

23

Lessons for China from US Food Safety History¹

Fred Gale and Sandra Hoffmann

US Department of Agriculture, USA

23.1 Introduction

China's consumers face many hazards in their foods, including melamine in infant formula, toxic dyes in egg yolks, meat from diseased animals, cooking oil recycled from waste, and heavy metals in rice and vegetables. While these food safety problems seem shocking, similar problems were commonplace in Europe and the United States 100 years ago.

In 1913, monthly circulars distributed by the Chicago Department of Health [1] warned local residents that certain foods could cause disease or death. The pamphlets reported dozens of deaths in the city weekly from tuberculosis, diphtheria, diarrhea, and other diseases, many transmitted by food. The authors sternly cautioned Chicago residents to avoid street vendors selling cold drinks, "dirty ice cream," ice in beverages, and uncooked vegetables. Readers were warned that tuberculosis could be spread by merchants who polished fruit by breathing on it and shining it with a dirty handkerchief. The pamphlets advised readers to find out where their milk came from and warned mothers that children who drank cow's milk were less likely to survive the summer than those breast fed, and gave instructions for pasteurizing milk at home. Circulars reported fines assessed on unlicensed restaurants and unsanitary milk depots.

The United States and Europe have made significant progress over the past century in addressing food safety problems. Americans and Europeans are now shocked by similar problems in contemporary China. In this chapter we explore parallels between nineteenth-century food safety problems in the United States and Britain, and those experienced today in China. We also look at parallels in economic and institutional development and what lessons these parallels might provide for China as it works to improve food safety today.

1 Note: The views expressed in this article are those of the authors and do not necessarily reflect the positions of the US Department of Agriculture or the Economic Research Service.

23.2 Food Safety Then and Now

Advances in disease control, toxicology, immunizations, testing, and sanitation have helped China to avoid many serious food-borne diseases, yet many of the problems and behaviors observed in nineteenth-century Europe and North America are commonplace in twenty-first-century China. This suggests that the problems are not wholly or even primarily technical, but rather are problems of management and institutional structure.

A number of food safety problems prevalent in nineteenth-century Britain and the United States are now common in China (see Table 23.1). In nineteenth-century Britain and the United States, it was common practice to mix inferior materials into products like flour, beer, and tea; add dyes, flavorings, and whitening agents to hide inferior materials or spoilage; or to brush hams with borax, creosote, salt, and red dye to make them appear well-smoked [2]. During the 1860s, as much as one-fifth of beef supplied in Great Britain came from diseased animals [3]. The sale of meat from diseased swine was

Table 23.1 Similar food safety problems in three countries.

Britain	United States	China
<i>Problem: Selling meat from diseased animals</i>		
1863: As much as one-fifth of beef in London was from diseased animals. Traders used fat from healthy animals to hide problems of diseased carcasses [2]	1870s: Reports that US meatpackers processed the carcasses of swine that had died from hog cholera raised alarms [4]	2014: Police report breaking up a network that sold pork from diseased pigs in 11 provinces [39]
<i>Problem: Nonfood ingredients used as substitutes to reduce cost</i>		
1858: Lozenge makers replaced sugar with plaster of Paris or limestone to reduce costs; 20 people died when arsenic was used by mistake [6]	1900: According to a US Senator, "... investigation during the last session of Congress showed that very dangerous ... substances were being used to adulterate flour [which] impaired the credit of American flour in foreign countries." [22]	2008: Flour was adulterated with talcum powder and laundry detergent [40] 2009: Pesticide, bleach, and detergent were added to flour used for steamed bread [41]
<i>Problem: Infants harmed by adulteration of milk or infection with pathogens</i>		
Late 1800s: Rising infant mortality was believed to be linked to the use of adulterated or infected milk [2]	1900: "Last month over four hundred babies ... were killed by poisoned milk ... contaminated by a ... preservative liquid, known as formaldehyde. This toxic agent has been introduced into the dairy business under various fancy names." [42] 1906: An advocate of "pure food" attributed high death rates of infants in New York City to pathogens and chemical preservatives in milk [43]	2004: Children died from malnourishment after consuming infant formula containing flour and other non-nutritive substances [44] 2008: Children died of kidney failure after consuming milk adulterated with melamine [45]

Source: Compiled by authors from sources cited.

common in the United States during hog cholera epidemics in the early twentieth century [4]. Milk, alternately viewed as “the perfect food” and as a dangerous vector for the spread of disease, was a major concern [5].² High infant mortality rates in cities were believed to be linked to consumption of milk that was adulterated or was infected with bacteria. There were complaints about the poor quality of “swill” milk produced by poorly nourished cattle fed on grain mash from breweries, and it was common for milk sellers to dilute milk or add dyes or flavorings to milk that were sometimes harmful [2, 5].

