



# Reducing and Managing Food Scares

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**SUMMARY** A series of high-profile food-related scares around the globe has drawn attention to the issue of food safety and other health risks associated with agriculture. Because the scope of the problem is different at different levels of economic development, we need nuanced policy options to promote safer food production systems worldwide.

**F**OODBORNE DISEASES RESULT FROM THE INGESTION OF CONTAMINATED or naturally hazardous foods. They include a broad range of illnesses caused by pathogens and chemicals. The most important causes of foodborne diseases are biological (caused by parasitic and microbial infections), but while most infectious diseases in humans are declining, incidences of foodborne diseases appear to be increasing.<sup>1</sup>

What were the high-profile foodborne disease events in 2014? What do they tell us about the different patterns of foodborne disease characteristic of different levels of development, particularly for emerging economies? We answer these questions below; discuss other food- and health-related issues, such as antimicrobial resistance; and close with suggestions on how food safety can be better managed.

## FOODBORNE DISEASE EVENTS IN 2014

In 2014, as in previous years, foodborne disease received much media and policy attention. In Denmark, an outbreak of listeriosis associated with pork sausages killed 12 people, and the small firm producing the sausage meat was closed down. In Canada, revised estimates of the burden of foodborne disease suggested that one in four Canadians is affected each year. More than 90 percent of this burden is caused by just four pathogens and, as is often the case, most (three out of four) of the pathogens responsible are transmissible between animals and

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people (zoonotic). In the United Kingdom, a report on a major food fraud scandal that broke out in 2013 revealed how a highly competitive and under-regulated industry allowed firms to adulterate beef



In China, trading centers in Hunan came to a standstill when cadmium was found in rice, a legacy of cultivation in polluted soils. In a separate incident, thousands of dead pigs were reportedly dumped in rivers and reservoirs, further undermining trust in the safety and wholesomeness of pork.

with horsemeat, which although posing no threat to human health did undermine general confidence in the food system.<sup>2</sup>

Meanwhile, cholera—which is both water- and foodborne—broke out in the Cameroon, Cuba, Ghana, and South Sudan. For Cuba, it was the first outbreak in more than a century. The government of Ghana responded to its national outbreak by attempting to ban street food vending.

In China, trading centers in Hunan came to a standstill when cadmium was found in rice, a legacy of cultivation in polluted soils. In a separate incident, thousands of dead pigs were reportedly dumped in rivers and reservoirs, further undermining trust in the safety and wholesomeness of pork. Problems were not confined to the indigenous industry. An American-owned meat factory operating in China was found selling out-of-date and tainted meat to clients, including McDonald's and Starbucks. McDonald's expects that this will reduce the company's global earnings by US\$0.15–0.20 per share.

Across the strait, a scandal in Taiwan erupted over the use of “gutter oil”—recycled oil from

restaurant waste and animal byproducts. The premier of Taiwan apologized and the chief executive officer of the Taiwanese company responsible was arrested.

As 2014 drew to an end, the largest-ever outbreak of Ebola hemorrhagic fever in West Africa was ongoing. The most likely initial source of this outbreak was exposure to bats.

Other events of 2014 were more in keeping with the overall long-term progress being made around the globe in better managing infectious diseases—advances that have resulted from better education, information, technology, and institutions. For instance, data from the *Global Burden of Disease* report released by the World Health Organization (WHO) in June 2014 showed that diarrheal disease in 2012 decreased by 38 percent from the year 2000.<sup>3</sup>

In 2014 technologies to better manage high-priority diseases continued to be developed and released. One example is the development of encapsulated fecal transplants for *Clostridium difficile*. This unpleasant disease has increased rapidly in the last few decades, and food is considered a potential transmission route. As much as 90 percent of cases that do not respond to antibiotic treatment improve when feces from healthy people are transplanted to the victim. Going forward, this sometimes-difficult treatment process will be facilitated by encapsulating the feces to be transplanted in an easy-to-swallow pill.

