5 Health Impacts

The Hidden Costs of Industrial Food Systems

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Health Impacts: The Hidden Costs of Industrial Food Systems

Voluntary exchanges in food markets should benefit everyone. However, the price we pay for food often does not adequately reflect the full cost to society of producing or consuming it. Economists use the term “externality” to refer to the costs that are not incorporated into market prices. They are the hidden costs of our food systems. Such externalities are evidence of “market failure,” meaning that the market has failed to convey—through prices—the true social value of food. An example would be the health consequences (skin lesions, respiratory problems, cancers, miscarriages, and birth defects) of high levels of toxic agrochemicals used in banana production in many areas of Latin America. The price of these bananas, sold in supermarkets around the world, does not reflect the health costs borne not only by the workers in banana plantations, but also by members of their families, and their communities.

In *Unravelling the Food-Health Nexus* (2017), IPES-Food, in collaboration with the Global Alliance for the Future of Food, undertook a systemic analysis of the negative health impacts of industrial food systems, occurring through five channels: i) occupational hazards; ii) environmental contamination; iii) contaminated, unsafe and altered foods; iv) unhealthy dietary patterns; and v) food insecurity. Below we summarize these findings, underline the challenges with regard to taking action to correct these market failures, and reflect on leverage points for overcoming these challenges and building healthier food systems.

Five Channels of Impact

Food systems impact human health through five broad channels, with most of these impacts linking back to the same underlying *industrial* food system practices (IPES-Food, 2017):

Impact Channel 1: Occupational Hazards

Firstly, a variety of occupational hazards can be identified across food systems. Farmers’ and agricultural workers’ exposure to harmful substances, dangerous

working conditions and general insecurity have been extensively documented and associated with a range of health problems such as increased rates of musculoskeletal disorders, respiratory diseases, skin disorders, certain cancers, poisoning by chemicals and heart-related illnesses (Anderson and Athreya, 2015; Cavalli *et al.*, 2019). Acute accidental and intentional (suicidal) pesticide poisoning is common, especially in developing countries.

The risk of occupational injury and death is much higher in agriculture, fishing, and forestry than in any other work environment. In the USA, fatal work injury rates per 100,000 full-time equivalent workers in 2018 were 23.4 in agriculture and almost 80 in fishing, which is well above the average for all industries at 3.5 deaths (US Department of Labor, 2019). But the food manufacturing sector also presents high rates of injuries and fatalities (Neff, 2014), as a result of high-stress environments that can cause anxiety, depression, mental illness, and even lead to suicide (Lunner Kolstrup *et al.*, 2013).

The plight of migrant workers is of particular concern. The harsher working conditions, language and communication barriers, lack of safety instructions and training, and poorly maintained equipment are factors accounting for the higher occupational injury rates for foreign workers in many countries (Moyce and Schenker, 2018).

Impact Channel 2: Environmental Contamination

Severe health impacts arise via the exposure of whole populations to contaminated environments “downstream” of food production, including the pollution of soil, air, and water resources.

Endocrine disrupting chemicals (EDCs) pose one of the greatest challenges for public health; EDCs are chemicals that interfere with hormonal systems, and there are almost 800 chemicals known or suspected to function as EDCs (World Health Organization and United Nations Environment Programme, 2013). EDCs are found in the pesticides used in conventionally grown crops; hormones used in the production of meat, poultry, and dairy products; chemicals used to coat canned foods and in some plastic containers; compounds used as food preservatives; and even substances in non-stick cookware¹ (Wielogórska *et al.*, 2015). Potentially harmful effects can be generated from very low concentrations and from very short periods of exposure (Khetan, 2014). Growing scientific evidence shows that exposure to these chemicals can lead to adverse reproductive outcomes (infertility, cancers, malformations), as well as impacts on thyroid function, and neuroendocrine and neurodevelopmental functions (Gore *et al.*, 2015; World Health Organization and United Nations Environment Programme, 2013). Studies have also linked EDCs with increased rates of obesity and susceptibility to type-2 diabetes (Gore *et al.*, 2015).