Many of these examples are remarkably similar to those occurring in contemporary China. Similar adulterants are often added to foods. The appearance and taste can be altered by using bleach, dyes, chemicals, or animal fat. Preventing the butchering and sale of meat from diseased animals has been a major concern for Chinese authorities. Problems with milk are probably the most prominent current food safety concern in China. China’s food safety challenges today include hazards from residues of toxic pesticides, antibiotics, and other chemicals that were not yet in use during the nineteenth century. China’s most prominent milk-adulteration incident came to light in 2008 when the chemical melamine was found to have been added to mask the watering-down of milk by artificially increasing the apparent protein content.

23.3 Urbanization and Food Safety

In the US and Britain in the nineteenth century and in contemporary China, widespread food safety problems were preceded by a period of very rapid urbanization. Urbanization disrupts the social and market relationships that consumers had previously relied on to help assure food safety. In agrarian societies, people often produce food for their own consumption or they purchase food produced and sold locally. Repeated transactions among the same parties provide incentives to maintain food safety and quality. As societies urbanize, new mechanisms must be developed to assure safety in longer, more anonymous supply chains. For example, European society needed new guarantors of product standards to replace medieval trade guilds that declined as industrialization progressed [2]. Urbanization and industrialization increases the frequency of impersonal market transactions creating wider opportunities for fraud. In the United States, the development of a nationwide system of railways and refrigeration in the nineteenth century allowed regional specialization in agricultural production and nationwide transport of fresh meat, but also led to disease outbreaks and concerns about unsanitary meat [4].

The development of reliable mechanisms for assuring food safety and quality tends to lag behind changes in food supply chains associated with urbanization. In Europe and North America, public frustration with the inability to rely on the safety and quality of food led to pressure to create public institutions designed to assure food safety [6]. There is similar frustration in China today. In each of the three countries the first major national food safety legislation was introduced as the population became predominantly urban (see Figure 23.1). Britain introduced its first food adulteration law in 1860 as the urban share of its population approached 50%. The United States also introduced

² The concerns about milk are evident in 1913 Chicago Health Department bulletins [1].

U.S. Pure Food and Drug Act, 1906

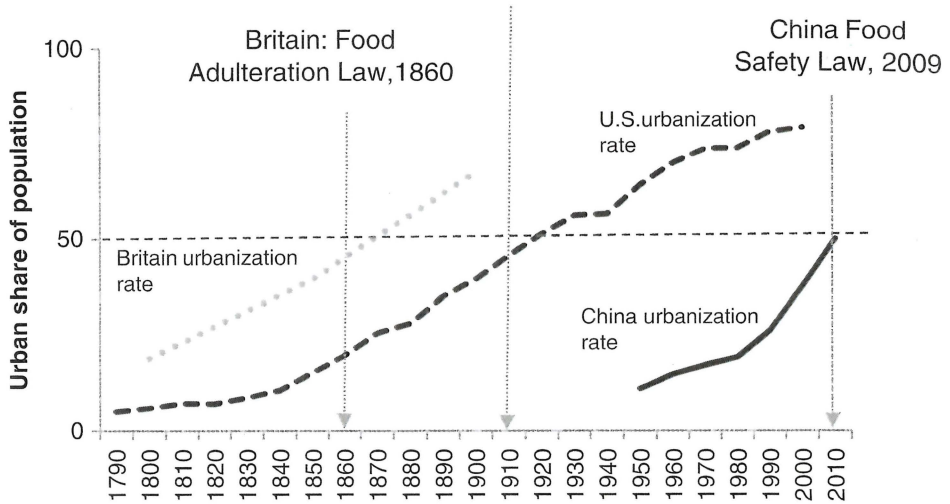


Figure 23.1 Urbanization rate and introduction of food safety laws. *Source:* Data compiled by authors. British population estimates from [46]; US estimates from [8] and www.census.gov; China data from www.stats.gov.cn.

its Pure Food and Drug Act in 1906 as its urbanization rate approached 50%. China introduced its first food safety law in 2009, just as its urbanization rate reached 50%. While urbanization data may not be strictly comparable across countries, the data illustrate the nexus between urbanization and food safety concerns. Recent rapid urbanization of China's population – from 30% in 1990 to 56% in 2015 – appears to be creating continued upheaval in its food system. The 2009 Chinese Food Safety Law was extensively revised in 2015 – only six years later. That same year President Xi Jinping and Premier Li Keqiang each identified food safety as a key government priority.

23.4 Development of US Food Safety Regulation

Historical similarities suggest that China might draw insights about food safety governance from experiences in developing modern food safety systems in Britain and the US. However, it may be dangerous to blindly adopt institutions and regulatory mechanisms from other countries without understanding how they developed. It is also important to understand the legal systems and cultural factors that influence the structure of rules in other countries. In the discussion that follows we look at the development of US food safety institutions and consider what lessons might be drawn from this experience for contemporary China.

In the United States, food safety regulation developed and evolved over many years in response to changes in the economy, science, and technology. The nineteenth century saw industrialization of the manufacturing sector, urbanization of the population, and mechanization and commercialization of the agricultural sector in the US [7]. Between 1860 and 1940, US Census Bureau data show that farmland area in the US more than

doubled, from 407 million to over 1 billion acres, but the share of the population living on farms dropped by half, to 21%, as labor productivity increased [8].