Food safety reform took place in several countries, notably Taiwan, which created a food safety agency, and the United States, which began implementation of its 2011 Food Safety Modernization Act—the country's most sweeping reform for food safety in 70 years. High-level policy coordination on food safety included an Organisation for Economic Co-operation and Development meeting on the future of agriculture, which identified food safety as a major concern, and a World Trade Organization workshop on risk analysis for food safety, which summed up the progress and challenges since the previous workshop in 2000. WHO released preliminary results of a reference group study on foodborne disease attribution,<sup>4</sup> and a book was published covering the results of a decade of CGIAR research on food safety in the informal markets of Africa.<sup>5</sup>

## THREE WORLDS OF FOOD SAFETY CONCERNS

The notable food safety events of 2014 summarized above illustrate both the complexity and the diversity of food safety issues. From these examples we can identify three “worlds” characterized by different food safety concerns:

- ▶ **Developed economies**, where foodborne diseases are of high concern but impose relatively small health burdens
- ▶ **Least developed economies**, where foodborne diseases, although prevalent, are not among the highest priorities of public health officials
- ▶ **The emerging economies**, where foodborne diseases are both highly prevalent and highly prioritized

We examine each below in turn.

### Developed Economies: The “Worried Well”

As exemplified by the events in Europe cited above, foodborne disease remains an important public health problem in high income countries. This is mainly because other infectious diseases in this part of the world have been successfully brought under control. (Less than 7 percent of the disease burden in high income countries is caused by infection, compared with 43 percent in low income countries.)<sup>6</sup>

There are, of course, differences among developed economies. For example, some countries with relatively advanced animal and human health systems are reported to have made little progress over the last decade in the control of zoonotic foodborne pathogens (the United States is one example), while others have had notable success with some diseases (such as control of salmonellosis in the European Union).<sup>7</sup> From a global perspective, however, an epidemiological transition has occurred in the countries of this group, and the main health problems associated with food are obesity and the contribution of diets to cardiovascular disease and cancer.<sup>8</sup>

Yet paradoxically, as the absolute burden of infectious disease decreases, the cases that do occur receive more attention from the media, the public, and policymakers. A single outbreak of

*Escherichia coli* (a pathogen commonly associated with meat and raw milk) that killed one child and sickened three others led to the restructuring of the national food safety system in Australia. Moreover, in developed economies the cumulative cost of even occasional illness in terms of treatment and lost income is high. Foodborne disease has been estimated to cost the US economy US\$14–16 billion each year<sup>9</sup> and to set Australia back \$1.2 billion annually.<sup>10</sup> Improvements in food safety along the value chain, especially on farms, have been shown to be realistic and economically feasible. For example, the cost of achieving a salmonella-safe compound feed in Europe was estimated at €1.8–2.3 per ton of feed.<sup>11</sup>

Developed economies are experiencing an increasing number of concerns over nonsafety food attributes, including animal welfare, environmental sustainability, provenance, and food crime. With the European horsemeat scandal of 2013, adulteration and food fraud reemerged as a major issue. The extensive media coverage of the scandal revealed not only widespread fraud but also

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the complexity of the European meat supply chain and the extent of meat imports. There is widespread public distrust of the industrial agrifood complex, and many consumers remain unconvinced of the safety of genetically modified foods despite a lack of scientific evidence of risk. There is also a widespread belief in the greater safety of organic and local products, which is also not well supported by evidence.

### The Least Developed Economies: “The Cold Spots”

In the least developed economies, foodborne disease is probably common but largely underreported. We know that diarrhea is the third most important cause of disease burden in low income countries,<sup>12</sup> most of which is associated with contaminated food and water.<sup>13</sup> The exact contribution of foodborne disease to the burden of gastrointestinal disease in developing countries is unknown but will likely increase as communities rapidly gain access to safe water while most of their food remains contaminated. However, the poorest consumers are to some degree protected from foodborne disease by their limited access to the foods most often implicated as the source of foodborne disease (such as livestock products, fish, and leafy vegetables), the short value chains for these products, and indigenous practices (such as fermentation and lengthy cooking) that mitigate risk.

