traditional knowledge should be a global goal, and worthy of substantial investment for indigenous scientists to support their populations' rights to heritage, health, and wellbeing, and through them, the wellbeing of the planet. The Iroquois concept of seven generation stewardship urges the current generation of humans to live and work for the benefit of the seventh generation into

#### Panel 14: People's experience—a Māori approach to holistic health and wellbeing

Cardiovascular disease, diabetes, primary pulmonary hypertension, renal failure. My father and brother left high school at the age of 13 and 15 respectively, but each could tell you what these diseases were. Not that it did much good. My father was dead at 46 and my brother just died of renal failure. He was 54. Both suffered from diabetes, and obesity. This story is no different from many other indigenous peoples' experiences of NCDs. Ironically, in many Māori communities, providing hospitality to others has often meant large quantities of food of questionable nutritional value. Sugary drinks, high-fat, cheap cuts of meat, alcohol, drugs, and tobacco are all common in Māori communities. Illogically, institutional attempts to provide health-enhancing opportunities through nutritional food or community-based physical activity initiatives are often met with contempt because the underlying suggestion is that the institution knows what's better for Māori than they do themselves. Likewise, many Māori sometimes respond to outside control with self-destructive behaviour to maintain their authority.

A large number of Māori now live in urban settings. Many urbanised Māori yearn for a reconnection to their ancestral old ways but many can't afford to regularly travel to their traditional homelands and many end up following mainstream practices as their tribal connections weaken. However, I choose to believe and to hope that there is another way to avoid early deaths, like those of my father and brother. I hope for a way forward that does not depend on deficit conversations in order for action to occur.

I want a system of understanding and pursuing health that is centred on Indigenous ways of knowing. I want to have an approach to health that is environmentally centred with people being the benefactors of knowing the places that have given their ancestors strength for millennia. Consequently, I am developing a Māori approach to health that is built on Indigenous potential, that is environmentally centred and is the synthesis of ancestral pathways and contemporary Māori interpretations, known as the Atua Matua Māori Health Framework.

Atua are environmental personifications and guardians that guide the behaviour of contemporary Māori while matua are their human counterparts. Atua Matua is a form of resistance. Its primary interest is the pursuit of Indigenous knowledge, the rediscovery of new old ways that look to the past to navigate the future. It's likely that the answers to Indigenous health problems already exist in their communities, but have been forsaken for the new brand of medical autonomy that has sidelined indigenous ways. An Atua Matua approach suggests that for contemporary Māori, it is the synthesis of the old and the new, of Indigenous and non-indigenous thinking, of reinterpreting what our ancestors stated into contemporary applications that will provide a pathway forward. After all, our people came to a new land to find a better life that included new environments they had never seen before. We learnt, we survived, we flourished. We did it before. We can do it again.

Contributed by Dr Ihi Heke, Indigenous health and outdoor education specialist, Tomarata, New Zealand.

the future. The Commission proposes the establishment of a Seven Generations Fund for Traditional Peoples' Science to build an international traditional peoples' knowledge platform for decision making and action for seven generations to come. Resuscitating traditional peoples' knowledge of sustainable food systems, use of biodiversity, world views, and collective approaches will not only strengthen their ability to meet the challenges for their own people, but also provide ways forward for all humanity to meet the challenges of The Global Syndemic.

#### Community-based actions

The classic framing of "Think global, act local" to convert, otherwise daunting, global problems into community action could be applied to The Global Syndemic with the added catch line of "reorient systems". People can leverage their individual agency better within their local school, grocery store, or workplace for small changes than they can in the education system, the food system, or businesses at large for big changes. However, many small changes in communities can build into wider social change, especially if the local actions spread by creating virtuous cycles of mutual learning between communities. This section illustrates contemporary approaches to reducing

childhood obesity, where there is growing evidence and experience on how to activate systems change that is of relevance to The Global Syndemic.

Past interventions for prevention of unhealthy weight gain in childhood have reported variable effects, with little evidence of long-term sustainability of programmes or effects.<sup>305,306</sup> These interventions are undergoing an evolution in design and concepts with increasing upstream and complexity-oriented approaches. We characterise and compare three broad types of approaches (table 4) and then demonstrate several relatively well-developed examples of systems-based approaches from Victoria, Australia. The typologies outlined in table 4 are general categories and characteristics and it is important to note that any given community intervention can demonstrate a mix of these approaches. However, the majority of obesity prevention studies in systematic reviews are characterised as package delivery. This approach refers to an expert-led package of evidence-based interventions aimed at changing the proximal determinants of obesity, such as knowledge, behaviours, and local environments, and is delivered with a high implementation fidelity within a robust scientific design, such as a cluster randomised controlled trial, in settings such as schools. Intervention periods are often short-term, typically 1–2 years to match the duration of

|                                  | Package delivery   | Capacity building                                      | Systems-based  |
|----------------------------------|--|--|--|
| Research question (effects)      | What intervention package works?                                   | What works for what community?                         | What works for what systems in what contexts?            |
| Research question (process)      | How can the package best be implemented with fidelity?             | How can existing community capacity best be built?     | How can existing systems best be strengthened?           |
| What is the intervention?        | Package of individual and environmental interventions              | Building community capacity                            | Activating and re-orienting existing systems             |
| Who develops it?                 | Content experts consulting local experts                           | Local experts and content and process experts          | Local experts facilitated by content and process experts |
| Engagement and role of community | Consulted; co-implement  | Engaged; co-design and implement                       | Owned; design and implement                              |
| Role of experts                  | Create and co-implement  | Co-design; support implementation                      | Facilitate design and implementation                     |
| Usual funding source             | Research bodies (investigator initiated) or government departments | Research bodies or government departments              | Government departments or communities                    |
| Resources applied to             | Package delivery   | Capacity building in community organisations           | Supporting change agents in leveraging systems           |
| Evaluation design                | Randomised controlled trial, cluster randomised controlled trial   | Cluster randomised controlled trial, quasi-experiments | Quasi-experiments, natural experiments                   |
| Evaluation measurements          | BMI, individual* environments†                                     | BMI, individual, environments, community‡              | BMI, individual, environments, community, systems§       |
| Fidelity priority                | Package implementation   | Process and relationships in building capacity         | Process and relationships in activating systems          |
| Validity                         | Internal: strongest; external: weakest                             | Internal: moderate; external: moderate                 | Internal: weakest; external: strongest                   |
| Application to at-scale action   | Marginally relevant  | Proof of principle                                     | Directly applicable                                      |

BMI=body-mass index. \*For example, behaviours, attitudes, or knowledge. †For example, food and physical activity environments in schools. ‡For example, community capacity and community readiness to change. §For example, social networks and systems dynamics.

Table 4: Characteristics of the three broad types of interventions for prevention of childhood obesity

research-funded projects, and very few interventions are extended across a state or country, even if successful at the research stage.

Some studies have used a more whole-of-community approach and characterised their interventions as community capacity-building,<sup>307</sup> meaning they focused on actions to support community leadership, mobilising resources, increasing workforce skills, creating partnerships, and strengthening monitoring and evaluation.<sup>308</sup> Capacity-building creates stronger partnerships between research and practitioner communities and is more encompassing of multiple settings, multiple strategies and longer duration. These research designs often use quasi-experimental methods and so have weaker internal validity (table 4). This approach has been effective in reducing childhood obesity in some communities,<sup>309–311</sup> has proven sustainable, and has spread to surrounding areas,<sup>312</sup> but it has not been effective in other communities, such as Pacific adolescents.<sup>313–315</sup>

In recognition of obesity as an unwanted outcome or emergent property of complex, adaptive systems, systems science methods are being increasingly applied to community obesity prevention efforts. A systems-based approach to obesity prevention starts with the community's current systems and contexts and works collaboratively to understand the multilevel drivers of obesity and to identify ways that the existing systems can be used or reoriented to create better health outcomes

(table 4).<sup>316</sup> A range of methods exist to support the community through these processes,<sup>317</sup> including development of causal maps across all stages of system conceptualisation and intervention development, delivery, and evaluation.

Poor implementation is often cited as a major impediment to the effectiveness of community interventions<sup>316,318</sup> and a greater application of implementation science might help to overcome these barriers. Foster-Fishman<sup>319</sup> identified a range of systemic factors such as social, economic, leadership, organisational culture, or political climate that might impede or promote implementation. Deliberate consideration of these factors within a complex systems approach might optimise implementation.<sup>320</sup> For example, recently developed tools can guide the sensemaking processes so that teams can routinely and systematically assess implementation challenges and identify approaches to guiding action. The process is congruent with complex adaptive systems because it respects non-linearity, and is interactive and relationship-focused.<sup>321</sup>

#### Examples of systems activation approaches from Victoria, Australia

Healthy Together Victoria (HTV) was an effort to apply systems approaches to obesity prevention at the policy and community levels across the state of Victoria, Australia. During a brief, single term of state government (2011–15),

### Panel 15: People's experience—community-based health promoter

In 2014, agency leaders who had been delivering obesity prevention programmes for many years, agreed that business as usual wasn't having an impact on our community's health. We needed to find a better approach to leverage our relatively small government funding to achieve long-lasting population level improvements.

We found that 38% of our primary school children had overweight or obesity and this reinforced our resolve to act collectively and fearlessly. Deakin University facilitated some systems mapping workshops and from the community buzz that was created, we grew the number of community participants with smaller workshops in schools, workplaces, and professional networks.

Our systems map visually demonstrated that if you change one factor, many other connected factors alter and change with it. It was like magic, watching these maps being made. The energy levels in the room rose as participants started to visualise the complexity of the causes of obesity. This led to a shared understanding and realisation that if we made a lot of small changes across many of these factors, we could make a real impact. Conversations quickly turned to the recognition that there is no silver bullet, that the whole community needs to work together to solve the problem, and that different players could use the map to identify their roles in taking action. Blaming and finger pointing quickly dissolved into joint ownership.

What was so crucial was that this newly enhanced understanding of complexity led to the ability to identify

concrete actions to most effectively influence the systems. What was so exciting for me was that I could not have predicted many of the actions that these workshops produced. The snowball effect within the community has been even more amazing. We are now learning of changes made within the community by people who were not involved or connected to the initial workshops.

I learned that flexibility and participant control empowers the community and gives them ownership of both the problem and action. The strong focus on action has also resonated well with participants. Too often, we have sought input from the community for planning and prioritising but rarely given them ownership of the solution. Participants responded that by coming together and sharing ideas and commitments to act, they felt supported, braver, and bolder by being part of a bigger approach.

Between 2015 and 2017, we have seen improvements in physical activity, active transportation, fruit, vegetable, and sugary drinks consumption and a decrease in BMI of primary school children. Whilst it is very exciting to have these preliminary changes all heading in the right direction, for me, the most rewarding part was to be able to share these timely data with the community. By doing so, I sensed the participants are now feeling even further empowered and, not surprisingly, the next wave of community actions has started.

Contributed by Janette Lowe, Executive Officer at Southern Grampians Glenelg Primary Care Partnership, Australia.

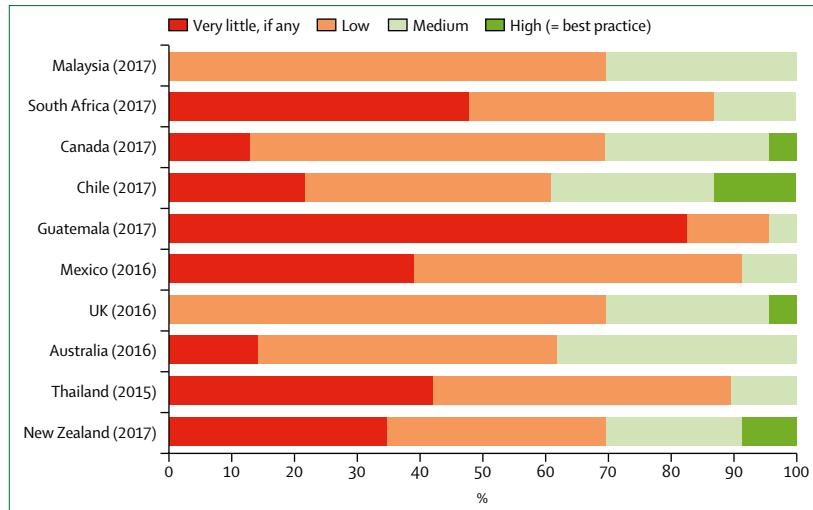
a substantial boost in funding for prevention, a solid existing base in prevention experience, strong intellectual leadership within the Department of Health, and supportive political leadership combined to create a step change in prevention approaches in Victoria. A change of government and political commitment ended HTV just as it was gaining momentum at the local level and across the state within and beyond the initial HTV intervention areas (appendix p 38).

This increasing interest within Victorian communities for systems interventions and the demise of HTV left a vacuum. A number of community-academic partnerships grew to continue the efforts, but in a more bottom-up fashion and based on the community's own capacity, interest, and remit to make systems changes within their settings (appendix p 39). This collective community approach generates coherence and positivity among health promotion professionals because it gives them traction to engage with other sectors (panel 15), and can initiate a community-based reorientation of systems for other aspects of The Global Syndemic.

### Accountability systems

Strengthening accountability systems will be central in ensuring that recommended policies are implemented to

reduce The Global Syndemic. For obesity in particular, many evidence-based policies are recommended by WHO, including the Ending Childhood Obesity reports, which have been approved at successive World Health Assemblies.<sup>22,322</sup> These WHO recommendations form the Account, which in accountability terms, means the agreed plan of action and responsibilities. However, these recommended actions have only been weakly implemented globally by the major actors—principally governments and food companies.<sup>2</sup> The next accountability steps are Taking the Account and Sharing the Account through more targeted, upstream monitoring systems.<sup>86</sup> The Commission believes that the downstream monitoring of indicators of obesity, undernutrition, climate change, and their consequences is essential for tracking outcomes, but monitoring upstream, at the policy implementation level, is also essential for strengthening accountability. An agriculture minister cannot be expected to be accountable for reducing obesity, but they can be accountable for enacting agreed agricultural policies towards healthy, sustainable, equitable, and prosperous food systems. Examples of upstream monitoring for accountability on food policies for obesity and NCDs will be used to illustrate the approach that the Commission believes should be applied more widely to The Global Syndemic.