Agriculture also has an important impact on air quality, potentially causing respiratory illness, cerebrovascular disease, ischemic heart disease, chronic obstructive pulmonary disease, and lung cancer (Lelieveld *et al.*, 2015). Agricultural

emissions of ammonia through livestock production and fertilizer use are an important factor in the high levels of air pollution in densely populated urban areas (Gu *et al.*, 2014; Paulot and Jacob, 2014). Agriculture has been identified as the largest contributor to air pollution in many regions of the world, including Europe, Russia, Turkey, Korea, Japan, and the Eastern USA (Lelieveld *et al.*, 2015). In several European countries, agricultural sources are responsible for as much as 40% of air pollution and its associated health burden (Lelieveld *et al.*, 2015).

Box 5.1 Global Systems Evaluation and True Cost Accounting

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Transformation has become the clarion call. Humans are using the Earth's resources at levels, scales, and speed that are changing Earth's ecological systems and, in so doing, warming, polluting, and degrading the environment at a level that threatens the future survival of humanity. Addressing food systems transformation also means addressing systemic issues like inequality, social justice, climate change, and poverty. Food systems transformation is affected by related global emergency challenges and trends including climate change, virulent infectious diseases, pollution of land, air, and water, millions of displaced people, ever more severe weather, species extinction, and biodiversity loss.

Evaluating these complex and dynamic agriculture and food systems interactions cannot be reduced to simple yardsticks like per hectare productivity of a single crop or the intake of nutrients. The question, then, is what framework and criteria should be used for evaluating food systems transformation. Currently, the most influential and widely used criteria internationally are those adopted and disseminated by the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development. Revised in 2019, the criteria call for interventions to be judged by their relevance, effectiveness, efficiency, impact, sustainability of impacts, and coherence. These mainstreamed criteria carry the message that incremental changes through projects and programs (essentially closed systems) are adequate, as they were decades ago. The DAC criteria are not aligned with the nature of complexity or the magnitude and urgency of transformations needed. Global systems evaluation and True Cost Accounting (TCA), in contrast, offer criteria appropriate for and aligned with transformation. Both advocate comprehensive, multi-faceted, and holistic evaluation through assessing systemic costs and benefits.

Global Systems Evaluation: Introducing Blue Marble Evaluation

Blue Marble Evaluation (BME) (Patton, 2019) has been developed by evaluation leaders as a leading-edge approach supporting the design, implementation,

evaluation, and adaptation of systems transformation processes and initiatives. BME encourages users to embrace and act on a whole-Earth perspective by looking beyond nation-state borders and across sectors and issue silos to connect the global and local, the human and ecological, and the macro and the micro. In doing so, evaluative thinking and diverse evaluation methods can be joined with systems thinking to illuminate system dynamics, boundaries, inter-relationships, and diverse perspectives.

BME invites application of four overarching principles to evaluating systems transformations (Patton, 2019).

- 1 Apply whole-Earth, big picture thinking to all aspects of systems change. Global problems require global interventions and, correspondingly, globally orientated design, implementation, evaluation, learning, and adaptation
- 2 Know and face the realities of the Anthropocene and act accordingly. Sustainability, resilience, equity, diversity, inclusion, health, and power dynamics need to be addressed to undertake interventions and evaluations knowledgeably and credibly in the context of the Anthropocene
- 3 Engage consistently with the magnitude, direction, and speed of transformations needed and envisioned. We are no longer in the incrementalism era. Major and rapid systems transformations are urgently needed in response to global, anthropogenic problems
- 4 Ensure transformational scale and scope. Transformation requires multiple interventions and actions on many fronts undertaken by diverse but interconnected actors

These evaluation principles direct attention to how systems are established and operate, including who benefits and who is disadvantaged.