Conversely, the poorest are more at risk from contaminants associated with staple foods, such as aflatoxins (fungal toxins that are especially prob-

filth-associated, and other diseases of neglect and poverty. In the least developed countries, food safety is apparently not a dominant concern of either the public or policymakers, and attempts to impose food safety regulation may on occasion create more harm (such as by increasing transaction costs and reducing food availability) than benefit.<sup>14</sup>

### The Emerging Economies: “The Hot Spots”

The third and arguably most important set of food safety concerns is seen in emerging economies. They are characterized by rapidly growing demand for the riskiest foods (animal source foods and vegetables), rapidly intensifying agriculture to meet these demands, but lagging food governance systems. Marked by both a high absolute burden of foodborne disease and a high level of concern, these countries are what can be called the foodborne disease “hot spots.”

Emerging economies have rapidly changing food systems, with urbanization creating bigger markets and longer and more complex food chains. In countries where infrastructure is lacking, the growth of cities stimulates urban and peri-urban production of perishable foods, including livestock products and vegetables. Indeed, to promote food security China has actively encouraged agricultural production within city limits.<sup>15</sup> Predictably, placing large, dense human populations in close proximity to large, dense livestock populations brings both public health and environmental hazards—risks that are compounded by poor agricultural practices (such as lack of traceability and reliance on veterinary drugs to mask poor husbandry) and lack of effective regulation.

The avian influenza pandemic revealed the generally low levels of biosecurity on farms, as well as the unsanitary conditions in slaughter, processing, and retail facilities in South Asia and Southeast Asia. Other major concerns are farming where industrial pollution is high, the use of gray water (domestic wastewater excluding sewage) is widespread, and management of livestock waste is poor. As a result, biological and chemical hazards are widespread in these systems, as well as the food emerging from them. Most studies of the farms and wet markets of emerging countries reveal high levels of pathogens and contaminants.



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lematic in maize, sorghum, and groundnuts). While around 4 billion people in tropical countries have uncontrolled exposure to aflatoxins, most of the known burden (hepatic carcinoma compounded with high rates of hepatitis B infections) is seen in the minority of countries (mainly African) where dietary diversity is low and reliance on staples, particularly maize, is high.

Moreover, in the poorest countries it is difficult to disentangle foodborne disease from the complex of waterborne, vector-borne, contagious,

Given the combination of poorly regulated intensification, high levels of concern, and relatively advanced ability to detect and analyze contaminants, as well as communicate them through mass and social media, it is not surprising that some of the most serious and widely publicized food safety problems are now occurring in emerging markets. The incidents of 2014 mentioned above are just the latest in a long series of food safety scares, which also includes the deliberate addition of melamine in milk that sickened thousands and killed six infants in China in 2008. (Melamine is a nitrogen-rich chemical that, because it shows up as protein on tests for milk quality, was added by middlemen so that manufacturers would buy their product.)<sup>16</sup> This practice of criminally adding melamine to milk began in response to China's setting of higher standards for protein levels following a scandal in 2004 when 13 babies died after drinking nutritionally inadequate formula. The melamine scandal well illustrates the challenges of improving food quality and safety in rapidly changing food systems in which regulatory capacity and private-sector incentives and compliance are weak.