The US food safety regulatory system developed in response to these fundamental changes in the economy. Problems began to arise as food and animals were traded over longer distances. Concerns included spread of animal disease, use of preservatives, adulteration with chemicals to hide spoilage, and unsanitary practices in processing plants. The regulatory structure continued to evolve in the twentieth century as new problems emerged and priorities changed.

The US Federal Government established a Bureau of Chemistry within the US Department of Agriculture (USDA) in 1862. Its initial focus was testing chemical fertilizer, but its later examination of chemical additives in foods was influential in the passage of the Pure Food and Drug Act of 1906 [12]. The USDA established a Bureau of Animal Industry in 1884 that had responsibilities for controlling animal disease and played an important role in meat inspection, the most visible food safety issue at the time. The US Meat Inspection Act was also enacted in 1906.

During the early twentieth century, food safety challenges continued and concern arose about conflicts of interest between the USDA's role in promoting agricultural production and its role in protecting consumers [9]. Under the Food, Drug, and Cosmetics Act of 1938 the USDA's Bureau of Chemistry was moved to the then-new "Federal Security Agency." It was renamed the Food and Drug Administration and in 1953 it was transferred to the Department of Health, Education, and Welfare, predecessor of the current Department of Health and Human Services.

During the decades that followed, laws were revised or amended to address major changes in the food supply, such as significant growth in the poultry industry in the 1950s, and development of new sweeteners, dyes, and pesticides following World War II. The Bureau of Animal Industry's veterinary and meat inspection functions were eventually split into two separate USDA agencies: the Animal and Plant Health Inspection Service (APHIS) and the Food Safety and Inspection Service (FSIS).

During the 1990s, meat again emerged as a focus of food safety attention. Contamination with bacteria could not be detected by sensory examination of animals and carcasses for lesions, other visible evidence of disease, and filth, as required by the 1906 Meat Inspection Act. The 1996 pathogen reduction rule reflected a shift toward prevention of contamination by adding a requirement that processors adopt standard operating procedures, identify "critical points" in the manufacturing process vulnerable

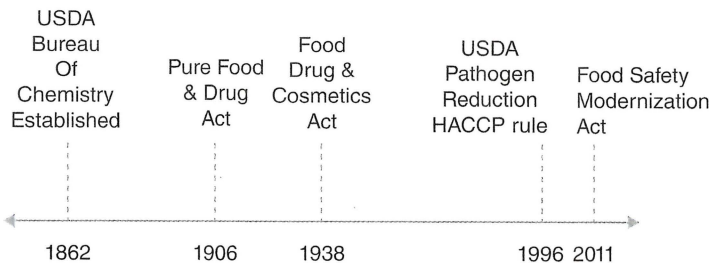


Figure 23.2 Highlights of US food safety regulatory history. *Source:* Compiled by authors from US Food and Drug Administration, "History," <http://www.fda.gov/AboutFDA/WhatWeDo/History/default.htm> (accessed June, 2015).

to contamination, specify and implement corrective actions, and maintain detailed records of these actions for inspectors' review [10].

The 2011 Food Safety Modernization Act (FSMA) continued the move toward prevention by requiring all food suppliers to adopt hazard analysis and control systems similar to those mandated by the 1996 rule for meat processors [11]. The Act uses a “farm to fork” approach to food safety that evaluates the entire supply chain, calls for regular inspections of facilities, and requires importers to ensure the safety of food procured from foreign suppliers.

23.5 Lessons from History

The long and complicated development of food safety regulation in the United States involved numerous laws, amendments, and institutional innovations to implement them. We offer a few lessons that can be drawn from the US experience.

23.5.1 An Informed Public Propels Food Safety Reforms

Public pressure for government action to address food safety problems was essential to early food safety reforms in both the United States and Britain. In both countries growing public awareness of food safety problems was elevated by scientific reports and news media. Incidents that gained public attention, like deaths due to toxic candy in Britain and reports of putrid meat supplied to US soldiers served as triggers for legislative action – much as public outrage over deaths from contaminated infant formula and news of widespread illegal feed additives spurred reform in China.

In both Britain and the United States, prominent scientists played a leading role by documenting food safety problems and their causes, and by advocating reforms. Frederick Accum in England in the 1850s, and Harvey Wiley in the United States from the 1880s through the 1900s were prominent scientists who used their epidemiological research on food adulteration and resulting disease to campaign for pure food legislation [6]. Daniel E. Salmon established cutting-edge bacteriological research at the US Department of Agriculture that served as a foundation for Federal animal disease control programs [4].

Scientific journals provided these scientists with vehicles to inform the public about the implications of their research findings for the public's health [6, 9]. The popular press played a role by translating this information for a wider public and promoting its broad dissemination. In the United States, a movement among reform-oriented journalists known as “muckrakers” exposed abusive business practices, in popular magazines such as *Collier's Weekly* and *Ladies Home Journal* [13]. Perhaps the most prominent and influential example of this literature was Upton.