**Figure 5: Benchmarking the level of implementation of recommended food environment policies by national governments**

The Healthy Food Environment Policy Index (Food-EPI) rates government action on policies to improve the healthiness of food environments as very little if any, low, medium, or high implementation compared to international best practice.

### Outcomes and risk factor monitoring

The 2013 WHO monitoring framework<sup>323</sup> for the Global Plan of Action to Prevent and Control NCDs 2013–2020<sup>22</sup> has nine targets, two of which explicitly relate to obesity: to halt an increase in obesity rates and reduce physical inactivity by 10% by 2025.<sup>323</sup> The first monitoring report on NCD progress, in 2015,<sup>324</sup> also included ten progress indicators (eg, setting targets, conducting health examination surveys, implementation of comprehensive strategy, and action plan and implementation of policies to reduce unhealthy diets) and the second progress report, in 2017, included 19.<sup>325</sup> In 2018, the WHO High-level Commission on NCDs found that progress has been slow and uneven and called for an acceleration in progress to address NCDs globally in its Time to Deliver report.<sup>20</sup> Unfortunately, the subsequent Political Declaration at the UN High-Level Meeting on NCDs in September, 2018 showed that the world's power brokers were far from ready to deliver action on reducing NCDs.<sup>326</sup>

The use of modelled trajectories to determine country-level obesity prevalence has helped to fill large data gaps.<sup>133</sup> Additionally, the global dietary database has been established to measure adult diets globally (17 dietary factors extracted from 1198 nutrition surveys from 193 countries).<sup>327</sup> The Global Observatory for Physical Activity developed country cards on the status of adult physical activity complementing the Active Healthy Kids Global Alliance report cards for children. At least 102 cities in 53 countries use WHO's Urban Health Equity Assessment and Response Tool<sup>328</sup> to analyse equitable urban health outcomes. Two global reports on (inequities in) urban health<sup>329</sup> have been published jointly by WHO and UN Habitat. For many countries, collection

of basic data through WHO's STEPwise Approach to Chronic Disease Risk Factor Surveillance surveys<sup>330</sup> is an important action.

### Upstream monitoring

In addition to further strengthening the outcomes data, considerably more upstream monitoring is needed for food and physical activity policies, systems, and environments to increase the accountability of major actors for coordinated actions. The WHO conducts periodic surveys among Member States on the implementation of actions to prevent NCDs<sup>331</sup> and national nutrition actions<sup>332</sup> through online repositories, databases, and interactive maps.<sup>333</sup> More than 2700 documents containing national NCD targets, policies and guidelines, have been submitted by Member States to WHO.<sup>333</sup> However, the information is self-reported and fairly generic and no sections are included that specifically examine countries' comprehensive monitoring efforts.

The absence of comprehensive, independent upstream monitoring has motivated several academic groups and NGOs to step in, using new methods to monitor policies and environments. The International Network for Food and Obesity/NCDs Research, Monitoring and Action Support (INFORMAS) has developed methods and indicators to measure and compare food environments and policies across countries.<sup>8</sup> Research groups in more than 30 countries are currently implementing INFORMAS monitoring modules.

An example of an INFORMAS cross-country comparison is shown in figure 5,<sup>334</sup> in which 11 countries used the same INFORMAS tool with about 47 indicators to measure food policy implementation by national governments. Guatemala had the highest proportion of policies at very low or no implementation, whereas Chile has the highest proportion of policies at the level of international best practice (figure 5). Across these countries, the top five priority food environment policies that were recommended for policy action by the government to fill the implementation gaps identified were: taxes on unhealthy foods, front-of-pack labelling, targets on the content of nutrients of concern in processed foods, restriction of unhealthy food marketing to children, and healthy school food policies.

The World Cancer Research Fund collects examples of nutrition policies implemented globally in its NOURISHING database and is now expanding this approach into physical activity and breastfeeding.<sup>335,336</sup> ATNI measures the progress of the top food and beverage manufacturers towards creating healthier food environments,<sup>249</sup> and the Global Nutrition Report has reported annually since 2014 on the progress of countries towards meeting their global commitments to nutrition.<sup>337</sup> Also, robust, independent evaluations of government nutrition policies are part of the accountability system.<sup>338,339</sup>

If countries collect monitoring data on food environments and policies, a national country profile can be

For the Global Observatory for Physical Activity see <https://www.globalphysicalactivityobservatory.com/>

For the Active Healthy Kids Global Alliance see <https://www.activehealthykids.org/>

constructed, similar to the Global Burden of Disease country profiles. New Zealand is the first country to have comprehensively surveyed national food environments and has constructed a dashboard of indicators to measure government and food industry progress and changes in the healthiness of food environments (appendix p 40). A similar dashboard, but for NCD policies more broadly, has also been developed for Pacific countries.<sup>340</sup>

Policies that promote built environments conducive to physical activity are mainly at the municipal, rather than national, level. The Global Observatory for Physical Activity country scorecard has only two national indicators that could be considered upstream, although the Active Healthy Kids Global Alliance Report Card for children contains more upstream indicators and has been implemented in around 30 countries. A more comprehensive dashboard of policy and environment indicators for physical activity is needed (appendix p 49).

#### **WHO-level and UN-level monitoring**

Although the aforementioned initiatives are valuable and measured by academics and NGOs, they are not embedded in the WHO-level and UN-level monitoring frameworks and modest funding restricts the pace, breadth, and sustainability of data collection. The SDGs, although not legally binding, are monitored by the UN using a set of 230 global outcome indicators and to date 140 national reviews have been posted online.<sup>341</sup> The UN Decade of Action on Nutrition (2015–25)<sup>26</sup> aims to lift global nutrition action to eradicate hunger and malnutrition in all its forms, and reduce the burden of diet-related NCDs in all age groups. It is calling on countries to establish and achieve specific, measurable, achievable, relevant, and time-bound (SMART) commitments and targets, which could form the Account around which monitoring and accountability systems can be built. Given the slow response by countries to date to create SMART commitments, upstream monitoring can still occur by including some of the upstream measures from INFORMAS, the World Cancer Research Fund, ATNI, and the Global Nutrition Report within formal UN monitoring systems. This stronger upstream monitoring system would contribute more powerfully to accountability and would stimulate governments to include such monitoring activities as a core activity.

A UN level framework should take into consideration key lessons from HIV/AIDS and tobacco prevention monitoring (appendix p 51). For example, joint reporting on government action by governments and civil society organisations to the UN and its agencies would be the most powerful. Additionally, like HIV/AIDS, the UN Convention on the Rights of People with Disabilities could provide a useful framework to address discrimination against people with obesity and diabetes. A human rights framing has also worked to increase monitoring efforts for HIV/AIDS.

WHO needs to monitor the implementation and impacts of the voluntary commitments made by transnational food and beverage companies. The International Food & Beverage Alliance (IFBA) formed in 2008 with eight of the biggest food and beverage companies with the purported aim to change their global business practices to support WHO's 2004 Global Strategy on Diet, Physical Activity, and Health. IFBA set their own Account with global pledges in five areas: product formulation and innovation, nutrition information, promotion of healthy lifestyles, public-private partnerships, and responsible marketing to children. IFBA has reported to WHO annually and published a 10-year progress report for 12 companies in 2018.<sup>342</sup> A proper accountability system for IFBA actions with WHO setting the Account based on its expectations of food industry actions is long overdue, and would ensure independent monitoring of progress and a much closer engagement process to effect real change within the food and beverage industry.

#### **Sustainability of monitoring efforts**

The use of existing and underused data needs to be further explored to make monitoring systems more sustainable. Several sources of existing data in a wide range of countries can be reoriented for monitoring purposes. For example, Household Consumption and Expenditure Surveys are conducted on a nationally representative sample to characterise important aspects of household socioeconomic conditions. Optimisation of this existing data collection for nutrition monitoring has previously been recommended,<sup>343</sup> which could be done in collaboration with The World Bank and FAO. Some efforts have been undertaken to engage the lay public in crowdsourcing data on food environments for monitoring purposes.<sup>344,345</sup> Other routinely available open access datasets that assess community environments have proven to be useful proxies to measure environments, such as the walkability index and community fitness index.<sup>346</sup> Additionally, mechanisms are needed to enable public health experts to access proprietary Big Data on food and beverage product sales, food marketing trends through social media, and geographic information systems that collect data on green spaces and food access for low-income community members in urban and rural settings.

#### **Engagement processes**

Engagement between all major actors is crucial in monitoring processes, to increase accountability. A strategic priority for UN agencies and many governments is to encourage the private sector, especially food companies, to create and implement actions that reduce obesity and diet-related NCDs. However, any such interaction has to guard against conflicts of interest. Corporations are governed by a fiduciary imperative which requires them to prioritise shareholder returns not

public health. This is elaborated elsewhere in the report in relation to policy, but monitoring and accountability systems are another opportunity for action.

Some lessons on the creation of relationships between independent monitors of action (eg, academia and civil society) and the main actors (eg, governments and food companies) can be learned from the work of INFORMAS and ATNI. Healthy Food Environment Policy Index (Food-EPI)<sup>347</sup> engages policymakers in several ways: through verification of the evidence regarding government implementation of policies, by acting as observers or raters during workshops, and by working with independent experts to propose priority policies to fill the implementation gaps. The Business Impact Assessment on Obesity (BIA-Obesity) from INFORMAS and ATNI similarly engages with companies on gathering and scoring their commitments on obesity and population-level nutrition.<sup>348</sup>

Better upstream monitoring systems are needed, with integration into the multiple UN-level commitments and implementation plans to improve accountabilities of actors and health and sustainability. An increased response to The Global Syndemic requires true multisectorial action, transparency, international accountability, and substantial investment in country-level monitoring systems. Other potential actors within accountability systems are also needed, such as investors and stock market indices.

### Strategic funding

As NCD burdens increase globally, in both developed and developing economies, their projected public health and long-term medical care expenditures are rising dramatically. Development agencies have not seriously engaged in supporting LMICs to address NCDs. Only 2·2% of development aid for health is allocated to NCDs, although NCDs are responsible for two thirds of deaths in LMICs, half of which occur under the age of 60 years (appendix p 52). Development agencies have been reluctant to support obesity prevention efforts in LMICs and have focused on reducing undernutrition. Nonetheless, development agencies, such as the World Bank, the Inter-American Development Bank, the Asian Development Bank, the African Development Bank, and the European Commission as well as some bilateral aid agencies, have a key role in preventing obesity and, even more broadly, to mitigate The Global Syndemic. These institutions have the potential to make direct investments in programmes or provide incentives and policy triggers for governments to enact double-duty or triple-duty actions that address The Global Syndemic (appendix p 52).

Development banks have several methods they can use to support action within countries. For example, investment lending involves agencies investing grant or credit resources to pay for inputs to governments for the design and implementation of programmes, such as obesity prevention programmes. When actions are

needed at a policy level, agencies can use other mechanisms, such as disbursement policy loans, that include disbursement-linked indicators, wherein credits to countries can be designed with policy triggers linked to actions such as regulations on mandatory front-of-pack food labels or implementation of fiscal policies for food. Funds are released if or when these clearly defined triggers are met. In other cases, countries, especially middle-income and high-income countries, sometimes request technical assistance or advisory services from agencies to design and implement relevant policies and programmes. These services are often negotiated not just with the ministries of health but also ministries of finance, commerce, industry, and other relevant ministries, as well as consumer associations, media associations, regulatory and legislative bodies, academia, and the corporate sector. This large conglomeration of potential actors makes these policies and programmes much harder to negotiate and equally hard to implement and monitor.

A combination of financial support from philanthropy and development agencies will be needed to support the efforts of countries to implement double-duty and triple-duty actions to address The Global Syndemic. The approach in Mexico of providing philanthropic funding to consumer and health NGOs to create public pressure for healthy policies, and to researchers, to evaluate their effects, could be applied in many other countries with adequate civil society and academic capacity. Given the funding for action in Mexico, an investment of \$1 billion from philanthropic and other sources could plausibly support 100 countries of different sizes and stages of development to apply Mexico's approach to double-duty or triple-duty actions towards mitigating The Global Syndemic. Compared with the annual \$2 trillion costs of obesity alone, the return on investment will be substantial. The establishment of the Green Climate Fund has shown that tens of billions of dollars can be mobilised from high-income countries to support mitigation and adaptation actions on climate change in LMICs. Much smaller amounts of funding for civil society organisations to demand double-duty or triple-duty actions from governments could help overcome the policy inertia that bedevils action on The Global Syndemic.

### Strategic research

There are three major research areas to highlight, in which important gaps exist: the application of systems science to The Global Syndemic, research on the sociocultural factors that explain the variance in obesity and thus the sociocultural barriers and enablers of societal action, and research to address the policy inertia that is preventing policy progress.

The application of systems science to obesity is nascent and should be a priority for research. In particular, system dynamics models or agent-based computational models exist for each of the components of The Global

Syndemic but no models that cover all components. A repository of systems models that address one or more aspects of The Global Syndemic would provide an opportunity for them to be replicated, tested, and extended across settings to develop generalisable patterns of system structure (generic structures) that can be used to address the evolving Global Syndemic. Systems science is inherently iterative, and there is potential to take models that have been tested and validated across contexts as a way to combine scientific knowledge across multiple disciplines and ecologies. Integration can be done sequentially with results from one set of computational models being used as inputs for other models (eg, using outputs from a system dynamics model of climate change to inform a model of food systems). It can also be done by integrating computational models using several methods (eg, hybrid modelling combining an aggregate model of a natural resource system and multi-agent model of individual consumers and organisations).

Sociocultural factors are probably the least explored determinants of obesity. If they can explain, to a large degree, differences in prevalence of obesity between populations, they might also identify differences in approaches to addressing obesity. The Pacific countries, which have the highest rates of obesity internationally, need to be included in a database of cultural dimensions. Overarching theories are needed that explain how these dimensions and other cultural factors related to food, fashion, and body size perception explain the national trajectories of obesity over time.