Such episodes lead to lack of trust in food, which in turn spurs greater reliance on imported and processed food. And the massive markets for livestock products in Asia, whether because of or in spite of these scandals, are not following the predicted trajectory in which informal markets are rapidly replaced by formal markets ("supermarketization"). In Vietnam, for example, 97 percent of pork is sold in traditional wet markets.<sup>17</sup> Even in Malaysia, where incomes are higher and supermarkets are commonplace, traditional markets remain the preferred place for buying fresh meat.<sup>18</sup> In east and southern Africa, informal markets currently supply 85–95 percent of the food purchased, and are predicted to predominate well into the next decades.<sup>19</sup>

Food safety can also have an impact on food exports and imports. The increasing introduction of food safety standards could create barriers to market access for small-scale producers, while at the same time leading to advantages for domestic producers who produce high-value products for export at competitive prices. Emerging economies are well placed to predominate in these kinds of markets.

Most experts believe that the emerging markets will eventually converge with the richer countries.<sup>20</sup> Indeed, panic over food safety can be a driver for improvement. In the United States, Upton Sinclair's

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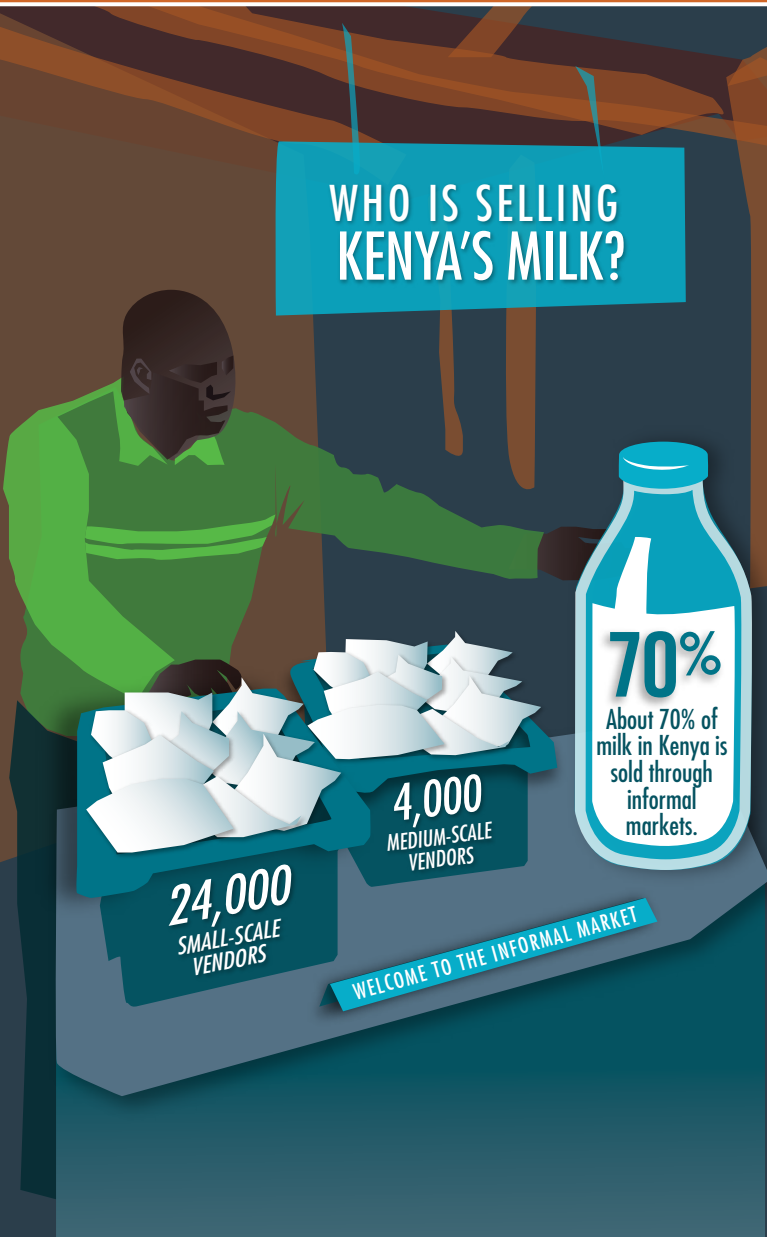
1906 book *The Jungle*, which exposed the shocking unsanitary practices in the Chicago meat yards, sparked widespread public outrage that eventually led to the establishment of the US Food and Drug Administration.<sup>21</sup> From this perspective, the situation in China—where a widely publicized finding is that half the establishments undergoing food inspections fail to pass—may be more positive than the situation in India, where no reports on food safety inspection or results are publicly available.<sup>22</sup> Governance and transparency are a more general problem in emerging economies, however, and it is unlikely that food safety will be a leading area of good governance unless there is concerted public pressure to make it so.