Sinclair's novel *The Jungle* which described filth, chemical treatment of diseased meat, and other unsanitary and abusive practices in Chicago meat-packing plants [14]. These exposés of adulteration and unsanitary practices helped generate public pressure for food and drug reform [6, 9, 15]. Numerous historians highlight the role of civic organizations in the United States including the Women's Christian Temperance Union, the General Federation of Women's Clubs, and the National Consumers League, as well as farmers groups and business organizations in campaigning for both local and national food safety legislation [6, 9, 16].

Another popular book published in 1933, *100 000 000 Guinea Pigs* [17], warned US consumers that they were routinely ingesting toxic chemicals and pesticide residues in foods.³ The same year, FDA officials prepared an exhibit of deceptively labeled foods that was known as “The American Chamber of Horrors” [19]. Both criticized weaknesses in the 1906 law and influenced enactment of the 1938 Food, Drug, and Cosmetics Act.

In both Britain and the United States, public outrage over highly publicized events triggered food safety reform. In Britain, mistaken adulteration of peppermint lozenges with arsenic killed 20 people (including 10 children) and sickened several hundred more in the city of Bradford during 1858. Public revulsion over these poisonings precipitated passage of the 1859 Bill to Regulate the Keeping and Sale of Poisons and the 1860 Adulteration Act [6]. In the United States, public concerns about meat were heightened by accusations that meat packers supplied “embalmed” beef (putrid meat masked by chemicals) to soldiers during the Spanish-American War [5]. Publication of *The Jungle*, while not a physical tragedy, influenced public opinion and played a role in President Theodore Roosevelt’s support for meat safety legislation [13]. The 1996 pathogen reduction rule was prompted in part by hundreds of illnesses and the deaths of four children linked to consumption of ground beef at outlets of a fast food chain [10, 18]. The 2011 Food Safety Modernization Act was influenced by another string of illnesses linked to spinach and by publicity about adulterated products imported from China. As in the early 1900s, political momentum needed to secure passage of the 2011 Act was built by newspapers and other media outlets that publicized food safety incidents as well as an effective alliance of consumer groups and business organizations.

Two important lessons can be drawn from this history. The first is the importance of having or developing the scientific capacity to provide reliable surveillance of the safety of the food supply. The second is the importance of transparency and informing the public about safety issues in the food supply. Openness in public information about the safety of the food supply is important to developing a constituency for stronger food safety programs. Moreover, as food safety programs become more effective and reliable, public information provides a means of building trust in the safety of the food supply.

Like nineteenth-century Britain and the United States, China has an emerging health-conscious class of educated consumers and an active news media that has disseminated information and generated public pressure for stronger regulation. However, the news media’s role in the reform process is limited by government control and reports that some media outlets have demanded payments from companies to withhold publication of negative articles. China also lacks the strong nongovernmental organizations that gave common citizens a means of advocating food legislation in the United States. In China, nongovernmental organizations – including a women’s federation, industry associations, and farmer cooperatives – are kept under tight control, and there are no prominent consumer groups.

China also lacks prominent scientists like Frederick Accum in Britain and Harvey Wiley in the United States, who played a key role as reformers [6]. China does not have a laboratory like Wiley’s Bureau of Chemistry in the United States or the Analytical

3 While this book was influential, some critics described it as unscientific and some assertions later were shown to be false or exaggerated.

Sanitary Commission established in Britain by Thomas Wakley and Arthur Hill Hassall that publicized problematic food additives [20].

23.5.2 National Rules are Needed to Assure Food Safety in a National Market

An important lesson from the history of food safety law in the US is that the jurisdictional scope of food safety laws needs to correspond to the geographic scope of the market. In an agrarian society, food markets are local, and local standards and enforcement tend to prevail. As society urbanizes, markets become national in scope, requiring national rules.

In the early history of the United States, food safety was regulated solely by state law and local ordinance. In 1785, Massachusetts was the first state to enact a law against food adulteration, and many other state laws were enacted during the century that followed. By the late nineteenth century, the United States had a patchwork of differing laws, standards, and funding levels across states [9, 21].

The shortcomings of differing state laws became apparent as transportation improved, and food and animals began moving all over the country in a national market. In 1899, a senator from Illinois estimated that a quarter of states had passed pure food legislation within the previous three years [22]. The uneven regulatory structure across states prevented effective control of food safety, spread animal diseases, and created opportunity for fraud. Differences in state rules allowed undetected movement of diseased animals between states. Some states hid animal disease outbreaks or underestimated their effects on other regions as means of protecting farmers in their state [4].

As markets became more nationally integrated following the American Civil War, the lack of coordinated national rules led to more economic conflicts [23]. Enforcement was sometimes influenced by local industry interests and used as a form of local protectionism. On the other hand, large companies serving a nationwide market found that differing state laws were an obstacle to their expansion, and big companies became strong supporters of national food laws [6, 15, 23, 24].