True Cost Accounting as a Global Systems Evaluation Framework

In evaluating the true costs and benefits of creating goods and offering services, True Cost Accounting (TCA) offers a framework for examining not just input-output efficiency but broader impacts on the environment, economy, polity, society, and culture, especially the interdependencies between human and natural systems. Systems design and evaluation using systems principles and criteria means looking beyond the traditional efficiency criterion to systems transformation criteria. TCA provides a framework for documenting, assessing, and acting on whether, how, and to what extent activities affect economic, social, cultural, and environmental systems. For example, applied to specific farming systems, this means identifying, quantifying (when possible), and making transparent all costs and benefits of producing food in a particular way, beyond the traditional value chain perspective: from the prices farmers receive, to the affordability for consumers, including externalities like impacts on the

environment, communities, and human health. This requires evaluation using criteria like equity, ecological sustainability, environmental health, community well-being, resilience, and regenerative/adaptive capacity. That is how global systems transformations can be evaluated comprehensively.

Vignette 1: Removing Regulatory Restrictions on Polluting Rivers, Lakes, and Farmland

In 2020 the Trump Administration asserted that many environmental regulations were too costly to producers, reflecting a closed-system, narrow efficiency judgment. Full-cost accounting from a global systems perspective would take into account the longer-term environmental and human health costs of pollution.

Vignette 2: True Cost Accounting and the COVID-19 Pandemic

Flattening the coronavirus disease (COVID-19) pandemic's curve focused on the health system's capacity to prevent infections and identify and treat those infected. When the magnitude of the pandemic led to economic and social shutdowns, poorer people, especially, were faced with food shortages. A lack of access to health care, increased unemployment, and income losses exacerbated food insecurity around the world. Agricultural and food systems were dramatically affected by food transportation restrictions and broken connections between producers of food and consumers. Hunger and malnutrition increased vulnerability to the coronavirus. TCA and systems perspectives support a broader understanding of the pandemic's impacts and could contribute to holistic solutions that provide short-term relief while contributing to longer-term systemic solutions that address multiple threats and crises.

In summary, global systems evaluation and TCA both advocate comprehensive, multidimensional, and holistic approaches by assessing systemic costs and benefits. TCA is, of course, an ideal—and therefore idealistic. But that is a purpose of criteria—to define standards and ideals. Addressing systems transformation criteria helps us to think holistically and systemically about the full costs, benefits, and impacts of transformational initiatives.

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Impact Channel 3: Contaminated, Unsafe, and Altered Foods

Illnesses also systematically arise from the ingestion of foods containing various pathogens, while risks are also linked to compositionally altered and novel foods.

Food-borne disease agents fall into distinct categories—most importantly bacteria (of which many have developed antimicrobial resistance), viruses, chemical agents and toxins (e.g., EDCs), and parasites—and can cause a variety of illnesses upon ingestion, ranging from gastrointestinal and diarrheal illnesses to influenza-like, respiratory, and neurological symptoms, allergies, as well as terminal sicknesses (Newell *et al.*, 2010).

Although all final consumers are exposed to foodborne pathogens, the probability of contracting illnesses with serious consequences is higher for vulnerable populations such as children, pregnant women, the elderly, and immune-compromised individuals (Lund, 2015; Yeni *et al.*, 2016). The World Health Organization also highlights that, in a regional comparison, persons living in low-income sub-regions of the world are disproportionately affected by food-borne diseases (World Health Organization, 2015).

Many bacterial, viral, and parasitic disease agents are zoonotic—that is, they are transmitted through fecal matter or direct contact with animals or their meat (Larsen *et al.*, 2014; World Health Organization, 2015). Therefore, disease outbreaks frequently originate in the consumption of meat, poultry, and animal products such as eggs and unpasteurized (or poorly pasteurized) milk, cheeses, and other dairy products (Doyle *et al.*, 2015; Painter *et al.*, 2013). However, zoonotic pathogens can also spread to non-animal products, for instance through the use of untreated manure on cropland, contaminated irrigation water, the runoff from livestock operations, and wildlife intrusion (Strawn *et al.*, 2013).

Recent changes in the scale and organization of food production and distribution have exacerbated food-borne disease risks. First, the movement of farm animals and foods across a global market makes traceability and the upholding of appropriate microbiological safety procedures increasingly complicated, while increased human mobility also leads to rapid spread of microbes and parasites (Carstens *et al.*, 2019; Manitz *et al.*, 2014; McEntire, 2013; Robertson *et al.*, 2013), as evidenced during the recent COVID-19 pandemic. Second, in many countries, diets are shifting to include greater shares of out-of-home consumption and the use of semi-prepared ingredients, leading to additional disease transmission channels through food preparation in restaurants and food services (Callejon *et al.*, 2015; Doyle *et al.*, 2015; Gould *et al.*, 2015). Finally, the changing climate could bring novel vectors into newly temperate climates or create temperature-related changes in contamination levels (Newell *et al.*, 2010).