Implementation science approaches are also needed at the policy level and the community level to understand the contexts and drivers of successful policy implementation. Similarly, at the community level, a priority question is how to implement comprehensive interventions across several settings to explain why some community programmes are effective and others are ineffective.

## Recommendations

The central finding of the Commission's work is that the future health of our people, environment, and planet will depend on the implementation of actions that concurrently address all aspects of The Global Syndemic. The Commission was mindful of the expansive list of evidence-informed recommendations for actions to address obesity, undernutrition, and climate change separately, including recommendations from previous *Lancet* Commissions and Series. After reviewing relevant evidence from many disciplines, this Commission identified six principles and developed nine recommendations and more than 20 actions to maximise impact on The Global Syndemic.

## Six underlying principles

We used six principles to identify the Commission's recommendations for action that would underpin the existing specific policy recommendations for obesity,

undernutrition, and climate change and that might help overcome the policy inertia they are facing. The actions recommended by the Commission should: (1) enhance the implementation of existing recommendations to address different aspects of The Global Syndemic; (2) be systemic in nature to influence feedback loops, power imbalances for government decision-making, policy, economic and social norms, and the purpose of the system; (3) target the underlying drivers of The Global Syndemic, especially policy inertia to implementation; (4) forge synergies within civil society across diverse movements to improve health, environmental, and social equity outcomes; (5) produce multiple benefits through double-duty or triple-duty actions; and (6) reduce inequities by addressing their causes and improve the conditions for socially disadvantaged and discriminated populations.

## Actions to maximise impact on The Global Syndemic

Effective responses to The Global Syndemic will be maximised if the following recommendations and specific actions are achieved progressively over the next decade.

### Think in Global Syndemic terms

Thinking in Global Syndemic terms will allow actors to focus on common systemic drivers that need common actions. The Commission recommends that all actors frame their commitments and actions on the SDGs in syndemic and systems terms to show their inherent connectedness and systemic origins. For example, defining the problems using terms like malnutrition in all its forms and The Global Syndemic and defining actions that are double-duty or triple-duty. This will enhance the synergism and collective efforts of multiple actors across settings and sectors. The Commission also recommends that national governments add urgency to their commitments to reduce poverty and inequalities. The consequences of The Global Syndemic fall disproportionately on the poor and socially disadvantaged populations, making poverty reduction a central goal for action that aligns with SDG 1.

### Join up the silos of thinking and action

Silos of thinking and action need to be linked by proactively creating platforms for collaborative work on common systemic drivers and double-duty or triple-duty actions. The Commission recommend that all actors create links across components of The Global Syndemic at all levels. Linking of initiatives at a global level (eg, SDGs and UNFCCC with the Decade of Action on Nutrition), national level (across health, education, social affairs, agriculture, and climate change ministries), and local level (eg, health and non-health organisations) will foster systemic thinking and double-duty or triple-duty actions.

*Strengthen national and international agency governance levers*  
National and international agency governance levers need to be strengthened to fully implement policy

actions that have been agreed upon through international guidelines, resolutions and treaties. The Commission makes the following recommendations so that this strengthening can be achieved. First, national governments should fully implement their human rights obligations to protect socially disadvantaged populations, especially children and women, and mobilise the public and a broad range of civil society organisations to create healthy and active environments for all people. Second, they should also accelerate their national commitments to, and achievement of, the UN SDG agenda and the UN Decade of Action on Nutrition by establishing SMART targets and strengthening accountability mechanisms to achieve outcomes. Third, UN agencies and regional bodies (eg, European Union and Pacific Forum) should use their constitutional provisions to develop legally binding agreements such as a Framework Convention on Food Systems. Member States should ratify the treaty, and translate the principles and guidelines into national laws to protect their populations from practices that undermine healthy food environments. Fourth, the World Trade Organisation should recognise WHO guidelines and standards for nutrient profiling, food and beverage product labelling, and restrictions on unhealthy food and beverage marketing targeted to children. This action will prevent repeated trade and investment law challenges by companies in response to countries creating policies for healthier food environments. Finally, the World Bank, development agencies, and other funders should encourage double-duty or triple-duty actions to address The Global Syndemic as an essential component of technical assistance and loans (appendix p 52).

### *Strengthen municipal governance levers*

Municipal governance levers also need to be strengthened to mobilise action at the local level and create pressure for national action. Municipal governments should show leadership to implement double-duty or triple-duty actions for The Global Syndemic. Cities are already responding to immediate problems such as pollution, congestion, and food insecurity. Therefore, implementing policies that address land use, active transportation, clean energy, and healthy food systems will serve as double-duty or triple-duty actions to improve the lives of their residents and future generations. To achieve this recommendation municipal governments should network and share resources and innovative strategies to address The Global Syndemic. Many coalitions, alliances, and networks at the local level can empower and foster actions at the national, regional, and global levels.

### *Strengthen civil society engagement*

Strengthening of civil society engagement will encourage systemic change and pressure for policy action at all levels of government to address The Global Syndemic.

Philanthropic investments and investors should create a global Food Fund to support civil society pressure for healthy and sustainable diets and food systems. Alongside the calls for a \$70 billion effort needed to reach the global targets on reducing undernutrition,<sup>349</sup> a much smaller investment (eg, \$1 billion) in strengthening social advocacy and social lobbying of civil society would greatly increase the demand for policy action on healthier food environments.

### *Reduce the influence of large commercial interests on public policy development*

The influence of large commercial interests on the public policy development process needs to be reduced so that governments can implement policies in the public interest that benefit the health of current and future generations, the environment, and the planet. Governments should adopt and institutionalise clear, transparent, and robust guidelines on conflicts of interest and processes for policy development and implementation. They should also strengthen democratic institutions, such as freedom of information laws, declarations of political donations, independent ombudsman and commissioner positions, and platforms for civil society engagement in public policy decision making.

### *Strengthen accountability systems*

To strengthen accountability systems for policy actions that address The Global Syndemic, the Commission makes the following recommendations. First, UN agencies should develop metrics for upstream monitoring of policy implementation and healthy environments to reduce malnutrition in all its forms and decrease greenhouse gas production. Parallel reporting to the UN agencies by governments and civil societies will enhance independent accountability. Second, the UN human rights treaty bodies, Human Rights Council Special Procedures, and the UN Interagency Task Force on NCDs should monitor state actions on protecting and promoting human rights in the context of The Global Syndemic. Third, NGOs and academia should scale up their monitoring systems on food policies and integrating similar approaches for physical activity policies and climate change policies. The existing food monitoring platforms, such as INFORMAS, ATNI and NOURISHING should join forces with UN agency monitoring and with monitoring platforms for physical activity and climate change policies. Finally, regional and global political and economic platforms, such as the World Economic Forum, Association of Southeastern Nations, and G20, should place The Global Syndemic high on their economic agendas. Because The Global Syndemic has enormous economic consequences, monitoring and mutual accountability systems for action at economic forums will protect national, regional, and global economies.

## Sustainable and health-promoting business models for the 21st century

Creating sustainable and health-promoting business models for the 21st century will shift business outcomes from a short-term, profit-only focus to sustainable, profitable models that explicitly include benefits to society and the environment. To achieve this goal, first, national governments should eliminate or redirect subsidies away from products that contribute to The Global Syndemic towards production and consumption practices that are sustainable for human health, the environment and the planet. Reducing subsidies to oil companies and large monocultural agricultural firms would allow subsidies to be directed towards innovations in sustainable energy and transportation and healthy, local food systems. Second, government, business, and economic thought-leaders should develop economic systems that include the costs of ill-health, environmental degradation, and greenhouse-gas emissions in the costs of products. Simultaneously, investments must be made to help those on low incomes manage financially as the full costings and circular economies develop. Convening organisations like the World Economic Forum could help to redefine the business models for the 21st century and lead the shift away from narrow, profit-maximisation models into broader models better able to deliver for people, planet, and prosperity. Third, governments should ensure information is readily available to consumers on the environmental footprints and health impacts of products. Such full disclosure will allow consumers to make fully informed choices and will create a demand-driven pressure for businesses to shift to healthier and more sustainable practices and products.

**Focus research on The Global Syndemic determinants and actions**  
 Creating an evidence base of systemic drivers and actions, including traditional approaches to health and wellbeing, will require research focused on The Global Syndemic determinants and actions. The Commission recommends that collaborations of scientists, policy makers, and practitioners co-create policy-relevant, empirical and modelling studies on the dynamics of aspects of The Global Syndemic and the effects of double-duty or triple-duty actions and systems approaches. Sharing results with policy makers will help them understand the systems they seek to influence and evaluate how effective their policies might be. The Commission also recommends that agencies fund research on indigenous and traditional knowledge to understand the paradigms, practices, and products that will promote better planetary health. An international Seven Generations Fund (decision making for seven generations to come) across several research funding agencies would help to resuscitate indigenous and traditional knowledge and wisdom about food systems, use of biodiversity, world views, and collective approaches to common challenges.

## Panel 16: Accounting monitoring for propositions

Between 2008 and 2018, several *Lancet* Commissions examined the effects of climate change on human health and planetary health. To track progress on health and climate change, the *Lancet* Commission on Health and Climate Change established the *Lancet Countdown* in 2015,<sup>39,350,351</sup> a broad international coalition of experts that assess and report biennially on 31 indicators distributed across five domains. The domains and indicators most relevant to The Global Syndemic are shown below.

### 1. Health impacts of climate hazards

Indicator 1.7. Food security and undernutrition. Indicators should also include obesity to assess the impact of double-duty or triple-duty actions.

### 2. Health resilience and adaptation

Indicator 2.1. Integration of health into national adaptation plans. Indicators here could also assess the extent to which national double-duty or triple-duty policy actions are established and implemented.

### 3. Health co-benefits of climate change resilience and mitigation

Indicator 3.7. Active travel infrastructure and uptake. Policies and environments that promote active travel through public transportation are double-duty duty actions that will increase physical activity and reduce greenhouse-gas emissions from car and other motorised vehicle use.

Indicator 3.8. Greenhouse-gas emissions from food systems and healthy diets. This indicator could also promote a plant-based diet and reduce meat consumption among populations, which represents a double-duty action to reduce obesity, heart disease, and diet-related cancers, as well as reduce methane production from agricultural livestock.

### 4. Economics and finance

Indicator 4.4. Value the health co-benefits of climate change mitigation and climate resilience. These indicators could also capture the financial impact of reduced comorbidities associated with increased physical activity and reduced obesity to drive the ongoing investment in double-duty and triple-duty actions.

### 5. Political and broader engagement

Indicator 5.1. Public engagement with health and climate change. Public mobilisation will be essential to create the political demand to reduce The Global Syndemic. This indicator could also monitor how linking the pandemics of obesity, undernutrition, and climate change could unite currently diverse and disparate constituencies worldwide.

## Future monitoring

Monitoring the progress for the aforementioned actions recommendations will be an ongoing task for the Commission and will link well with the existing *Lancet Countdown* on Climate Change and Health (panel 16). Many reports are being published on achieving better human health, reducing socioeconomic inequalities, achieving sustainable agriculture and diets, and reducing anthropogenic environmental damage. The concept of The Global Syndemic has the potential to bring these closely aligned challenges together under one umbrella and to advance actions and accountability to the next level needed to achieve planetary health.

## Contributors

BAS and WHD co-chaired the Commission and were the lead writers for the report. VIK was also part of the lead writing team. Commissioners and Fellows attended one or more of the three face-to-face meetings

and/or the consultation workshops and all were part of several writing groups established to write the initial drafts of the sections. All Commissioners and Fellows contributed through comments on multiple versions of the report. SF, PSH, MS, CH, BL, SG, and AP hosted consultation workshops in their institutions.

#### Declaration of interests

SA reports grants from the Australian National Health and Medical Research Council, during conduct of the study. HB and PMN report grants from Novo Nordisk, outside the submitted work. AC reports grants from Bloomberg Philanthropies, during the conduct of the study. SG reports grants from Bernard Lown Scholars in Cardiovascular Health Program, Harvard School of Public Health, during the conduct of the study. TL reports grants from Novo Nordisk, during the conduct of the study. GS is an academic partner on a healthy supermarket intervention trial that includes Australian local government and supermarket retail collaborators. BAS, SF, GS, SV, and TL are leading several INFORMAS studies to benchmark the policies and commitments of governments and food companies related to obesity prevention and nutrition. WHD receives consulting fees as a member of the scientific advisory committee for Weight Watchers, as a member and chair of the JPB Foundation's Poverty Advisory Board, and as a consultant for the RTI: Feeding Infants and Toddlers Study. He received a grant from Bridgespan to analyse NHANES data on obesity in young adults. BAS is a plaintiff in a defamation case against individuals and organisations related to the food industry. All other authors declare no competing interests.