In the United States, the national constitution impeded the enactment of national food safety laws. The United States is a federation of 50 state governments, and the constitution specifically gives the Federal government only a few regulatory powers – in particular the power to regulate trade between states – all powers not specifically granted to the Federal government by the constitution are reserved to the state governments.⁴ For much of the nineteenth century, national laws regulating food processing could not be enacted because the US Supreme Court interpreted regulation of manufacturing industry as a state power.

Beginning in the 1880s, the Supreme Court began to broaden its interpretation of the scope of the Federal government's power to regulate interstate commerce [4, 6]. In a 1905 ruling (*Swift v. United States*), the US Supreme Court reasoned that the interstate commerce clause of the US constitution gave the US Congress the power to regulate meat packers because the packers affected the flow of commerce in meat between states, even though their activities were "local."

⁴ This differs from Canada which is a federation of provinces, but the Federal government, rather than provincial governments, has residual power.

Today, US food safety law is a combination of federal, state, and local law. Federal law regulates the safety of any food shipped across state lines. State law governs the safety of food produced and sold exclusively within a state's boundaries, and sanitation and hygiene in restaurants and retail stores. State inspectors enforce state meat and food processing law. In many states, local governments may adopt retail and restaurant sanitation standards that are stricter than state standards and in all states, local governments adopt rules on how they will enforce sanitation standards in restaurants and grocery stores in their jurisdictions [25].

Consistency across states and localities occurs because state and local governments tend to look to national model codes or to federal rules in drafting their own rules. State governments typically draw on FDA model "food code" designed to assure adequate sanitation and hygiene in retail stores and restaurants. States often look to federal rules in drafting legislation governing meat processing and other food manufacture for products produced and sold within state boundaries. Yet in some cases, there is noticeable variation across states and localities. Recently variation has emerged in state laws governing GMO labeling and the regulation of unpasteurized milk produced and sold within the state.

China does not face the same legal constraints as the United States, but it is also struggling to move from a patchwork of provincial and city standards and regulations to a unified, national system. The transition is slowed by an approach to governance that gives local authorities a high degree of autonomy to implement laws, a long tradition of localized food markets, and inertia from local self-sufficiency policies carried over from the centrally planned economy. Even when national laws and standards are enacted, provinces still vary in the degree of local funding and enforcement.

As in the nineteenth-century United States, China's patchwork of local rules has become an impediment to companies serving a national market and to food safety enforcement. Some commentators accuse local officials of using food safety standards and testing methods to protect local companies from outside competitors [26, 27]. In past years, uneven funding levels led to lax implementation of animal inspections and veterinary rules by many local authorities. Over the last ten years, the central government began giving grants to fund disease control and other tasks in major hog-producing counties and subsidies to pay salaries at local veterinary stations to address the local funding shortfalls. In 2014, the central government began a pilot program to fund upgrades of food-testing capacity for county-level food-testing labs.

23.5.3 Food Safety Measures must be Practical to Ensure they can be Enforced

The risk reduction achieved from proposed food safety measures must be weighed against the practicality of implementing them and their restrictive impact on food supplies.

During the early 1900s, there was disagreement in the United States about the best way to prevent the spread of disease by milk: by pasteurizing milk or by certifying the sanitation of farms and suppliers [5, 28]. Advocates of "pure food" wanted to establish commissions of physicians that would oversee certifications of dairy farms, collectors and handlers of milk to certify that they maintained a pure water supply, a clean farm, and employed good hygiene and feeding of cows. However, certification doubled the cost of milk and only a negligible portion of the milk supply was ever certified.

Pasteurization was cheaper and did not require the extensive efforts needed to verify compliance with certification. Advocates of certification criticized pasteurization as a measure that could cover up unsanitary practices. Nevertheless, the process was adopted because it was cheaper and assured safe milk supplies for all consumers.

A German law introduced in 1900, dealt with the high proportion of cattle failing strict inspections by establishing a two-tier market with designated outlets for meat from these animals. Meat that passed inspection could be sold anywhere. Special shops were established to sell meat from diseased cattle and buyers were notified of the dangers, but this meat could not be supplied to hotels or restaurants [4].

The supply of qualified enforcement personnel limits the implementation of food safety measures. In the early twentieth century, British butchers claimed that health department meat inspections were inaccurate because the inspectors had little knowledge of livestock or meat, but officials refused to acknowledge the problem [3]. Diseased animals and meat moved to localities where inspections were lax [4].

China has adopted some of the world's strictest food safety standards and certifications that in many instances cannot be realistically implemented. For example, an author of this chapter once visited a model hog-raising village where farmers purportedly used "good agricultural practices" (GAP), a certification common in developed countries. A farmer interviewed there had a GAP schedule of activities posted on the wall that specified animal care and sanitation measures to be conducted throughout the day. The farmer mentioned that he liked raising pigs because he only had to spend a couple of hours per day tending them, suggesting that he did not adhere to the strict schedule required by GAP standards.