In addition to environmental exposure (see above), pesticide residues on foods represent a major health risk, including in regions with stringent controls in place. For example, 83% of EU soils contain one or more pesticides residues, 58% contain mixtures (Silva *et al.*, 2018), and residues are regularly found in samples (European Food Safety Authority, 2020). Furthermore, reliable

methods for assessing the health impacts of “cocktails” of different pesticide residues are still lacking (Reffstrup *et al.*, 2010).

Industrial contaminants in foods also represent a major health risk. An estimated total of 98.8% of the food consumed globally is estimated to be grown in unsustainable soils which have been degrading over the years (Kopittke, 2019). The use of wastewater for irrigation, particularly in regions with intensive mining and smelting activities, has led to dangerous levels of heavy metals such as mercury, lead, and cadmium in soils and water sources, while the intensification of livestock agriculture has led to increased concentrations of arsenic, zinc, and copper (Lu *et al.*, 2015).

Impact Channel 4: Unhealthy Dietary Patterns

Health impacts also occur through consumption of specific foods or groups of foods with problematic health profiles. Unhealthy dietary patterns are characterized by high consumption of added sugar, sodium, saturated fat, and trans-fat, and low consumption of fruit, vegetables, pulses, whole grains, and nuts (Global Panel on Agriculture and Food Systems for Nutrition, 2016; Willett *et al.*, 2019). Unhealthy diets have become increasingly prevalent in recent decades and are linked to the growth of overweight and obesity rates. The growing prevalence of obesity is a global health concern, as it heralds increasing incidence of several debilitating diseases, including type 2 diabetes, hypertension, coronary heart disease, metabolic syndrome, respiratory conditions, cancer, and osteoarthritis, as well as reproductive, gallbladder, and liver diseases (Butland *et al.*, 2007; Grundy, 2016; Swinburn, *et al.*, 2019; Wang *et al.*, 2011). In 2015 dietary factors accounted for 56% of cardiovascular disease deaths in men and 48% in women across Europe (Srouf *et al.*, 2019).

Overweight and obesity have reached epidemic levels in many countries. Since 1975 the worldwide prevalence of obesity has nearly tripled, with 39% of adults estimated to be overweight and 13% to be obese in 2016 (World Health Organization, 2017). Some 38 million children under the age of five years (UNICEF *et al.*, 2018) and over 340 million children under the age of 18 are now overweight or obese (World Health Organization, 2017). Non-communicable diseases are now the leading cause of death globally, responsible for 71% of all deaths, 85% of those in low- and middle-income countries (World Health Organization, 2018). The global prevalence of diabetes (closely linked with the rise in obesity) is estimated to be 6.4% among adults aged 20–79 years. The International Diabetes Federation estimates that one in 11 adults have diabetes, with 79% of cases from low- and middle-income countries (International Diabetes Federation, 2019).

Unhealthy diets often contain a significant amount of processed foods that are high in calories but low in nutrients. The increased global availability of ultra-processed “convenience” foods is one of the biggest drivers of dietary change leading to overweight, obesity, and chronic non-communicable diseases (Kaveeshwar and Cornwall, 2014; Monteiro *et al.*, 2013; Rauber *et al.*,

2018). A recent large observational prospective study concluded that higher consumption of ultra-processed foods was associated with higher risks of cardiovascular, coronary heart, and cerebrovascular diseases (Srour *et al.*, 2019); new forms of ultra-processing to produce “fast carbs” are affecting the molecular structure of food in ways that disturb the digestive and hormonal systems (Kessler, 2020). Worldwide, increased globalization of food manufacturers, supermarket chains, and fast-food restaurants has contributed to the increased supply of high-sugar/fat energy-dense foods at reduced prices (An *et al.*, 2019).