## OTHER HEALTH IMPACTS OF AGRIFOOD SYSTEMS

Foodborne disease is not the only impact agriculture has on human health. Since reliable records began in the first half of the 20th century, diseases have been emerging from agroecosystems at the rate of one every four months; three-quarters of these are zoonotic.<sup>23</sup> Historically, most of the diseases that are transmissible between animals and humans emerged

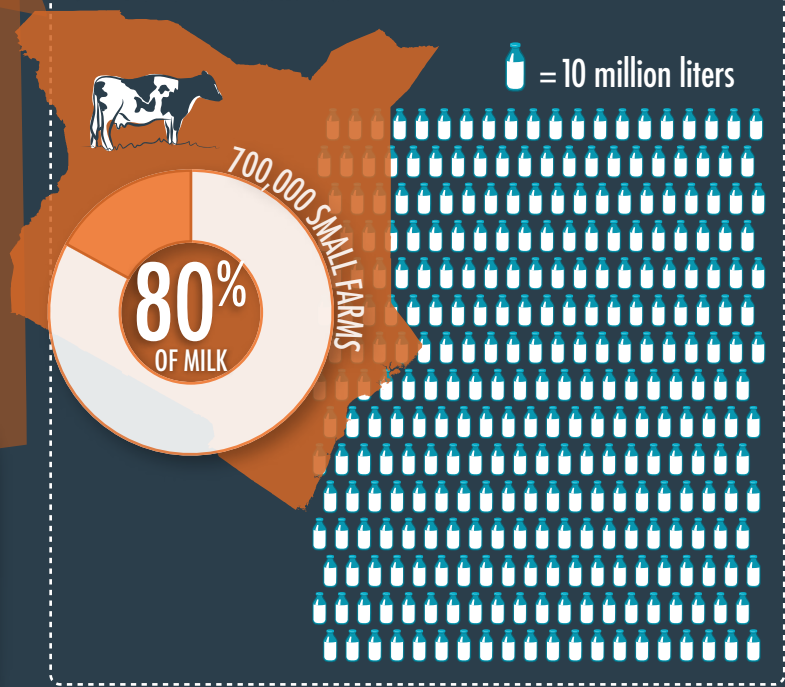
# THE INFORMAL MARKET: DON'T OVERLOOK IT

Policies banning or ignoring informal milk markets are counterproductive. Kenya is a positive example of how introducing improved technologies and standards to milk producers and traders can boost food safety and generate economic returns.



## WHO IS PRODUCING KENYA'S MILK?

Around 700,000 small farms each owning 1–10 cows produce 80% of the country's milk, **3–5 BILLION LITERS PER YEAR.**



## REDUCING KENYA'S SPILT MILK

By certifying the training of traders and their milk operations, the Kenyan government reduced milk loss stemming from:

1. adverse police actions,
2. milk becoming wasted and spoiled, and
3. direct confiscation of milk and containers,

contributing to US\$26 million in annual economic gains.