China has strict standards for testing a range of farm produce, feeds, livestock, and agricultural inputs for numerous adulterants, illegal additives, chemical residues, and chemical composition, but many laboratories do not have the capacity to conduct such extensive testing effectively on a large scale. A government evaluation report from a county in Hubei Province revealed that testing labs at the county level had few personnel with college degrees or other appropriate qualifications, that labs failed to carry out most of the testing protocols, much equipment was left idle, and labs selectively implemented directives from higher authorities [29].

If strict standards are rigidly enforced, it will restrict the supply of food to consumers. More often, strict standards are unevenly enforced, which is likely to undermine consumer confidence in regulation. A less stringent standard that can realistically be implemented and enforced may be more beneficial for consumers than a strict standard that is routinely violated.

23.5.4 International Trade Considerations Can Drive Positive Domestic Change

The international reputation of a country's food can motivate industry and government leaders to make necessary reforms and innovations to improve food safety. During the 1880s, Germany, Britain, Italy, and other European countries banned US pork and beef due to concerns about infection with trichinosis and other diseases. Controversy over meat caused diplomatic conflicts, but the prospect of losing export markets spurred the US industry to embrace measures to control animal diseases and to initiate inspection programs for meat. A senator praised an early food adulteration law for raising the international reputation of US flour and other products [22]. More recently, a USDA

survey found that meat-packing plants with foreign ownership made greater investments in food safety measures than those focused on the domestic market [30]. Concerns about the safety of imported food were an important influence on the 2011 Food Safety Modernization Act [11].

International trade plays an important role in improving food safety in China. “Green food,” China’s first food safety certification, was introduced in the early 1990s to increase confidence in the country’s exported food products. Other food safety certifications like HACCP, ISO-9001, and GAP were first introduced for export-oriented food producers and have since become more common for those serving the domestic market [31, 32]. China’s inspection and quarantine authorities assisted farmers and processors of exported apple juice concentrate in adopting food safety practices [33]. Multinational retail chains operating in China have been leaders in introducing more stringent food safety systems to the domestic market [34]. Many of the standards and certifications initially adopted exclusively by exporters later came into widespread use in the domestic market as Chinese consumers became more willing to pay for food safety attributes [35, 36]. In the years following China’s melamine-adulteration scandal, competition from imported infant formula brands has pressured Chinese dairy companies to upgrade their own food safety controls.

23.5.5 Food Safety Regulation Requires Coordination Across Government

Food safety regulation is challenging because it covers so many sectors – farm production, inputs, environment, transportation, markets, processing, retail, and food service, each of which can be regulated by a different agency. In the US, 15 federal agencies share responsibility for food safety, though most regulation is conducted by three: the US Food and Drug Administration, the US Department of Agriculture, and the US Environmental Protection Agency. Food safety can also be regulated at different levels of government. As discussed above, food safety in the United States is governed by local, state, and Federal law. Without attention and commitment, dividing responsibilities across multiple government agencies can lead to gaps in coverage and coordination problems.

The problems of dividing responsibilities and coordination are management issues that need deliberate focus. The new US Food Safety Modernization Act has explicit provisions intended to strengthen coordination between state and Federal food safety authorities. Within the US Federal government, different government agencies sign cooperative agreements that formalize coordination. Committees and working groups with members from different agencies and departments also help prevent duplication and gaps. There have been many proposals to improve coordination by consolidating food safety work in a single Federal agency, as was proposed earlier this year by President Obama [37].

These experiences show that no matter how governance of food safety is structured, there will be areas of interaction among different government authorities that will benefit from thoughtful coordination.

23.6 Concluding Remarks

China today benefits from more than a century of improvements in scientific knowledge, methods, and equipment. Just as important are advances in total quality management, risk assessment, risk analysis, and “farm to fork” approaches to food safety that

emphasize preventive measures. Nevertheless, China still faces difficult food safety challenges.

While China is encountering many of the same problems with tainted meat, preservatives, dyes, and adulterations that were common in the nineteenth century, it also faces contamination with chemical residues, pharmaceuticals, and heavy metals that became widespread problems during the twentieth century. Moreover, China faces challenges in controlling food-borne pathogens like *E. coli* that have received less attention in China than adulterations and residue problems.

US food safety regulation and enforcement mechanisms have been refined and improved over the last two centuries. Yet food safety remains a public concern as new problems and vulnerabilities emerge. China's food safety professionals will also need to continually assess risks and make improvements.

Training skilled personnel with technical skills who are knowledgeable about the food industry are critical to the development of an effective food safety system. While China can import equipment and management systems, it takes time to develop a cadre of personnel to take charge of food safety functions in regulatory organizations and companies.

There is cause for optimism as a new generation learns about practices in other countries and takes the initiative to improve food safety. Recently, a grassroots NGO staffed by volunteers established a research center that compiled and published the first detailed study of food safety incidents to inform consumers about food safety incidents [38]. The founder – an MBA student from Tsinghua University – said she was inspired by the example of Harvey Wiley, the USDA scientist who was instrumental in pushing forward the first national food safety law in the United States.