Impact Channel 5: Food Insecurity

Finally, health impacts occur through insufficient or precarious access to healthy and culturally acceptable foods and diets.

One of the goals of a sustainable food system is food security—“a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (Food and Agriculture Organization of the United Nations, 1996). People are food insecure when they cannot—or are at risk of not being able to—access a healthy diet. Insufficient diets result from insufficient access to/intake of calories or micronutrients.

In 2010 over 820 million people worldwide were facing hunger, which had been rising in parts of Africa, Latin America, and Asia. Another 2 billion people were experiencing moderate to severe food insecurity (Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, UNICEF, World Food Programme, and World Health Organization, 2019). These numbers are now expected to increase further as a consequence of the economic crisis in the wake of COVID-19 (Chan, 2020; World Food Programme, 2020). The Zero Hunger target set under the Sustainable Development Goals looks very unlikely to be reached by 2030.

Some of the health effects of undernourishment are well known. Inadequate intake of calories and proteins (protein-energy malnutrition—PEM) is the leading cause of death in children in developing countries (Global Panel on Agriculture and Food Systems for Nutrition, 2016). Low birth weights, stunted growth, and compromised neurodevelopmental capacity are also common consequences of PEM. Long-term health consequences of childhood exposure to hunger include greater risks for conditions such as asthma and depression in adolescence and early adulthood (Kirkpatrick *et al.*, 2010; McIntyre *et al.*, 2013). Micronutrient malnutrition increases the risk of infections and infectious diseases, as it weakens the immune system (Schaible and Kaufman, 2007). Overall, food insecure individuals are more likely to have poorer health (Vozoris and Tarasuk, 2003).

Challenges in Addressing Market Failures in Food Systems

The health impacts of food systems are thus severe, wide-ranging, and costly in human and economic terms, with recent studies such as the FAO’s “MARCH”

project (Food and Agriculture Organization of the United Nations, 2017) helping to advance the economic valuation of these impacts.

The obvious solution is to correct these market failures through a new set of policy incentives, including taxes on products generating negative externalities (such as sugar-sweetened beverages), and/or regulation or banning of toxic substances (such as proven EDCs and harmful pesticides). Similarly, subsidies for agroecological production or no taxation of “healthy food,” such as organically produced fruits and vegetables, should be implemented. While careful consideration of cultural/political environments is required, the precautionary principle in favor of public health must be applied, particularly in cases of toxic substances leading to life-long disabilities and death.

However, comprehensive policy reforms to correct market failures and address health risks in food systems remain the exception around the world. Rather than increasing efficiency and equity, government policies often privilege those generating negative externalities and disadvantage those (businesses, consumers, and civil society organizations), providing extra social benefits through their actions. In other words, market failure is being compounded by policy failure. Often, the point of contention is what is considered “enough evidence.” In IPES-Food’s 2017 review, we found that the collective strength, consistency, plausibility, and coherence of the scientific evidence has established a solid basis for action. The evidence has since grown in all of these areas. For example, the perilous situation of food- and farmworkers has been broadly recognized in the wake of the COVID-19 pandemic.

This points to a deeper problem rooted in the political economy of food systems. Market failures and policy failures in food systems are underpinned by what could be considered as “evidence failure”—not a *lack* of evidence, but rather challenges with regard to our ability to see the full picture of food system impacts, understand the connections between impacts and across food systems, and communicate them at the science-policy interface (IPES-Food, 2017).

Firstly, there are major blind spots in the evidence base. The biggest health risks tend to accrue to vulnerable groups and precariously employed workers (women, indigenous people, migrant workers, even children), who are less likely to report injuries and illnesses for fear of termination or victimization, or for lack of knowledge of their right to medical services (Cavalli *et al.*, 2019). In turn, employers could have a financial incentive to under-report injuries and illnesses that occur on their premises in order to lower their workers’ compensation insurance payments. Risks to farmers and farmworkers in developing countries are generally under-documented. These blind spots make it less likely for problems to be prioritized politically, allowing health risks to continue to afflict marginalized populations. This is compounded by a broader disconnection of the general public from the process of food production.