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#### References

- NCD Risk Factor Collaboration (NCD-RisC). 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. *Lancet* 2016; **387**: 1377–96.
- Roberto CA, Swinburn B, Hawkes C, et al. Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking. *Lancet* 2015; **385**: 2400–09.
- Popkin B, Monteiro C, Swinburn B. Overview: Bellagio Conference on program and policy options for preventing obesity in the low- and middle-income countries. *Obes Rev* 2013; **14** (suppl 2): 1–8.
- Singer MA. A dose of drugs, a touch of violence, a case of AIDS: conceptualizing the SAVA syndemic. *Free Inq Creat Sociol* 1996; **24**: 99–110.
- FAO, IFAD, WFP. The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. Rome: FAO, 2015.
- GBD 2016 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017; **390**: 1345–422.
- Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Prev Med* 1999; **29**: 563–70.
- Swinburn B, Sacks G, Vandevijvere S, et al, and the INFORMAS. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. *Obes Rev* 2013; **14** (suppl 1): 1–12.
- WHO. Tackling NCDs. 'Best buys' and other recommended interventions for the prevention and control of noncommunicable diseases. Geneva, Switzerland: World Health Organization, 2017.
- Johnston JL, Fanzo JC, Cogill B. Understanding sustainable diets: a descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. *Adv Nutr* 2014; **5**: 418–29.
- Bronfenbrenner U. Six theories of child development: revised formulations and current issues. In: Vasta R, ed. Ecological Systems Theory. London, UK: Jessica Kingsley; 1992: 187–249.
- Government Office for Science. Foresight: tackling obesity: future choices-project report, 2007.
- Puhl RM, Brownell KD. Confronting and coping with weight stigma: an investigation of overweight and obese adults. *Obesity (Silver Spring)* 2006; **14**: 1802–15.
- Gortmaker SL, Must A, Perrin JM, Sobol AM, Dietz WH. Social and economic consequences of overweight in adolescence and young adulthood. *N Engl J Med* 1993; **329**: 1008–12.
- Donaldson E. Advocating for sugar-sweetened beverage taxation: a case study of Mexico. Baltimore, MD: Johns Hopkins Bloomberg School of Public Health, 2015.
- Branson C, Duffy B, Perry C, Wellings D. Acceptable behaviour? Public opinion on behaviour change policy. London: Ipsos Mori, 2018.
- Bayer R, Kirp D. AIDS in the Industrialized Democracies. New Brunswick, NJ: Rutgers University Press; 1992.
- Baker P, Gill T, Friel S, Carey G, Kay A. Generating political priority for regulatory interventions targeting obesity prevention: an Australian case study. *Soc Sci Med* 2017; **177**: 141–49.
- WHO. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation (WHO Technical Report Series 894). Geneva, Switzerland: World Health Organization, 2000.
- WHO. Time to deliver: Report of the WHO Independent High-level Commission on Noncommunicable Diseases. Geneva, Switzerland: World Health Organization, 2018.
- World Health Assembly. Resolution 65.6. Annex 2. Comprehensive implementation plan on maternal, infant and young child nutrition. Geneva, Switzerland: World Health Organization, 2012. [https://www.who.int/nutrition/topics/WHA65.6\\_resolution\\_en.pdf](https://www.who.int/nutrition/topics/WHA65.6_resolution_en.pdf) (accessed Dec 11, 2018).
- WHO. Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020. Geneva, Switzerland: World Health Organization, 2013.
- Development Initiatives. Global Nutrition Report 2017: Nourishing the SDGs. Bristol, UK: Development Initiatives, 2017.
- von Grebmer K, Bernstein J, Hossain N, et al. 2017 Global Hunger Index: The inequalities of hunger. Washington, DC; Bonn; and Dublin: International Food Policy Research Institute, Welthungerhilfe, and Concern Worldwide, 2017.
- Food and Agriculture Organization of the United Nations. The Second International Conference on Nutrition: Committing to a future free of malnutrition. Rome: Food and Agriculture Organization of the United Nations, 2014.
- WHO. Decade of action on nutrition—the April 2016 proclamation. World Health Organization, 2018. [http://www.who.int/nutrition/decade-of-action/information\\_flyer/en/](http://www.who.int/nutrition/decade-of-action/information_flyer/en/) (accessed Jan 31, 2018).
- United Nations. Resolution adopted by the General Assembly on 25 September 2015. 70/1. Transforming our world: the 2030 Agenda for Sustainable Development. New York: United Nations, 2015.
- Development Initiatives. 2018 Global Nutrition Report: shining a light to spur action on nutrition. Bristol, UK: Development Initiatives, 2018.
- Tsai AC, Mendenhall E, Trostle JA, Kawachi I. Co-occurring epidemics, syndemics, and population health. *Lancet* 2017; **389**: 978–82.
- Mendenhall E, Kohrt BA, Norris SA, Ndetei D, Prabhakaran D. Non-communicable disease syndemics: poverty, depression, and diabetes among low-income populations. *Lancet* 2017; **389**: 951–63.

- 31 Chakrapani V, Newman PA, Shunmugam M, Logie CH, Samuel M. Syndemics of depression, alcohol use, and victimisation, and their association with HIV-related sexual risk among men who have sex with men and transgender women in India. *Glob Public Health* 2017; **12**: 250–65.
- 32 Singer M, Clair S. Syndemics and public health: reconceptualizing disease in bio-social context. *Med Anthropol Q* 2003; **17**: 423–41.
- 33 NCD Risk Factor Collaboration (NCD-RisC). 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. *Lancet* 2017; **390**: 2627–42.
- 34 Afshin A, Forouzanfar MH, Reitsma MB, et al, and the GBD 2015 Obesity Collaborators. Health effects of overweight and obesity in 195 countries over 25 years. *N Engl J Med* 2017; **377**: 13–27.
- 35 Lehnert T, Sonntag D, Konnopka A, Riedel-Heller S, König HH. Economic costs of overweight and obesity. *Best Pract Res Clin Endocrinol Metab* 2013; **27**: 105–15.
- 36 Dobbs R, Sawers C, Thompson F, et al. Overcoming obesity: an initial economic analysis: McKinsey Global Institute, 2014. [https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Economic%20Studies%20TEMP/Our%20Insights/How%20the%20world%20could%20better%20fight%20obesity/MGI\\_Overcoming\\_obesity\\_Full\\_report.ashx](https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Economic%20Studies%20TEMP/Our%20Insights/How%20the%20world%20could%20better%20fight%20obesity/MGI_Overcoming_obesity_Full_report.ashx) (accessed Dec 11, 2018).
- 37 Black RE, Allen LH, Bhutta ZA, et al, and the Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet* 2008; **371**: 243–60.
- 38 Costello A, Abbas M, Allen A, et al. Managing the health effects of climate change: Lancet and University College London Institute for Global Health Commission. *Lancet* 2009; **373**: 1693–733.
- 39 Watts N, Adger WN, Agnolucci P, et al. Health and climate change: policy responses to protect public health. *Lancet* 2015; **386**: 1861–94.
- 40 Stern N. The economics of climate change. London: HM Treasury, 2006.
- 41 World Economic Forum. Global Risks Report 2017, 12th Edition. Geneva, Switzerland: World Economic Forum, 2017.
- 42 Smith KR, Woodward A, Campbell-Lendrum D, et al. Human health: impacts, adaptation, and co-benefits. In: Field CB, Barros VR, Dokken DJ, et al, eds. 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. Cambridge, UK; New York, NY, USA: Cambridge University Press, 2014; 709–54.
- 43 Myers SS, Smith MR, Guth S, et al. Climate Change and Global Food Systems: Potential Impacts on Food Security and Undernutrition. *Annu Rev Public Health* 2017; **38**: 259–77.
- 44 Phalkey RK, Aranda-Jan C, Marx S, Höfle B, Sauerborn R. Systematic review of current efforts to quantify the impacts of climate change on undernutrition. *Proc Natl Acad Sci USA* 2015; **112**: E4522–29.
- 45 Taub DR, Miller B, Allen H. Effects of elevated CO<sub>2</sub> on the protein concentration of food crops: a meta-analysis. *Glob Change Biol* 2008; **14**: 565–75.
- 46 Lobell DB, Schlenker W, Costa-Roberts J. Climate trends and global crop production since 1980. *Science* 2011; **333**: 616–20.
- 47 United States Environmental Protection Agency. Climate Impacts on Agriculture and Food Supply. United States Environmental Protection Agency, 2017. <https://archive.epa.gov/epa/climate-impacts/climate-impacts-agriculture-and-food-supply.html> (accessed Dec 11, 2018).
- 48 Porter JR, Xie L, Challinor AJ, et al. Food security and food production systems. In: Field CB, Barros VR, Dokken DJ, et al, eds. 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. Cambridge, UK; New York, NY: Cambridge University Press, 2014: 485–533.
- 49 Springmann M, Mason-D'Croz D, Robinson S, et al. Global and regional health effects of future food production under climate change: a modelling study. *Lancet* 2016; **387**: 1937–46.
- 50 Frank S, Havlik P, Souissana JF, et al. Reducing greenhouse gas emissions in agriculture without compromising food security? *Environ Res Lett* 2017; **12**: 105004.
- 51 Hertwich EG, van der Voet E, Suh S, et al. Assessing the environmental impacts of consumption and production: priority products and materials, a report of the Working Group on the Environmental Impacts of Products and Materials to the International Panel for Sustainable Resource Management. Nairobi, Kenya: United Nations Environment Programme, 2010.
- 52 Vermeulen SJ, Campbell BM, Ingram JSI. Climate Change and Food Systems. *Annu Rev Environ Resour* 2012; **37**: 195–222.
- 53 Reisinger A, Clark H. How much do direct livestock emissions actually contribute to global warming? *Glob Change Biol* 2018; **24**: 1749–61.
- 54 Aleksandrowicz L, Green R, Joy EJ, Smith P, Haines A. The impacts of dietary change on greenhouse gas emissions, land use, water use, and health: a systematic review. *PLoS One* 2016; **11**: e0165797.
- 55 Bajzelj B, Richards KS, Allwood JM, et al. The importance of food demand management for climate mitigation. *Nat Clim Chang* 2014; **4**: 924–29.
- 56 FAO. Food Wastage Footprint & Climate Change. Food and Agriculture Organization, 2015. [https://www.fao.org/fileadmin/templates/nr/sustainability\\_pathways/docs/FWF\\_and\\_climate\\_change.pdf](https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/FWF_and_climate_change.pdf) (accessed Dec 11, 2018).
- 57 An R, Ji M, Zhang S. Global warming and obesity: a systematic review. *Obes Rev* 2018; **19**: 150–63.
- 58 Dannenberg AL, Burton DC, Jackson RJ. Economic and environmental costs of obesity: the impact on airlines. *Am J Prev Med* 2004; **27**: 264.
- 59 Moradi S, Mirzababaei A, Dadfarma A, et al. Food insecurity and adult weight abnormality risk: a systematic review and meta-analysis. *Eur J Nutr* 2018; published online Sept 15. DOI:10.1007/s00394-018-1819-6.
- 60 Gillman MW, Barker D, Bier D, et al. Meeting report on the 3rd International Congress on Developmental Origins of Health and Disease (DOHaD). *Pediatr Res* 2007; **61**: 625–29.
- 61 NCD Risk Factor Collaboration. Worldwide trends in children's and adolescents' body mass index, underweight, overweight and obesity, in comparison with adults, from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies with 128·9 million participants. *Lancet* 2017; **390**: 2627–42.
- 62 Tzioumis E, Kay MC, Bentley ME, Adair LS. Prevalence and trends in the childhood dual burden of malnutrition in low- and middle-income countries, 1990–2012. *Public Health Nutr* 2016; **19**: 1375–88.
- 63 Delpach F, Maire B, Monnier E, Holdsworth M. Globesity: a planet out of control? London, UK: Routledge; 2009.
- 64 Egger G, Swinburn B. Planet Obesity: How we are eating ourselves and the planet to death. Crows Nest, NSW: Allen & Unwin, 2010.
- 65 Friel S. Climate change and the people's health: Oxford University Press; 2018.
- 66 Reardon T, Timmer CP. The Economics of the Food System Revolution. *Annu Rev Resour Econ* 2012; **4**: 225–64.
- 67 Kicsi R, Buta S. Multinational Corporations In the Architecture of Global Economy. *USV Annals Econ Pub Admin* 2012; **12**: 140–47.
- 68 Unravelling the Food-Health Nexus: Addressing Practices, Political Economy, and Power Relations to Build Healthier Food Systems. Global Alliance for the Future of Food, 2017. <https://futureoffood.org/impact-areas/advancing-well-being/unravelling-the-food-health-nexus/> (accessed Dec 11, 2018).
- 69 Chan M. WHO Director-General addresses health promotion conference. World Health Organization, 2013. [http://www.who.int/dg/speeches/2013/health\\_promotion\\_20130610/en/](http://www.who.int/dg/speeches/2013/health_promotion_20130610/en/) (accessed Feb 3, 2018).
- 70 Worldwatch Institute. Agricultural Subsidies Remain a Staple in the Industrial World. Worldwatch Institute, 2014. <http://vitalsigns.worldwatch.org/vs-trend/agricultural-subsidies-remain-staple-industrial-world> (accessed May 18, 2018).
- 71 Struben J, Chan D, Dubé L. Policy insights from the nutritional food market transformation model: the case of obesity prevention. *Ann NY Acad Sci* 2014; **1331**: 57–75.
- 72 Finegood DT. The Complex Systems Science of Obesity. In: Cawley J, ed. The Oxford Handbook of the Social Science of Obesity. Oxford University Press, 2012.
- 73 Monteiro CA, Moura JC, Cannon G, Ng SW, Popkin B. Ultra-processed products are becoming dominant in the global food system. *Obes Rev* 2013; **14** (suppl 2): 21–28.