**Source:** S. Kaitibie, A. Omore, K. Rich, B. Salasya, N. Hooten, D. Mwero, and P. Kristjanson, "Policy Change in Dairy Marketing in Kenya: Economic Impact and Pathways to Influence from Research," in CGIAR Science Council, *Impact Assessment of Policy-Oriented Research in the CGIAR: Evidence and Insights from Case Studies*, a study commissioned by the Science Council Standing Panel on Impact Assessment (Rome, CGIAR Science Council Secretariat, 2008).

in the intensive animal industries of Europe and the western United States. More recently there appears to be a shift toward developing countries in Southeast Asia and South America, possibly tracking the rapid intensification in these regions.<sup>24</sup>

Once again, emerging antimicrobial resistance threatens to leave humanity highly vulnerable to infectious diseases, which before the modern era were responsible for the majority of human deaths. Antibiotics are widely used in livestock and fish production, both to promote growth and to treat

or prevent illness, and antimicrobial resistance is widely present in bacteria in animals, animal environments, and animal source foods. There is increasing consensus that resistance to antimicrobials of human importance has been generated in animals and has since spread to humans.<sup>25</sup> At present, there is little evidence regarding the contribution of livestock and fish farming to the burden of human disease resulting from antimicrobial resistance. However, creation of antimicrobial resistance is likely to be especially problematic in emerging economies, where large amounts of antibiotics are manufactured and used with minimal regulation or reporting.<sup>26</sup> One study estimated that the Asia-Pacific region has nearly half of the global antimicrobial market by volume (although only 8 percent by revenue).<sup>27</sup>

Other health impacts of agriculture include occupational disease, poisoning from plant toxins, the creation of environments suitable for disease or disease vectors, and contributions to climate change with indirect effects on disease dynamics.<sup>28</sup>

## GLOBAL FOOD SAFETY

In an increasingly globalized world, a food safety problem created in one place can easily spread to others. Food safety and the prevention of emerging diseases can be seen as global public goods whose management requires international coordination and effort. Since the World Trade Organization agreement of 1994, which established an international framework for assessing food safety and disease introduction risk, there has been increasing consensus on the need for risk-based approaches and coordination between the standard setters for plant and animal health and food safety. These bodies include WHO, International Plant Protection Convention, World Animal Health Organization (OIE), and Codex Alimentarius Commission, a joint committee of the Food and Agriculture Organization of the United Nations (FAO) and WHO. There has been some progress in improving global surveillance, but underreporting remains a major problem in most countries.

In developed economies, most notably in Europe, private standards for food, whether for export or

domestic consumption, are often more stringent than public standards. Producers have incentives to ensure the quality and safety of their products because “food scandals” can have serious negative

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economic, legal, and reputational consequences. This concern is increasingly being felt around the globe, including in developing countries. One example of this is the International Food Standard (IFS), originally developed by retailers and wholesalers in Germany to ensure the safety of own-brand products. Version 6 of IFS Food, which is the latest version, is a collaboration of retail federations from all over the world.<sup>29</sup>

## TOWARD BETTER MANAGEMENT OF FOOD SAFETY

Fortunately, foodborne disease is largely a fixable problem, as illustrated by developed economies. Food safety systems came into being more than a hundred years ago. The first systems relied on visual inspection at retail, during processing, and on farms. But with time came codes of good practices (for both agriculture and manufacturing), voluntary standards, regulatory limits, testing for hazards, and methods for ensuring that food-handling processes remain within safe limits. However, these methods require expertise and incur costs, and uptake has been limited in many emerging and least developed economies.

Food safety management has traditionally relied on “control and command”—the setting of strict standards and the enforcement of these standards by



both inspection and credible threats. In developed economies, these approaches are being supported by greater reliance on self-regulation and industry buy-in. Initiatives such as the industry-led Global Food Safety



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Initiative and the World Bank–led Global Food Safety Partnership are gradually being extended to emerging and even least developed economies.