Chinese citizens studying the history of food safety in other countries can find inspiration, as well as cautionary lessons. The authors hope that this chapter will spur more study on this topic.

References

- 1 Chicago School of Sanitary Instruction. 1921. *Chicago's Health XV*.
- 2 E.J.T. Collins. 1993. Food adulteration and food safety in Britain in the 19th and early 20th centuries. *Food Policy* 18(2): 95–109.
- 3 P.J. Atkins. 2004. The Glasgow case: meat, disease and regulation, 1889–1924, *The Agricultural History Review* 52(2): 161–182.
- 4 A.L. Olmstead and P.W. Rhode. 2015. *Arresting Contagion: Science, Policy, and Conflicts Over Animal Disease Control*. Cambridge: Harvard University Press.
- 5 H. Levenstein. 2012. *Fear of Food*. Chicago: University of Chicago Press.
- 6 J. London. 2014. Tragedy, transformation, and triumph: Comparing the factors and forces that led to the adoption of the 1860 Adulteration Act in England and the 1906 Pure Food and Drug Act in the United States, *The Food and Drug Law Journal* 69: 315–342.
- 7 D.R. Hurt. (2002). *American Agriculture: A Brief History*. Purdue University Press.
- 8 A.L. Olmstead and P.W. Rhode. 2006. Farms – number, population, land, and value of property: 1850–1997 [Census years]. Table Da14–27 in *Historical Statistics of the United States, Earliest Times to the Present: Millennial Edition*, edited by S.B. Carter, S.S. Gartner, M.R. Haines, A.L. Olmstead, R. Sutch, and G. Wright. New York: Cambridge University Press. <http://hsus.cambridge.org/HSUSWeb>

- 9 M.T. Law. 2006. How do regulators regulate? Enforcement of the Pure Food and Drugs Act, 1907–38, *Journal of Law, Economics and Organization* 22(2): 459–489.
- 10 US Department of Agriculture, Food Safety and Inspection Service. 25 July 1996. Pathogen reduction, Hazard Analysis and Critical Control Point (HACCP) systems; final rule, *Federal Register* 61(144): 38805–38989. <http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/93-016F.pdf> (accessed June, 2015).
- 11 S. Hoffmann. 2011. U.S. food safety policy enters a new era, *Amber Waves*, 9(4): 24–29. http://www.ers.usda.gov/amber-waves/2011-december/us-food-safety-policy.aspx#VY59IF_D-5s (accessed June, 2015).
- 12 M.T. Law and G.D. Libecap. 2006. The determinants of progressive era reform: The Pure Food and Drugs Act of 1906, in *Corruption and Reform: Lessons from America's Economic History*, edited by E.L. Glaeser and C. Goldin. Chicago: University of Chicago Press.
- 13 A.F. Kantor. 1976. Upton Sinclair and the Pure Food and Drugs Act of 1906, *American Journal of Public Health* 66(12): 1202–1205.
- 14 U. Sinclair. 1906. *The Jungle*, republished online at <https://www.gutenberg.org/files/140/140-h/140-h.htm> (accessed June, 2015).
- 15 I.D. Barkan. 1985. Industry invites regulation: The passage of the Pure Food and Drug Act of 1906, *American Journal of Public Health* 75(1): 18–26.
- 16 J. Haydu. 2012. Frame brokerage in the Pure Food Movement, 1879–1906, *Social Movements Studies*, 11(1): 97–112.
- 17 A. Kallet and F. J. Schlink. 1932. *100,000,000 Guinea Pigs: Dangers in Everyday Foods, Drugs, and Cosmetics*, New York: The Vanguard Press.
- 18 M. Nestle. 2010. *Safe Food: The Politics of Food Safety*. Berkeley, CA: University of California Press.
- 19 R. D. Lamb. 1936. *American Chamber of Horrors*, New York: Farrar & Rinehart.
- 20 B. Charnley. 2008. Arguing over adulteration: the success of the Analytical Sanitary Commission, *Endeavour*, 32(4): 129–133.
- 21 R.T. Law. 2003. The origins of state pure food regulation, *The Journal of Economic History*, 63(4): 459–489.
- 22 W.E. Mason. 1900. Food adulterations, *The North American Review*. 170(521): 548–552. http://www.unz.org/Pub/NorthAmericanRev/?Period=1900_04 (accessed June, 2015).
- 23 G.D. Libecap. 1992. The rise of the Chicago Packers and the origins of meat inspection and antitrust, *Economic Inquiry* 30: 242–262.
- 24 D.J. Wood. 1985. The strategic use of public policy: Business support for the 1906 Food and Drug Act, *The Business History Review* 59(3): 403–432.
- 25 C.A. Roberts. 2001. *The Food Safety Information Handbook*. Westport, CT: Onyx Press.
- 26 Xianjun Li. 2007. Zhiliang Jiance Yao Dapo Difang Baohu Zhuyi (Quality testing must break local protectionism), *Xinhua News*, February 16. http://news.xinhuanet.com/comments/2007-02/16/content_5743825.htm (accessed May, 2015).
- 27 *Zhengzhou Evening News*. 2015. Zhua Shipin Anquan Dapo Difang Baohu Zhuyi (Local protectionism must be broken to achieve food safety), *Zhengzhou Evening News*, March 9, page A08. http://zzwb.zynews.com/html/2015-03/09/content_641716.htm (accessed May, 2015).
- 28 D. Block. 1999. Purity, economy and social welfare in the progressive era pure milk movement, *Journal for the Study of Food and Society* 3(1): 20–27.