- 74 Monteiro CA, Moura JC, Levy RB, Canella DS, Louzada MLDC, Cannon G. Household availability of ultra-processed foods and obesity in nineteen European countries. *Public Health Nutr* 2018; **21**: 18–26.
- 75 Fiolet T, Srour B, Sellem L, et al. Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. *BMJ* 2018; **360**: k322.
- 76 Thow AM, Reeve E, Naseri T, Martyn T, Bollards C. Food supply, nutrition and trade policy: reversal of an import ban on turkey tails. *Bull World Health Organ* 2017; **95**: 723–25.
- 77 Gewertz D, Errington F. Cheap Meat: Flap Food Nations in the Pacific Islands. Berkeley and Los Angeles, CA and London, England: University of California Press, 2010.
- 78 Ruby MB, Alvarenga MS, Rozin P, Kirby TA, Richer E, Rutzstein G. Attitudes toward beef and vegetarians in Argentina, Brazil, France, and the USA. *Appetite* 2016; **96**: 546–54.
- 79 Mahajan A. Africa Rising: How 900 million African consumers offer more than you think. Upper Saddle River, NJ: Prentice Hall, 2009.
- 80 Stuckler D, Nestle M. Big food, food systems, and global health. *PLoS Med* 2012; **9**: e1001242.
- 81 Economos CD, Hammond RA. Designing effective and sustainable multifaceted interventions for obesity prevention and healthy communities. *Obesity (Silver Spring)* 2017; **25**: 1155–56.
- 82 International Food Policy Research Institute. Global Nutrition Report 2015: Actions and Accountability to Advance Nutrition and Sustainable Development. Washington, DC: International Food Policy Research Institute, 2015.
- 83 Hawkes C, Demaio AR, Branca F. Double-duty actions for ending malnutrition within a decade. *Lancet Glob Health* 2017; **5**: e745–46.
- 84 Ridgway EM, Lawrence MA, Woods J. Integrating environmental sustainability considerations into food and nutrition policies: insights from Australia's national food plan. *Front Nutr* 2015; **2**: 29.
- 85 Freidberg S. Wicked nutrition: the controversial greening of official dietary guidance. *Gastronomica* 2016; **16**: 69–80.
- 86 Swinburn B, Kraak V, Rutter H, et al. Strengthening of accountability systems to create healthy food environments and reduce global obesity. *Lancet* 2015; **385**: 2534–45.
- 87 Monteiro CA, Cannon G, Moura JC, et al. Dietary guidelines to nourish humanity and the planet in the twenty-first century. A blueprint from Brazil. *Public Health Nutr* 2015; **18**: 2311–22.
- 88 Swinburn BA, Sacks G, Hall KD, et al. The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011; **378**: 804–14.
- 89 FAO. The State of Food and Agriculture 2013. Rome: Food and Agriculture Organization of the United Nations, 2013.
- 90 Jägerskog A, Jönch Clausen T. Feeding a thirsty world—challenges and opportunities for a water and food secure future. Report Nr. 31. Stockholm, Sweden: Stockholm International Water Institute, 2012.
- 91 High Level Panel of Experts on Food Security and Nutrition. Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome: High Level Panel of Experts on Food Security and Nutrition, 2017.
- 92 International Food Policy Research Institute. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. Washington, DC: International Food Policy Research Institute, 2016.
- 93 Ritchie H, Roser M. Meat and seafood production & consumption. Our World In Data, 2018. <https://ourworldindata.org/meat-and-seafood-production-consumption> (accessed Dec 5, 2018).
- 94 Ripple WJ, Smith P, Haberl H, Montzka SA, McAlpine C, Boucher DH. Ruminants, climate change and climate policy. *Nat Clim Chang* 2013; **4**: 2.
- 95 Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, de Haan C. Livestock's long shadow: environmental issues and options. Rome: Food and Agriculture Organization of the United Nations, 2006.
- 96 Wang Y, Beydoun MA. Meat consumption is associated with obesity and central obesity among US adults. *Int J Obes* 2009; **33**: 621–28.
- 97 You W, Henneberg M. Meat consumption providing a surplus energy in modern diet contributes to obesity prevalence: an ecological analysis. *BMC Nutr* 2016; **2**: 22.
- 98 Micha R, Michas G, Mozaffarian D. Unprocessed red and processed meats and risk of coronary artery disease and type 2 diabetes—an updated review of the evidence. *Curr Atheroscler Rep* 2012; **14**: 515–24.
- 99 Pan A, Sun Q, Bernstein AM, et al. Red meat consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis. *Am J Clin Nutr* 2011; **94**: 1088–96.
- 100 Bouvard V, Loomis D, Guyton KZ, et al, and the International Agency for Research on Cancer Monograph Working Group. Carcinogenicity of consumption of red and processed meat. *Lancet Oncol* 2015; **16**: 1599–600.
- 101 Mottet A, de Haan C, Faluccia A, Tempio G, Opio C, Gerber P. Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. *Glob Food Secur* 2017; **14** (suppl C): 1–8.
- 102 Louzada MLDC, Ricardo CZ, Steele EM, Levy RB, Cannon G, Monteiro CA. The share of ultra-processed foods determines the overall nutritional quality of diets in Brazil. *Public Health Nutr* 2018; **21**: 94–102.
- 103 Baker P, Friel S. Food systems transformations, ultra-processed food markets and the nutrition transition in Asia. *Global Health* 2016; **12**: 80.
- 104 Zehner E. Promotion and consumption of breastmilk substitutes and infant foods in Cambodia, Nepal, Senegal and Tanzania. *Matern Child Nutr* 2016; **12** (suppl 2): 3–7.
- 105 Uauy R, Kain J. The epidemiological transition: need to incorporate obesity prevention into nutrition programmes. *Public Health Nutr* 2002; **5**: 223–29.
- 106 Garnett T. Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy* 2011; **36**: S23–32.
- 107 Hadjikakou M. Trimming the excess: environmental impacts of discretionary food consumption in Australia. *Ecol Econ* 2017; **131**: 119–28.
- 108 Tilman D, Clark M. Global diets link environmental sustainability and human health. *Nature* 2014; **515**: 518–22.
- 109 Global Panel on Agriculture and Food Systems for Nutrition. Food systems and diets: Facing the challenges of the 21st century London, UK: Global Panel on Agriculture and Food Systems for Nutrition 2016.
- 110 Eat-Lancet Commission. The EAT-Lancet Report on Food, Planet and Health. EAT Forum, 2018. <https://eatforum.org/initiatives/eat-lancet/> (accessed Dec 11, 2018).
- 111 International Panel of Experts on Sustainable Food Systems. The new science of sustainable food systems: overcoming barriers to food systems reform. Food and Agriculture Organization of the United Nations, 2015. <http://www.fao.org/agroecology/database/detail/en/c/453669/> (accessed Dec 11, 2018).
- 112 International Food Policy Research Institute. IFPRI Global Food Policy Report 2017. 2018. <https://gfpr.ifpri.info> (accessed Feb 8, 2018).
- 113 Ottersen OP, Dasgupta J, Blouin C, et al. The political origins of health inequity: prospects for change. *Lancet* 2014; **383**: 630–67.
- 114 Whitmee S, Haines A, Beyrer C, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet Commission on planetary health. *Lancet* 2015; **386**: 1973–2028.
- 115 Haines A. Addressing challenges to human health in the Anthropocene epoch—an overview of the findings of the Rockefeller/Lancet Commission on Planetary Health. *Int Health* 2017; **9**: 269–71.
- 116 WHO. Physical activity for health. More active people for a healthier world: draft global action plan on physical activity 2018–2030. World Health Organization, 2017. <http://www.who.int/ncds/governance/Global-action-plan-on-PA-DRAFT-2-Dec-2017.pdf?ua=1> (accessed March 11, 2018).
- 117 Shekar M, Kakietek J, Eberwein JD, Walters D. An Investment Framework for Nutrition: Reaching the Global Targets for Stunting, Anemia, Breastfeeding, and Wasting. Washington, DC: World Bank, 2017.
- 118 Colchero MA, Rivera-Dommarco J, Popkin BM, Ng SW. In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Aff (Millwood)* 2017; **36**: 564–71.
- 119 Moodie R, Stuckler D, Monteiro C, et al, and the Lancet NCD Action Group. Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra-processed food and drink industries. *Lancet* 2013; **381**: 670–79.
- 120 The Editors. Soda Taxes Can Protect Health in Asia. Bloomberg, Feb 24, 2016. <https://www.bloomberg.com/view/articles/2016-02-23/soda-taxes-can-protect-health-in-asia> (accessed March 11, 2018).

- 121 Simon C, Kocot SL, Dietz WH. Partnership for a healthier America: creating change through private sector partnerships. *Curr Obes Rep* 2017; **6**: 108–15.
- 122 Partnership for a Healthier America. Past Annual Progress Reports. Partnership for a Healthier America, 2017. <https://www.healthieramerica.org/progress-reports/2016/conclusion/past-annual-progress-reports> (accessed March 11, 2018).
- 123 Farley T. Saving Gotham: A Billionaire Mayor, Activist Doctors, and the Fight for Eight Million Lives. New York, NY; London, UK: W.W. Norton & Company; 2015.
- 124 IPCC. Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge: Cambridge University Press, 2014.
- 125 Frank LD. Economic determinants of urban form: resulting trade-offs between active and sedentary forms of travel. *Am J Prev Med* 2004; **27** (suppl): 146–53.
- 126 Flint E, Webb E, Cummins S. Change in commute mode and body-mass index: prospective, longitudinal evidence from UK Biobank. *Lancet Public Health* 2016; **1**: e46–55.
- 127 Woodcock J, Edwards P, Tonne C, et al. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *Lancet* 2009; **374**: 1930–43.
- 128 Duhl LI, Sanchez AK. Healthy cities and the city planning process: A background document on links between health and urban planning. Copenhagen, Denmark: World Health Organization Regional Office for Europe, 1999.
- 129 Friel S, Marmot M, McMichael AJ, Kjellstrom T, Vägerö D. Global health equity and climate stabilisation: a common agenda. *Lancet* 2008; **372**: 1677–83.
- 130 Herrick C. Healthy acities of/from the South. In: Parnell S, Oldfield S, eds. The Routledge handbook on cities of the Global South. New York: Routledge, 2014: 556–68.
- 131 United Nations Human Settlements Programme. Urbanization and development: Emerging futures. World cities report 2016. Nairobi, Kenya: United Nations Human Settlements Programme, 2016.
- 132 Hackworth J. The Neoliberal city: Governance, ideology, and development in American urbanism. Ithaca, NY: Cornell University Press, 2007.
- 133 Murray MJ. The spatial dynamics of postmodern urbanism: social polarisation and fragmentation in São Paulo and Johannesburg. *J Contemp Afr Stud* 2004; **22**: 139–69.
- 134 United Nations Human Settlements Programme. Planning sustainable cities: Global report on human settlements 2009. London, UK and Sterling, VA: Earthscan, 2009.
- 135 Smit W, Hancock T, Kumaresen J, Santos-Burgoa C, Sánchez-Kobashi Meneses R, Friel S. Toward a research and action agenda on urban planning/design and health equity in cities in low and middle-income countries. *J Urban Health* 2011; **88**: 875–85.
- 136 Goenka S, Ajay V, Jeemon P, Prabhakaran D, Varghese C, Reddy KS. Powering India's growth. New Delhi, India: IC Health Scientific Secretariate, 2007.
- 137 Gilbert A. Good urban governance: Evidence from a model city? *Bull Lat Am Res* 2006; **25**: 392–419.
- 138 Rabinovitch J. Curitiba: Towards sustainable urban development. *Environ Urban* 1992; **4**: 62–73.
- 139 Giles-Corti B, Vernez-Moudon A, Reis R, et al. City planning and population health: a global challenge. *Lancet* 2016; **388**: 2912–24.
- 140 Ashe M, Jernigan D, Kline R, Galaz R. Land use planning and the control of alcohol, tobacco, firearms, and fast food restaurants. *Am J Public Health* 2003; **93**: 1404–08.
- 141 Dixon J, Omwega AM, Friel S, Burns C, Donati K, Carlisle R. The health equity dimensions of urban food systems. *J Urban Health* 2007; **84** (suppl): i118–29.
- 142 Shaw HJ. Food desserts: Towards the development of a classification. *Geogr Ann, Ser B* 2006; **88**: 231–47.
- 143 Sushil Z, Vandevijvere S, Exeter DJ, Swinburn B. Food swamps by area socioeconomic deprivation in New Zealand: a national study. *Int J Public Health* 2017; **62**: 869–77.
- 144 Morland KB, Evenson KR. Obesity prevalence and the local food environment. *Health Place* 2009; **15**: 491–95.
- 145 Battersby J, Crush J. Africa's urban food desserts. *Urban Forum* 2014; **25** (2): 143–51.
- 146 Smit W, de Lannoy A, Dover RV, Lambert EV, Levitt N, Watson V. Making unhealthy places: The built environment and non-communicable diseases in Khayelitsha, Cape Town. *Health Place* 2016; **39**: 196–203.
- 147 Minten B. The food retail revolution in poor countries: Is it coming or is it over? *Econ Dev Cult Change* 2008; **56**: 767–89.
- 148 Riley L, Legwegoh A. Comparative urban food geographies in Blantyre and Gaborone. *Afr Geogr Rev* 2014; **33**: 52–66.
- 149 Demmler KM, Klasen S, Nzuma JM, Qaim M. Supermarket purchase contributes to nutrition-related non-communicable diseases in urban Kenya. *PLoS One* 2017; **12**: e0185148.
- 150 Oggutu J, Roesel K, McCrindle C, Hendrickx S, Makita K, Grace D. Arrive alive in South Africa: Chicken meat the least to worry about. In: Roesel K, Grace D, eds. Food safety and informal markets: Animal products in sub-Saharan Africa. Abingdon, UK: Routledge, 2014.
- 151 Kuussana ED, Eledi JA. As the city grows, where do the farmers go? Understanding peri-urbanization and food systems in Ghana—evidence from the Tamale metropolis. *Urban Forum* 2015; **26**: 443–65.
- 152 Sallis JF, Bull F, Burdett R, et al. Use of science to guide city planning policy and practice: how to achieve healthy and sustainable future cities. *Lancet* 2016; **388**: 2936–47.
- 153 C40 Cities Climate Leadership Group. The power of C40 Cities. C40 Cities, 2018. <http://www.c40.org/cities> (accessed Dec 11, 2018).
- 154 WHO. Healthy Settings. World Health Organization, 2018. [http://www.who.int/healthy\\_settings/types/cities/en/](http://www.who.int/healthy_settings/types/cities/en/) (accessed Dec 11, 2018).
- 155 de Leeuw E. Evaluating WHO Healthy Cities in Europe: issues and perspectives. *J Urban Health* 2013; **90** (suppl 1): 14–22.
- 156 WHO. WHO Global Action Plan on physical activity 2018–2030. World Health Organization (in press).
- 157 NCD Risk Factor Collaboration. Adult Body-Mass Index. Country-specific data for all countries. NCD Risk Factor Collaboration, 2017. [http://ncdrisc.org/downloads/bmi/NCD\\_RisC\\_Lancet\\_2017\\_BMI\\_age\\_standardised\\_country.csv](http://ncdrisc.org/downloads/bmi/NCD_RisC_Lancet_2017_BMI_age_standardised_country.csv) (accessed Dec 11, 2018).
- 158 The World Bank Group. CO<sub>2</sub> emissions (kt). The World Bank Group, 2018. <https://data.worldbank.org/indicator/EN.ATM.CO2E.KT> (accessed Dec 11, 2018).
- 159 The World Bank Group. GDP per capita, PPP (constant 2011 international \$). The World Bank Group, 2018. <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD?end=2015&locations=SE-US-DK-GB-DE&start=2005> (accessed Dec 11, 2018).
- 160 The World Bank Group. GINI index (World Bank estimate). 2018. <https://data.worldbank.org/indicator/SI.POV.GINI> (accessed Feb 2018).
- 161 Stiglitz JE. Inequality, living standards and economic growth. In: Jacobs M, Mazzucato M, eds. Rethinking Capitalism: Economics and Policy for Sustainable and Inclusive Growth. West Sussex, UK: Wiley Blackwell; 2016: 134–55.
- 162 Flannery T. The Future Eaters: An Ecological History of the Australasian Lands and People. New York: Grove Press, 2002.
- 163 Crutzen PJ, Stoermer EF. The "Anthropocene". *Global Change Newsletter* 2000; **41**: 17–18.
- 164 Dorfman L, Wilbur P, Lingas EO, Woodruff K, Wallack L. Accelerating policy on nutrition: Lessons from tobacco, alcohol, firearms and traffic safety. Berkeley, CA: Berkeley Media Studies Group of the Public Health Institute, Robert Wood Johnson Foundation, The California Endowment, 2005.
- 165 Yach D, McKee M, Lopez AD, Novotny T. Improving diet and physical activity: 12 lessons from controlling tobacco smoking. *BMJ* 2005; **330**: 898–900.
- 166 Kersh R, Morone J. How the personal becomes political: prohibitions, public health, and obesity. *Stud Am Polit Dev* 2002; **16**: 162–75.
- 167 Brownell KD, Warner KE. The perils of ignoring history: big tobacco played dirty and millions died. How similar is Big Food? *Milbank Q* 2009; **87**: 259–94.
- 168 Keck ME, Sikkink K. Activists beyond borders: Advocacy networks in international politics. New York: Cornell University Press; 2014.
- 169 Geneau R, Stuckler D, Stachenko S, et al. Raising the priority of preventing chronic diseases: a political process. *Lancet* 2010; **376**: 1689–98.