Risk-based approaches for prioritization can improve the efficiency and effectiveness of food safety management. The great majority of the disease burden is caused by a small number of hazards (mostly zoonotic pathogens), and typically a small number of actors and products create a disproportionate amount of risk. This pattern means that targeting the riskiest products, pathogens, and practices can lead to greater risk mitigation at lower cost. Currently only a few countries consistently use risk targeting (notably Australia and Canada). Extending this approach could have many benefits, especially in resource-poor contexts. Risk-based approaches also include methodologies for structured assessment of the public health impact of a food safety problem and the options for managing it. The Codex Alimentarius Commission is the global standard setter for food safety and provides detailed information on the risk-based approaches that are now the gold standard.<sup>30</sup>

In developing countries, regulations have been largely ineffective in the domestic markets where most people buy and sell the riskiest perishable products. This failure can be attributed to poor

governance, inappropriate food safety systems, and a lack of information, incentives for compliance, and resources. Approaches that are possibly more promising involve working with the informal sector to gradually improve practices and building systems with positive incentives for compliance.

One example is the informal dairy sector in Kenya (see Infographic on page 46). In Kenya, around 700,000 smallholders owning 1–10 cows produce 80 percent of the milk (3–5 billion liters per year). Around 70 percent of milk is sold through the informal sector, comprising about 4,000 medium- and 24,000 small-scale operators. A CGIAR research project found that policies banning informal milk markets act as a barrier to the uptake of improved technologies among producers and traders. A model was developed whereby traders would receive training and then be given a certification allowing their operation. This policy was recognized by the governing and regulatory bodies in Kenya. Evaluations showed that trained hawkers (market agents) produced safer milk, the informal sector had no worse compliance than the formal sector, and the changes in policy led to economic gains of US\$26 million annually.<sup>31</sup>

Management of food safety is complicated by its emotive nature. There is a remarkably wide divergence in how the public and experts assess food risk. For example, food safety experts consider marine toxins to be a serious concern and pesticide residues a minor concern; for the general public, however, these estimates are completely reversed. Most surveys indicate that the general public is most worried about pesticide residues, food additives, hormones, and other chemicals in food. Yet research shows that most outbreaks of foodborne disease are associated with microbiological contamination: people are many times more likely to become ill as a result of microorganisms in food than as a result of pesticide residues.

Technology and marketing innovations have potential to continue to improve food safety. Consumers universally demand food safety, but it is largely a “credence good”—consumers cannot directly assess its presence. Some steps, such as ongoing research on packages that change color when pathogens are present or market-side tests for adulteration or pathogens, could allow consumers

and market agents to detect and refuse unsafe food, thereby pushing quality assurance up the supply chain. Some cheap and effective technologies already exist for reducing health risks, yet nonscientific fears concerning the “unnaturalness” or lack of safety of the technique have meant that they are by and large not being used. (Examples of this include lactoperoxidase for milk preservation or irradiation of food to eliminate pathogens.) Other technologies are under development, some of which may prove to be acceptable as well as effective. Additionally, attitudes toward existing solutions may turn more favorable if food availability worsens. Mobile phones and Internet tracking are already providing more comprehensive and accurate surveillance, and molecular epidemiology allows tracking of pathogens from the victim to the source. Also, continued innovation in intensive farming systems can reduce hazards at the source, mitigate environmental damage, and dampen the development of antimicrobial resistance.

## CONCLUSIONS

A series of high-profile foodborne disease events, along with concerns over the ecological and animal

welfare impacts of agriculture, has led consumers in developed and emerging economies to become increasingly wary of industrial agrifood systems and their products. At the same time, consumers (especially the less rich) are increasingly dependent on the abundant, cheap, and generally safe foods these intensive systems produce.

Some consumers are demanding a total reconfiguration of agrifood systems, the reconceptualization of food as a commons rather than as a commodity, and a complete dismantling of current food systems.<sup>32</sup>

However, it seems most likely that growing concern over food safety will result in increased safeguards for intensive production that better assure consumers of food safety. Improved production methods may also reduce the emergence of diseases from agroecosystems.

A positive evolution of agrifood systems will require better governance and continued technological innovation. Food safety and prevention of disease emergence from agroecosystems are global public goods requiring international cooperation and investments in safer foods and agriculture by the international community as well as national governments. ■

# NOTES

## CHAPTER 6

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