Secondly, food systems are complex, and health impacts cannot always be traced back to their origin. For example, zoonotic pathogens and antimicrobial resistance can spread through multiple pathways within and around food systems. Chronic exposure to EDCs is hard to trace to specific sources or even

to specific chemicals. Many of the health impacts described above are compounded by factors like climate change, poverty, and unsanitary conditions, which are reinforced by industrial food and farming practices.

Thirdly, powerful actors—from multinational agribusinesses to governments and donors—have the power to establish the narratives that frame the problems and the solutions in food systems (IPES-Food, 2016; IPES-Food, 2017). These “solutions”—from biofortification to climate-smart agriculture—are premised on further industrialization and standardization of food systems. They ignore the role of current systems in driving health risks (e.g., by perpetuating poverty and climate change) and thereby obscure the extent and severity of health impacts in food systems.

Leverage Points for Building Healthier Food Systems

What is required in building healthier food systems is nothing short of revisiting the fundamental pillars and underlying assumptions of the industrial food and farming model. Five leverage points were identified in the 2017 IPES-Food report to help to break the current cycles, addressing the deficits of public awareness, scientific evidence, and political will in combination:

- **Leverage Point 1—Promoting Food Systems Thinking:** We must systematically bring to light the multiple connections between different health impacts, between human health and ecosystem health, between food, health, poverty, and climate change, and between social and environmental sustainability.
- **Leverage Point 2—Reasserting Scientific Integrity and Research as a Public Good:** Research priorities, structures, and capacities need to be fundamentally realigned with principles of public interest and public good, and the nature of the challenges we face (i.e., cross-cutting sustainability challenges and systemic risks).
- **Leverage Point 3—Bringing the Alternatives to Light:** We need to know more about the positive health impacts and positive externalities of alternative food and farming systems (e.g., agroecological crop and live-stock management approaches that build soil nutrients, sequester carbon in the soil, or restore ecosystem functions such as pollination and water purification).
- **Leverage Point 4—Adopting the Precautionary Principle:** The complexity of food systems is real and challenging, but cannot be an excuse for inaction in the face of threats of serious or irreversible damage to human health.
- **Leverage Point 5—Building Integrated Food Policies under Participatory Governance:** The monumental task of building healthier food systems requires more democratic and more integrated ways of managing risk and governing food systems. A range of actors—policymakers, big and small private sector firms, healthcare providers, environmental groups,

consumers' and health advocates, farmers, agri-food workers, and citizens—must collaborate and take shared ownership of this endeavor.

Collectively, these steps can provide a new basis for action to build healthier food systems, including taxation of externalities. A systemic approach to food and health has been translated into concrete policy proposals in the shape of IPES-Food's advocacy for a Common Food Policy for the EU (see Box 5.2). Integrated food policies, in particular, can provide the framework for ensuring that policies combine in a way that puts health, equity, and sustainability at the heart of our food systems and redistributes power in the process.

Box 5.2 A Common Food Policy for the EU

At the European level, health and nutrition goals have typically been addressed in isolation from broader food and agriculture policies, focused on specific actors and parts of the chain (e.g. retailers, schools, consumers), and limited to guidance and voluntary action. In contrast, the Common Food Policy blueprint—co-developed with over 400 food system actors—establishes *healthy agro-ecosystems* and *healthy sustainable diets for all* as two of the five overarching objectives for EU food systems (IPES-Food, 2019). In doing so, it requires actions on the supply and demand-side to be packaged together, and identifies sector-specific reforms (e.g. to the EU's Common Agricultural Policy and Trade policies) in relation to these overarching objectives. One proposal requires EU Member States to adopt “healthy food environment plans”—including action on social policies, education, urban planning, zoning and licensing, marketing, public procurement, and beyond—as a condition for continuing to receive agricultural subsidies. Widespread calls for an integrated food policy have been taken up by the European Commission in the “Farm to Fork Strategy” launched in May 2020, which places renewed emphasis on health and nutrition and recognizes the need to look beyond consumer responsibility and build healthy “food environments” (European Commission, 2020).

Note

- 1 While impacting health through environmental contamination, EDCs are also linked to health impacts as occupational hazards (Impact Channel 1) and contaminated foods (Impact Channel 3).

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