- 170 Daynard RA. Lessons from tobacco control for the obesity control movement. *J Public Health Policy* 2003; **24**: 291–95.
- 171 Piketty T, Goldhammer A. Capital in the Twenty-First Century. Cambridge, MA: The Belknap Press of Harvard University Press, 2014.
- 172 Navarro V. Neoliberalism, globalization, and inequalities: Consequences for health and quality of life. Amityville, NY: Blackwell Publishing Ltd, 2007.
- 173 Burris S, Kempa M, Shearing C. Changes in governance: a cross-disciplinary review of current scholarship. *Akron L Rev* 2008; **41**: 1–67.
- 174 Bakker K, Kooy M, Shofiani NE, Martijn E-J. Governance failure: rethinking the institutional dimensions of urban water supply to poor households. *World Dev* 2008; **36**: 1891–915.
- 175 Johnston LM, Finegood DT. Cross-sector partnerships and public health: challenges and opportunities for addressing obesity and noncommunicable diseases through engagement with the private sector. *Annu Rev Public Health* 2015; **36**: 255–71.
- 176 Buse K, Tanaka S, Hawkes S. Healthy people and healthy profits? Elaborating a conceptual framework for governing the commercial determinants of non-communicable diseases and identifying options for reducing risk exposure. *Global Health* 2017; **13**: 34.
- 177 Hill PS. Understanding global health governance as a complex adaptive system. *Glob Public Health* 2011; **6**: 593–605.
- 178 Mejia-Costa A, Fanzo J. Fighting maternal and child malnutrition: Analysing the political and institutional determinants of delivering a national multisectoral response in six countries. Brighton, UK: Institute of Development Studies, 2012.
- 179 Mejia Acosta A, Haddad L. The politics of success in the fight against malnutrition in Peru. *Food Policy* 2014; **44**: 26–35.
- 180 Gillespie S, Haddad L, Mannar V, Menon P, Nisbett N, and the Maternal and Child Nutrition Study Group. The politics of reducing malnutrition: building commitment and accelerating progress. *Lancet* 2013; **382**: 552–69.
- 181 Baker P, Hawkes C, Wingrove K, et al. What drives political commitment for nutrition? A review and framework synthesis to inform the United Nations Decade of Action on Nutrition. *BMJ Glob Health* 2018; **3**: e000485.
- 182 Gillespie S, van den Bold M, Hodge J, Herforth A. Leveraging agriculture for nutrition in South Asia and East Africa: examining the enabling environment through stakeholder perceptions. *Food Secur* 2015; **7**: 463–77.
- 183 Pelletier DL, Frongillo EA, Gervais S, et al. Nutrition agenda setting, policy formulation and implementation: lessons from the Mainstreaming Nutrition Initiative. *Health Policy Plan* 2012; **27**: 19–31.
- 184 Hawkes C, Brazil BG, de Castro IRR, Jaime PC. How to engage across sectors: lessons from agriculture and nutrition in the Brazilian School Feeding Program. *Rev Saude Publica* 2016; **50**.
- 185 Levinson FJ, Balarajan Y, Marini A. Addressing malnutrition multisectorally: what have we learned from recent international experience. New York, NY: UNICEF and MDG Achievement Fund, 2013. <https://scalingupnutrition.org/news/addressing-malnutrition-multisectorally-what-have-we-learned-from-recent-international-experience/> (accessed Dec 11, 2018).
- 186 Jeruszka-Bielak M, Sicinska E, de Wit L, et al. Stakeholders' views on factors influencing nutrition policy: a qualitative study across ten European countries. *Pol J Food Nutr Sci* 2015; **65**: 293–302.
- 187 Kennedy E, Tessema M, Hailu T, et al. Multisector nutrition program governance and implementation in Ethiopia: opportunities and challenges. *Food Nutr Bull* 2015; **36**: 534–48.
- 188 Lindell I. The multiple sites of urban governance: insights from an African city. *Urban Stud* 2008; **45**: 1879–901.
- 189 Meagher K. Informal economies and urban governance in Nigeria: Popular empowerment or political exclusion? *Afr Stud Rev* 2011; **54**: 47–72.
- 190 Agence Français de Développement (AFD). Kisumu: ISUD-Plan: Part 1. Integrated Strategic Urban Development Plan: Understanding Kisumu. Kisumu, Kenya; 2013.
- 191 Crush J, Frayne B. Supermarket expansion and the informal food economy in Southern African cities: implications for urban food security. *J South Afr Stud* 2011; **37**: 781–807.
- 192 Weatherspoon DD, Reardon T. The rise of supermarkets in Africa: implications for agri-food systems and the rural poor. *Dev Policy Rev* 2003; **21**: 333–55.
- 193 Ansell C, Gash A. Collaborative governance in theory and practice. *J Public Adm Res Theory* 2008; **18**: 543–71.
- 194 Polk M. Co-producing knowledge for sustainable cities: joining forces for change. Abingdon, Oxon; New York, NY: Routledge, 2015.
- 195 Onyango GM, Obera BO. Tracing Kisumu's path in the co-production of knowledge for urban development. In: Polk M, ed. Co-producing Knowledge for Sustainable Cities: Joining Forces for Change. Abingdon, Oxon; New York, NY: Routledge, 2015: 70–97.
- 196 Balarajan Y, Reich MR. Political economy of child nutrition policy: A qualitative study of India's Integrated Child Development Services (ICDS) scheme. *Food Policy* 2016; **62**: 88–98.
- 197 Hawkes C, Ahern AL, Jebb SA. A stakeholder analysis of the perceived outcomes of developing and implementing England's obesity strategy 2008–2011. *BMC Public Health* 2014; **14**: 441.
- 198 Nisbett N, Wach E, Haddad L, El Arifeen S. What drives and constrains effective leadership in tackling child undernutrition? Findings from Bangladesh, Ethiopia, India and Kenya. *Food Policy* 2015; **53**: 33–45.
- 199 International Panel of Experts on Sustainable Food Systems. Too big to feed: exploring the impacts of mega-mergers, consolidation and concentration of power in the agri-food sector. International Panel of Experts on Sustainable Food Systems, 2017.
- 200 Oreskes N, Conway EM. Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming. Bloomsbury Publishing USA, 2011.
- 201 Kraak VI, Swinburn B, Lawrence M, Harrison P. An accountability framework to promote healthy food environments. *Public Health Nutr* 2014; **17**: 2467–83.
- 202 WHO. Safeguarding against possible conflicts of interest in nutrition programmes. Draft approach for the prevention and management of conflicts of interest in the policy development and implementation of nutrition programmes at country level. Report by the Director-General. 142nd session. EB142/23. 4 December 2017. Geneva: World Health Organization, 2017.
- 203 International Panel of Experts on Sustainable Food Systems. What makes urban food policy happen? Insights from five case studies. International Panel of Experts on Sustainable Food Systems, 2017. [http://www.ipes-food.org/\\_img/upload/files/Cities\\_full.pdf](http://www.ipes-food.org/_img/upload/files/Cities_full.pdf) (accessed Dec 11, 2018).
- 204 De Schutter O. The transformative potential of the right to food. United Nations General Assembly, 2014.
- 205 Grover A. Unhealthy foods, non-communicable diseases and the right to health. Report of the Special Rapporteur on the right of everyone to the highest attainable standard of physical and mental health to the twenty-sixth session of the Human Rights Council. A/HRC/26/31. United Nations, 2014. [https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session29/Documents/A\\_HRC\\_29\\_33\\_ENG.DOCX](https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session29/Documents/A_HRC_29_33_ENG.DOCX) (accessed Dec 11, 2018).
- 206 Hunt P, Yamin AE, Bustreo F. Making the case: what is the evidence of impact of applying human rights-based approaches to health? *Health Hum Rights* 2015; **17**: 1–10.
- 207 Gibbons ED. Climate change, children's rights, and the pursuit of intergenerational climate justice. *Health Hum Rights* 2014; **16**: 19–31.
- 208 Ferguson L, Tarantola D, Hoffmann M, Gruskin S. Non-communicable diseases and human rights: Global synergies, gaps and opportunities. *Glob Public Health* 2017; **12**: 1200–27.
- 209 Cathaoir KO. Childhood Obesity and the Right to Health. *Health Hum Rights* 2016; **18**: 249–62.
- 210 United Nations. Universal Declaration of Human Rights, G.A. res. 217A (II). United Nations, Dec 10, 1948. <http://www.un.org/en/universal-declaration-human-rights/> (accessed Dec 11, 2018).
- 211 FAO. The right to food around the globe. Rome: Food and Agriculture Organization of the United Nations, 2018. <https://www.fao.org/right-to-food-around-the-globe/en/> (accessed Dec 11, 2018).
- 212 United Nations Committee on Economic, Social and Cultural Rights. International Covenant on Economic, Social and Cultural Rights, G.A. res. 2200A (XXI). Office of the United Nations High Commissioner for Human Rights, Dec 16, 1966. [https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A\\_RES\\_2200A\(XXI\)\\_economic.pdf](https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_2200A(XXI)_economic.pdf) (accessed Dec 11, 2018).