- 29 Baokang County Oversight Office. 2015. Xian ji Jianyan Jiance Jigou Zhenghe de Nandian yu Duice (Conformity of County-Level Inspection and Testing Organizations: Difficulties and Countermeasures), investigation report, Xiangyang City (Hubei Province) Oversight Office, April 27. http://www.hbxysbb.gov.cn/dcyj/201504/t20150427_29999.html (accessed May, 2015).
- 30 E. Golan, T. Roberts, E. Salay, J. Caswell, M. Ollinger, and D. Moore. 2004. *Food Safety Innovation in the United States: Evidence from the Meat Industry*, US Department of Agriculture, AER831. <http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer831.aspx> (accessed May, 2015).
- 31 L. Calvin, F. Gale, D. Hu, and B. Lohmar. 2006. Food safety improvements underway in China, *Amber Waves*, November. <http://www.ers.usda.gov/amber-waves/2006/november/food-safety-improvements-underway-in-china/> (accessed November 2016).
- 32 Z. Wang, H. Yuan, and F. Gale. 2009. Costs of adopting a Hazard Analysis Critical Control Point System: Case study of a Chinese poultry processing firm, *Review of Agricultural Economics* 31(3), 574–588.
- 33 F. Gale, S. Huang, and Y. Gu. 2010. *Investment in Processing Industry Turns Chinese Apples into Juice Exports*, US Department of Agriculture, FTS-344-01. http://www.ers.usda.gov/media/141094/fts34401_1_.pdf (accessed June, 2015).
- 34 H.F. Gale and D. Hu. 2012. Food safety pressures push integration in China's agricultural sector, *American Journal of Agricultural Economics* 94(2): 483–488.
- 35 C. Zhang, J. Bai, and T.I. Wahl. 2012. Consumers' willingness to pay for traceable pork, milk, and cooking oil in Nanjing, *Food Control* 27: 21–28.
- 36 Z. Wang, Y. Mao, and F. Gale. 2008. Chinese consumer demand for food safety attributes in milk products, *Food Policy* 33: 27–36.
- 37 C. Doering. Obama proposes single agency to oversee U.S. food safety, *USA Today*, 2 Feb 2015. <http://www.usatoday.com/story/news/2015/02/02/obama-proposes-consolidating-food-safety-oversight/22764529/> (accessed November 2016).
- 38 J. Ma. 2015. Going Public, *NewsChina*, June 2015. <http://www.newschinamag.com/magazine/going-public> (accessed May, 2015).
- 39 Legal Evening News. 2015. Qian Yu Dun Bing Si Zhurou Liuru 11 Shengqu (over 1000 tons of diseased pork marketed in 11 provinces). January 12. <http://business.sohu.com/20150112/n407723835.shtml> (accessed November 2016).
- 40 *Boxun*. 2008. Shandong Heixin Mianfen Hunru Huashifen, Zhiqingzhe Cong Bu Mai (Sinister Shandong flour contains talcum powder, knowledgeable people never buy it), October 20. <http://www.boxun.com/news/gb/china/2008/10/200810201247.shtml> (accessed June, 2015).
- 41 *China Daily*. 2009. Mantou Jubaodi Nongyao yi Zengjia Kougan (Pesticide reportedly added to Shaanxi Steamed Bread to Increase Flavor), March 13. <http://news.sina.com/oth/chinesedaily/301-101-101-107/2009-03-13/05193708235.html> (accessed November 2016).
- 42 *The Cincinnati Lancet-Clinic*. 1900. Formaldehyde poisoned milk. 45 (August 25): 193–194.
- 43 *Chicago Tribune*. 1906. Milk killing N.Y. babes: Expert warns of danger from dairymen's dishonesty, 24 December, p. 10.
- 44 State Council Emergency Management Office. 2005. Anhui Fuyang Liezhi Naifen Shijian (Fuyang Inferior Milk Powder Incident), August 9, http://www.gov.cn/yjgl/2005-08/09/content_21396.htm (accessed November 2016)

- 45 *China Youth Daily*. 2009. Sanlu Sanjuqingan Naifen Shijian Quanguocheng Huifang (Review of the San Lu Melamine Milk Powder Incident), January 1. <http://news.sohu.com/20090101/n261527309.shtml> (accessed June, 2015).
- 46 P. Bairoch and G. Goertz. 1986. Factors of urbanisation in the nineteenth century developed countries: A descriptive and econometric analysis, *Urban Studies* 23: 285–305.