- 213 De Schutter O. The transformative potential of the right to food. Final Report of the Special Rapporteur on the right to food to the twenty-fifth session of the Human Rights Council. Office of the United Nations High Commissioner for Human Rights, 2014. [https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session25/Documents/A\\_HRC\\_25\\_57\\_ENG.DOC](https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session25/Documents/A_HRC_25_57_ENG.DOC) (Dec 11, 2018).
- 214 United Nations Committee on Economic, Social and Cultural Rights. International Covenant on Economic, Social and Cultural Rights, G.A. res. 2200A (XXI). General Comment No.14 (Art. 12, para. 43(b)). E/C.12/2000/4. Office of the United Nations High Commissioner for Human Rights, Aug 11, 2000. <https://www.refworld.org/pdfid/4538838d0.pdf> (accessed Dec 11, 2018).
- 215 WHO. Substantive issues arising in the implementation of the International Covenant on Economic, Social and Cultural Rights. Geneva, Switzerland: World Health Organization, 2000. [http://apps.who.int/disasters/repo/13849\\_files/o/UN\\_human\\_rights.htm](http://apps.who.int/disasters/repo/13849_files/o/UN_human_rights.htm) (accessed Dec 11, 2018).
- 216 Food and Agriculture Organization of the United Nations. Voluntary guidelines to support the progressive realization of the right to adequate food in the context of national food security, adopted by the 127th Session of the FAO Council, November 2004. Rome: Food and Agriculture Organization of the United Nations, 2005.
- 217 Food and Agriculture Organization of the United Nations, World Health Organization Rome Declaration on Nutrition. Second International Conference on Nutrition. ICN2 2014/2. Food and Agriculture Organization of the United Nations, Nov 19–21, 2014. <http://www.fao.org/3/a-m1542e.pdf> (accessed Dec 11, 2018).
- 218 De Schutter O. The specter of productivism and food democracy. *Wis L Rev* 2014; **2014**: 199.
- 219 Shaheed F. Report of the Special Rapporteur in the field of cultural rights to the sixty-ninth session of the General Assembly. A/69/286. Office of the United Nations High Commissioner for Human Rights, 2014. [https://www.ohchr.org/en/hrbodies/hrc/regularsessions/session31/documents/a.hrc.31.59\\_e.docx](https://www.ohchr.org/en/hrbodies/hrc/regularsessions/session31/documents/a.hrc.31.59_e.docx) (accessed Dec 11, 2018).
- 220 Kuhnlein HV, Burlingame B. Why do Indigenous Peoples' food and nutrition interventions for health promotion and policy need special consideration? In: Kuhnlein HV, Erasmus B, Spigelski D, Burlingame B, eds. Indigenous peoples' food systems and well-being: interventions and policies for healthy communities. Quebec, Canada; Rome, Italy: Center for Indigenous Peoples' Nutrition and Environment, Food and Agriculture Organization of the United Nations (FAO), 2013.
- 221 United Nations. Convention on the Elimination of All Forms of Discrimination Against Women, G.A. res. 34/180. (Art. 10 & 13). Office of the United Nations High Commissioner for Human Rights, Dec 18, 1979. <http://www.ohchr.org/Documents/ProfessionalInterest/cedaw.pdf> (accessed Sept 6, 2017).
- 222 Musaiger AO, Al-Mannai M, Tayyern R, et al. Perceived barriers to healthy eating and physical activity among adolescents in seven Arab countries: a cross-cultural study. *Sci World J* 2013; **2013**: 232164.
- 223 United Nations Committee on the Rights of the Child. Convention on the Rights of the Child. G.A. res. 44/25. CRC/C/GC/15. Office of the United Nations High Commissioner for Human Rights, Nov 20, 1989. [https://www2.ohchr.org/english/bodies/crc/docs/GC/CRC-C-GC-15\\_en.doc](https://www2.ohchr.org/english/bodies/crc/docs/GC/CRC-C-GC-15_en.doc) (accessed Dec 11, 2018).
- 224 Knox JH. Report of the independent expert on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment, submitted to the twenty-fifth session of the Human Rights Council. Office of the United Nations High Commissioner for Human Rights, 2013. [https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session25/Documents/A-HRC-25-53\\_en.doc](https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session25/Documents/A-HRC-25-53_en.doc) (accessed Dec 11, 2018).
- 225 United Nations Committee on Economic, Social and Cultural Rights. International Covenant on Economic, Social and Cultural Rights, G.A. res. 2200A (XXI). General Comment No.12 (Art. 11, para. 21). E/C.12/1999/5. 12 May 1999. [http://www.fao.org/fileadmin/templates/righttofood/documents/RTF\\_publications/EN/General\\_Comment\\_12\\_EN.pdf](http://www.fao.org/fileadmin/templates/righttofood/documents/RTF_publications/EN/General_Comment_12_EN.pdf) (accessed Sept 7, 2011).
- 226 Mercer SL, Green LW, Rosenthal AC, Husten CG, Khan LK, Dietz WH. Possible lessons from the tobacco experience for obesity control. *Am J Clin Nutr* 2003; **77** (suppl): 3S–82S.
- 227 De Schutter O. Towards a framework convention on healthy diets. *SCN News* 2015; **41**: 94–98.
- 228 Hoffman SJ, Röttingen JA, Frenk J. Assessing proposals for new global health treaties: an analytic framework. *Am J Public Health* 2015; **105**: 1523–30.
- 229 Conference of the Parties. Guidelines for implementation of Article 5.3 of the WHO Framework Convention on Tobacco Control (decision FCTC/COP3(7)). Geneva, Switzerland: World Health Organization, 2008.
- 230 WHO. Framework of engagement with non-State actors (FENSA). Geneva, Switzerland: World Health Organization, 2016.
- 231 Brown K, Rundall P, Lobstein T, Mwatsana M, Jeffery B. Open letter to WHO DG candidates: keep policy and priority setting free of commercial influence. *Lancet* 2017; **389**: 1879.
- 232 Consumers International, World Obesity Federation. Recommendations towards a Global Convention to protect and promote healthy diets. London, UK: Consumers International, World Obesity Federation, 2014.
- 233 Consumers International, World Obesity Federation, UK Health Forum, Consumer Council of Fiki, Consumidor EPD. Open letter to Margaret Chan and José Graziano Da Silva ahead of the Second International Conference on Nutrition (ICN2). Consumers International, 2014. <http://www.consumersinternational.org/media/2373/wcrd2015-openletter.pdf> (accessed March 20, 2017).
- 234 Pan American Health Organization. PAHO's Project on Public Health, International Human Rights Law and Vulnerable Groups. Pan American Health Organization, 2017. [http://www.paho.org/hq/index.php?option=com\\_content&view=article&id=1349%3Aproject-public-health-international-human-rights-law-vulnerable-groups&catid=1178%3Ahuman-rights-health&Itemid=1207&lang=en](http://www.paho.org/hq/index.php?option=com_content&view=article&id=1349%3Aproject-public-health-international-human-rights-law-vulnerable-groups&catid=1178%3Ahuman-rights-health&Itemid=1207&lang=en) (accessed March 20, 2017).
- 235 Pan American Health Organization. Strategy on Health-related Law. Washington, DC: Pan American Health Organization, 2015.
- 236 America's Pledge. US Climate Leadership—one year later. America's Pledge, 2018. <https://oneyearlater.americaspledgeonclimate.com/> (accessed Dec 11, 2018).
- 237 Lang T, Barling D, Caraher M. Food Policy: Integrating Health, Environment & Society. Oxford: Oxford University Press, 2009.
- 238 Freedhoff Y. The food industry is neither friend, nor foe, nor partner. *Obes Rev* 2014; **15**: 6–8.
- 239 Wiist WH. The corporate play book, health, and democracy: the snack food and beverage industry's tactics in context. In: Stuckler D, Siegel K, eds. Sick societies. Responding to the global challenge of chronic disease. Oxford University Press, 2011: 204–16.
- 240 Center for Science in the Public Interest. Big Soda vs. Public Health. Center for Science in the Public Interest, 2016. <https://cspinet.org/resource/big-soda-vs-public-health-2017-edition> (accessed Dec 11, 2018).
- 241 Bes-Rastrollo M, Schulze MB, Ruiz-Canela M, Martínez-Gonzalez MA. Financial conflicts of interest and reporting bias regarding the association between sugar-sweetened beverages and weight gain: a systematic review of systematic reviews. *PLoS Med* 2013; **10**: e1001578.
- 242 Kearns CE, Schmidt LA, Glantz SA. Sugar industry and coronary heart disease research: A historical analysis of internal industry documents. *JAMA Intern Med* 2016; **176**: 1680–85.
- 243 Koplan JP, Brownell KD. Response of the food and beverage industry to the obesity threat. *JAMA* 2010; **304**: 1487–88.
- 244 Taylor A, Jacobson M. Carbonating the World: The Marketing and Health Impact of Sugar Drinks in Low- and Middle-income Countries. Washington, DC: Center for Science in the Public Interest, 2016.
- 245 Binks M. The Role of the Food Industry in Obesity Prevention. *Curr Obes Rep* 2016; **5**: 201–07.
- 246 WHO. Addressing and managing conflicts of interest in the planning and delivery of nutrition programmes at country level. Report of a technical consultation convened in Geneva Switzerland, on 8–9 October 2015. Geneva, Switzerland: World Health Organization, 2016.
- 247 MacKay S. Legislative solutions to unhealthy eating and obesity in Australia. *Public Health* 2011; **125**: 896–904.
- 248 Sugarmen SD. Enticing Business to Create a Healthier American Diet: Performance-Based Regulation of Food and Beverage Retailers. *Law Policy* 2014; **36**: 91–112.

- 249 Access to Nutrition Foundation. Access to Nutrition Index—Global Index 2016. Access to Nutrition Foundation, 2016. [https://www.accesstonutrition.org/sites/2015.atnindex.org/files/atni-global-index-2016\\_2.pdf](https://www.accesstonutrition.org/sites/2015.atnindex.org/files/atni-global-index-2016_2.pdf) (accessed Dec 11, 2018).
- 250 Ronit K, Jensen JD. Obesity and industry self-regulation of food and beverage marketing: a literature review. *Eur J Clin Nutr* 2014; **68**: 753–59.
- 251 Piwoz EG, Huffman SL. The impact of marketing of breast-milk substitutes on WHO-recommended breastfeeding practices. *Food Nutr Bull* 2015; **36**: 373–86.
- 252 Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. *Obes Rev* 2013; **14**: 960–74.
- 253 Knai C, Petticrew M, Durand MA, et al. Has a public-private partnership resulted in action on healthier diets in England? An analysis of the Public Health Responsibility Deal food pledges. *Food Policy* 2015; **54**: 1–10.
- 254 Commonwealth of Australia. Health Star Rating System. Commonwealth of Australia, 2014. <http://healthstarring.gov.au/internet/healthstarring/publishing.nsf/content/home> (accessed May 3, 2018).
- 255 WHO. WHO's engagement with non-State actors. World Health Organization, 2018. <http://www.who.int/about/collaborations/non-state-actors/en/> (accessed Dec 11, 2018).
- 256 International Baby Food Action Network. 142nd session of the Executive Board. Agenda Item EB 3.1 Draft thirteenth general programme of work 2019–2023 (EB142/3, EB142/3 Add.1/ and EB142/3 Add.2). GIFA, 2018. <https://www.gifa.org/wp-content/uploads/2018/01/EB142-IBFAN-Statement-item3.1-GPW13.pdf> (accessed Dec 11, 2018).
- 257 Kordos M, Vojtovic S. Transnational Corporations in the Global World Economic Environment. *Procedia Soc Behav Sci* 2016; **230**: 150–58.
- 258 Moodie R, Swinburn B, Richardson J, Somaini B. Childhood obesity—a sign of commercial success, but a market failure. *Int J Pediatr Obes* 2006; **1**: 133–38.
- 259 Coady D, Parry I, Sears L, Shang B. How large are global fossil fuel subsidies? *World Dev* 2017; **91**: 11–27.
- 260 Dangour AD, Hawkesworth S, Shankar B, et al. Can nutrition be promoted through agriculture-led food price policies? A systematic review. *BMJ Open* 2013; **3**: e002937.
- 261 Hellström E, Hämäläinen T, Lahti V, Cook J, Jousilahti J. Towards a sustainable well-being society. from principles to applications. Sitra Working Paper 14, 2015. [https://media.sitra.fi/2017/02/23221124/Towards\\_a\\_Sustainable\\_Wellbeing\\_Society\\_2.pdf](https://media.sitra.fi/2017/02/23221124/Towards_a_Sustainable_Wellbeing_Society_2.pdf) (accessed Dec 11, 2018).
- 262 United Nations Global Compact. United Nations Global Compact. 2018. <https://www.unglobalcompact.org/what-is-gc/mission> (accessed Dec 11, 2018).
- 263 Global Reporting Initiative. GRI Standards. Global Reporting Initiative, 2018. <https://www.globalreporting.org/standards> (accessed Dec 11, 2018).
- 264 RobecoSAM. Dow Jones Sustainability Indices. RobecoSAM, 2018. <http://www.sustainability-indices.com/index-family-overview/djsi-family-overview/index.jsp> (accessed Dec 11, 2018).
- 265 Fleming P, Jones MT. The end of corporate social responsibility: crisis & critique. London, UK and Thousand Oaks, CA: Sage, 2013.
- 266 Sridhar K, Jones G. The three fundamental criticisms of the Triple Bottom Line approach: an empirical study to link sustainability reports in companies based in the Asia-Pacific region and TBL shortcomings. *Asian J Bus Ethics* 2013; **2**: 91–111.
- 267 The B Team. About. The B Team, 2018. <http://www.bteam.org/about/> (accessed Dec 11, 2018).
- 268 Uncharted. Approach. Uncharted, 2018. <https://uncharted.org/approach/> (accessed Dec 11, 2018).
- 269 Forum for the Future. Reinventing the way the world works. Forum for the Future, 2018. <https://www.forumforthefuture.org/about> (accessed Dec 11, 2018).
- 270 Eccles RG, Ioannou I, Serafeim G. The impact of corporate sustainability on organizational processes and performance. *Manage Sci* 2014; **60**: 2835–57.
- 271 Hirigoyen G, Poulain-Rehm T. Relationships between Corporate Social Responsibility and Financial Performance: What is the Causality? SSRN, March 1, 2014. <https://ssrn.com/abstract=2531631> (accessed Dec 11, 2018).
- 272 Backholer K, Martin J. Sugar-sweetened beverage tax: the inconvenient truths. *Public Health Nutr* 2017; **20**: 3225–27.
- 273 Government of Western Australia. Hope for the future: the Western Australian State Sustainability Strategy 2013. Natural Resource Management Program. [http://www.nrm.wa.gov.au/media/19609/state\\_sustainability\\_strategy\\_2003.pdf](http://www.nrm.wa.gov.au/media/19609/state_sustainability_strategy_2003.pdf) (accessed Dec 11, 2018).
- 274 Freudenberg N. Lethal but Legal: Corporations, Consumption, and Protecting Public Health. New York, NY: Oxford University Press, 2014.
- 275 Access to Nutrition Index. Investors. Access to Nutrition Index, 2018. <https://www.accesstonutrition.org/investors> (accessed Dec 11, 2018).
- 276 Stanley M. Millennials drive growth in sustainable investing. Morgan Stanley, 2017. <https://www.morganstanley.com/ideas/sustainable-socially-responsible-investing-millennials-drive-growth> (accessed Dec 11, 2018).
- 277 Spitzer H, Martinuzzi A. Methods and tools for corporate impact assessment of the Millennium Development Goals (MDGs) and sustainable development. European Sustainable Development Network, 2013. [https://www.sd-network.eu/pdf/case%20studies/ESDN%20Case%20Study\\_No%202014\\_final.pdf](https://www.sd-network.eu/pdf/case%20studies/ESDN%20Case%20Study_No%202014_final.pdf) (accessed Dec 11, 2018).
- 278 Mialon M, Swinburn B, Allender S, Sacks G. Systematic examination of publicly-available information reveals the diverse and extensive corporate political activity of the food industry in Australia. *BMC Public Health* 2016; **16**: 283.
- 279 Booth SL, Sallis JF, Ritenbaugh C, et al. Environmental and societal factors affect food choice and physical activity: rationale, influences, and leverage points. *Nutr Rev* 2001; **59**: S21–39.
- 280 Marini M, Sriram N, Schnabel K, et al. Overweight people have low levels of implicit weight bias, but overweight nations have high levels of implicit weight bias. *PLoS One* 2013; **8**: e83543.
- 281 Robinson TN. Save the world, prevent obesity: piggybacking on existing social and ideological movements. *Obesity (Silver Spring)* 2010; **18** (suppl 1): S17–22.
- 282 Economos CD, Brownson RC, DeAngelis MA, et al. What lessons have been learned from other attempts to guide social change? *Nutr Rev* 2001; **59**: S40–56.
- 283 Sabatier PA, Jenkins-Smith HC. Policy change and learning: an advocacy coalition approach (theoretical lenses on public policy). Boulder, CO: Westview Press, 1993.
- 284 Benford RD, Snow DA. Framing processes and social movements: An overview and assessment. *Annu Rev Sociol* 2000; **26**: 611–39.
- 285 Bray GA, Kim KK, Wilding JPH, World Obesity Federation. Obesity: a chronic relapsing progressive disease process. A position statement of the World Obesity Federation. *Obes Rev* 2017; **18**: 715–23.
- 286 Ramos Salas X, Forhan M, Caulfield T, Sharma AM, Raine K. A critical analysis of obesity prevention policies and strategies. *Can J Public Health* 2018; **108**: e598–608.
- 287 Morley B, Niven P, Dixon H, et al. Population-based evaluation of the 'LiveLighter' healthy weight and lifestyle mass media campaign. *Health Educ Res* 2016; **31**: 121–35.
- 288 Nestle M. Food Politics: How the Food Industry Influences Nutrition and Health. Berkeley, CA: University of California Press, 2002.
- 289 Institute of Medicine. Alliances for obesity prevention. Finding common ground. A Workshop Summary. Washington, DC: National Academies Press, 2012.
- 290 Vago S. Social change. 4th edn. Upper Saddle River, NJ: Prentice Hall, 1999.
- 291 McAdam D, McCarthy JD, Zald MN. Comparative perspectives on social movements: Political opportunities, mobilizing structures, and cultural framings. Cambridge, UK: Cambridge University Press, 1996.
- 292 Huang TT, Cawley JH, Ashe M, et al. Mobilisation of public support for policy actions to prevent obesity. *Lancet* 2015; **385**: 2422–31.
- 293 Siegal G, Siegal N, Bonnie RJ. An account of collective actions in public health. *Am J Public Health* 2009; **99**: 1583–87.
- 294 Oliver PMG. Whatever happened to critical mass theory? A retrospective and assessment. *Sociol Theory* 2001; **19**: 292–311.
- 295 The New World Foundation. Funding Social Movements. The New World Foundation Perspective. New York, NY: The New World Foundation, 2003.

- 296 Hofstede Insights. Compare countries. 2018. <https://www.hofstede-insights.com/product/compare-countries/> (accessed Jan 12, 2018).
- 297 Murphy M, Robertson W, Oyeboe O. Obesity in International Migrant Populations. *Curr Obes Rep* 2017; **6**: 314–23.
- 298 Delavari M, Sønderlund AL, Swinburn B, Mellor D, Renzaho A. Acculturation and obesity among migrant populations in high income countries—a systematic review. *BMC Public Health* 2013; **13**: 458.
- 299 Anderson I, Robson B, Connolly M, et al. Indigenous and tribal peoples' health (*The Lancet-Lowitja Institute Global Collaboration*): a population study. *Lancet* 2016; **388**: 131–57.
- 300 Kumanyika S, Taylor WC, Grier SA, et al. Community energy balance: a framework for contextualizing cultural influences on high risk of obesity in ethnic minority populations. *Prev Med* 2012; **55**: 371–81.
- 301 Viruell-Fuentes EA, Miranda PY, Abdulrahim S. More than culture: structural racism, intersectionality theory, and immigrant health. *Soc Sci Med* 2012; **75**: 2099–106.
- 302 FAO. Indigenous peoples. United Nations Food and Agriculture Organisation, 2017. <http://www.fao.org/indigenous-peoples/en/> (accessed Dec 15, 2017).
- 303 United Nations Permanent Forum on Indigenous Issues. The State of the World's Indigenous Peoples. New York, NY: United Nations Department of Economic and Social Affairs, Secretariat of the Permanent Forum on Indigenous Issues, 2009.
- 304 Turner NJ, Plotkin M, Kuhnlein HV. Global environmental challenges to the integrity of Indigenous Peoples' food systems. In: Kuhnlein HV, Erasmus B, Spigelski D, Burlingame B, eds. Indigenous Peoples' Food Systems and Wellbeing: Interventions and Policies for Healthy Communities. Rome: United Nations Food and Agriculture Organisation, 2013: 23–38.
- 305 Bleich SN, Vercammen KA, Zatz LY, Frelier JM, Ebbeling CB, Peeters A. Interventions to prevent global childhood overweight and obesity: a systematic review. *Lancet Diabetes Endocrinol* 2018; **6**: 332–46.
- 306 Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in children. *Cochrane Database Syst Rev* 2011; **12**: CD001871.
- 307 Bell AC, Simmons A, Sanigorski AM, Kremer PJ, Swinburn BA. Preventing childhood obesity: the sentinel site for obesity prevention in Victoria, Australia. *Health Promot Int* 2008; **23**: 328–36.
- 308 Simmons A, Reynolds RC, Swinburn B. Defining community capacity building: is it possible? *Prev Med* 2011; **52**: 193–99.
- 309 de Silva-Sanigorski AM, Bell AC, Kremer P, et al. Reducing obesity in early childhood: results from Romp & Chomp, an Australian community-wide intervention program. *Am J Clin Nutr* 2010; **91**: 831–40.
- 310 Millar L, Kremer P, de Silva-Sanigorski A, et al. Reduction in overweight and obesity from a 3-year community-based intervention in Australia: the 'It's Your Move!' project. *Obes Rev* 2011; **12** (suppl 2): 20–28.
- 311 Sanigorski AM, Bell AC, Kremer PJ, Cuttler R, Swinburn BA. Reducing unhealthy weight gain in children through community capacity-building: results of a quasi-experimental intervention program, Be Active Eat Well. *Int J Obes* 2008; **32**: 1060–67.
- 312 Swinburn B, Malakellis M, Moodie M, et al. Large reductions in child overweight and obesity in intervention and comparison communities 3 years after a community project. *Pediatr Obes* 2014; **9**: 455–62.
- 313 Utter J, Scragg R, Robinson E, et al. Evaluation of the Living 4 Life project: a youth-led, school-based obesity prevention study. *Obes Rev* 2011; **12** (suppl 2): 51–60.
- 314 Fotu KF, Millar L, Mavoa H, et al. Outcome results for the Ma'alahi Youth Project, a Tongan community-based obesity prevention programme for adolescents. *Obes Rev* 2011; **12** (suppl 2): 41–50.
- 315 Kremer P, Waqa G, Vanualailai N, et al. Reducing unhealthy weight gain in Fijian adolescents: results of the Healthy Youth Healthy Communities study. *Obes Rev* 2011; **12** (suppl 2): 29–40.
- 316 Allender S, Millar L, Hoymand P, et al. Whole of Systems Trial of Prevention Strategies for Childhood Obesity: WHO STOPS Childhood Obesity. *Int J Environ Res Public Health* 2016; **13**: E1143.
- 317 Hoymand P. Community based system dynamics. New York, NY: Springer, 2013.
- 318 Institute of Medicine. Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation. Washington, DC: The National Academies Press, 2012.
- 319 Foster-Fishman PG, Nowell B, Yang H. Putting the system back into systems change: a framework for understanding and changing organizational and community systems. *Am J Community Psychol* 2007; **39**: 197–215.
- 320 Wolfenden L, Jones J, Williams CM, et al. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. *Cochrane Database Syst Rev* 2016; **10**: CD011779.
- 321 Simpson KM, Porter K, McConnell ES, et al. Tool for evaluating research implementation challenges: a sense-making protocol for addressing implementation challenges in complex research settings. *Implement Sci* 2013; **8**: 2.
- 322 WHO. Report of the Commission on Ending Childhood Obesity. Geneva, Switzerland: World Health Organization, 2016.
- 323 WHO. NCD Global Monitoring Framework. World Health Organization, 2013. [https://www.who.int/nmh/global\\_monitoring\\_framework/en/](https://www.who.int/nmh/global_monitoring_framework/en/) (accessed Dec 11, 2018).
- 324 WHO. Non-communicable disease monitoring report 2015. Geneva, Switzerland: World Health Organization, 2015.
- 325 WHO. Non-communicable Diseases Progress Monitor 2017. Geneva, Switzerland: World Health Organization, 2017.
- 326 NCD Alliance. UN NCD Political Declaration in a sick and sorry state. NCD Alliance, 2018. <https://ncdalliance.org/news-events/news/media-release-un-ncd-political-declaration-in-a-sick-and-sorry-state> (accessed Dec 11, 2018).
- 327 Global Nutrition and Policy Consortium. Global dietary database: measuring diet in countries worldwide. Global Dietary Database, 2017. <http://www.globaldietarydatabase.org/the-global-dietary-database-measuring-diet-worldwide.html> (accessed Aug 25, 2017).
- 328 WHO. Urban Health Equity Assessment and Response Tool (Urban HEART). World Health Organization, 2017. [http://www.who.int/kobe\\_centre/measuring/urbanheart/en/](http://www.who.int/kobe_centre/measuring/urbanheart/en/) (accessed Aug 25, 2017).
- 329 WHO. UN Habitat. Global Report on Urban Health. Geneva, Switzerland: World Health Organization, 2016.
- 330 WHO. STEPwise approach to chronic disease risk factor surveillance (STEPS). World Health Organization, 2011. <http://www.who.int/chp/steps/riskfactor/en/index.html> (accessed Dec 11, 2018).
- 331 WHO. Assessing national capacity for the prevention and control of NCDs. World Health Organization, 2017. <https://www.who.int/ncds/surveillance/ncd-capacity/en/> (accessed Dec 11, 2018).
- 332 WHO. Global database on the Implementation of Nutrition Action (GINA). World Health Organization, 2018. <http://www.who.int/nutrition/gina/en/> (accessed July 4, 2017).
- 333 WHO. Noncommunicable Disease Document Repository. World Health Organization, 2017. <https://extranet.who.int/ncdccs/documents/Db> (accessed Feb 13, 2017).
- 334 Vandevijvere S, Barquera S, Caceres G, et al. An 11-country study to benchmark the implementation of recommended nutrition policies by national governments using the Healthy Food Environment Policy Index, 2015–2018. *Obes Rev* (in press).
- 335 Hawkes C, Jewell J, Allen K. A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework. *Obes Rev* 2013; **14** (suppl 2): 159–68.
- 336 World Cancer Research Fund. WCRF International Food Policy Framework for Healthy Diets: NOURISHING. World Cancer Research Fund, 2017. [http://www.wcrf.org/policy\\_public\\_affairs/nourishing\\_framework/](http://www.wcrf.org/policy_public_affairs/nourishing_framework/) (accessed Dec 12, 2017).
- 337 International Food Policy Research Institute. 2014 Global Nutrition Report. Global Nutrition Report, 2014. <https://globalnutritionreport.org/reports/2014-global-nutrition-report/> (accessed Dec 11, 2018).
- 338 Smed S, Scarborough P, Rayner M, Jensen JD. The effects of the Danish saturated fat tax on food and nutrient intake and modelled health outcomes: an econometric and comparative risk assessment evaluation. *Eur J Clin Nutr* 2016; **70**: 681–86.
- 339 Colchero MA, Popkin BM, Rivera JA, Ng SW. Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. *BMJ* 2016; **352**: h6704.
- 340 Tolley H, Snowdon W, Wate J, et al. Monitoring and accountability for the Pacific response to the non-communicable diseases crisis. *BMC Public Health* 2016; **16**: 958.

- 341 United Nations Sustainable Development Knowledge Platform. High-level political forum on sustainable development. Voluntary national reviews. United Nations Sustainable Development Knowledge Platform, 2017. <https://sustainabledevelopment.un.org/vnrs/> (accessed Aug 25, 2017).
- 342 International Food and Beverage Alliance. Ten years of progress. International Food and Beverage, Alliance 2018. <https://ifballiance.org/ten-year-progress-report> (accessed Dec 11, 2018).
- 343 Fiedler JL, Carletto C, Dupriez O. Still waiting for Godot? Improving Household Consumption and Expenditures Surveys (HCES) to enable more evidence-based nutrition policies. *Food Nutr Bull* 2012; **33** (suppl): S242–51.
- 344 Dunford E, Trevena H, Goodsell C, et al. Foodswitch: a mobile phone app to enable consumers to make healthier food choices and crowdsourcing of National Food Composition Data. *JMIR Mhealth Uhealth* 2014; **2**: e37.
- 345 Vandevijvere S, Williams R, Tawfiq E, Swinburn B. A food environments feedback system (FoodBack) for empowering citizens and change agents to create healthier community food places. *Health Promot Int* 2017; published online Nov 14. DOI:10.1093/heapro/dax079.
- 346 Walkability index. Data.gov, 2017. <https://catalog.data.gov/dataset/walkability-index> (accessed Dec 11, 2018).
- 347 Swinburn B, Vandevijvere S, Kraak V, et al, and the INFORMAS. Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: a proposed Government Healthy Food Environment Policy Index. *Obes Rev* 2013; **14** (suppl 1): 24–37.
- 348 Vandevijvere S, Kasture A, Mackay S, Swinburn B. Committing to health: Food company policies for healthier food environments. Company assessments and recommendations using the Business Impact Assessment on obesity and population nutrition (BIA-Obesity) tool. Auckland, New Zealand: The University of Auckland, 2018.
- 349 The World Bank. Investing in Nutrition: The Foundation for Development, 1,000 Days. <https://thousanddays.org/resource/investing-in-nutrition/> (accessed April 30, 2018).
- 350 Watts N, Adger WN, Ayeb-Karlsson S, et al. The *Lancet* Countdown: tracking progress on health and climate change. *Lancet* 2017; **389**: 1151–64.
- 351 Watts N, Amann M, Ayeb-Karlsson S, et al. The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. *Lancet* 2018; **391**: 581–630.

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