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REVIEW

Food safety management and regulation: International experiences and lessons for China

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Abstract

China is experiencing rapid urbanization, changes in diets, and modernization of food retailing and production. In this context, food safety can become a greater concern for a variety of reasons. The purpose of this article is to review the international experiences and lessons regarding food safety management, regulation, and consumer behavior, with the goal of identifying how to improve food safety in middle income countries such as China. International experience in addressing food safety provides two general kinds of lessons. First, a middle-income country such as China needs to develop the capacity to carry out risk analysis in order to better focus public resources on the most important risks. Second, it will be important to leverage market incentives so as to make the best use of limited public capacity to enforce standards. International experiences show that food safety management is feasible where market incentives exist, and that public-private partnerships can support the process of improving food safety management. Market incentives require effective consumer or buyer demand, mechanisms to identify and reward quality, and supply chain coordination. Public efforts can be targeted to supporting these market developments for the risks that are the greatest burden to public health.

Keywords: food safety regulation, supply chain coordination, risk analysis

1. Food safety is an issue of increasing importance as food systems modernize

Several high profile food safety incidents in the past few years in China have demonstrated the challenges for food safety in modernizing food systems. Naturally occurring hazards may become more prevalent with changes in the organization of production. Increased use of certain inputs can result in hazardous residues when such use is unregulated and producers are untrained. And, intentional adulteration can occur when production cannot be easily traced or monitored. At the same time, consumers may demand greater levels of safety with higher incomes and less real or perceived control over food sources.

China's food safety concerns are not unique, as they have arisen within a context of increased international attention to food safety. More stringent public regulation, improved private supply chain coordination, and new rules for international trade have emerged in the past two decades to address food safety concerns. These developments are the result of several factors, including the growth in trade of perishable and high value products; advances in hazard detection and epidemiology; high profile health scares; and scientific and regulatory consensus on best approaches to risk management.

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Within middle-income countries, food safety's importance is two-fold. First, meeting food safety standards is a necessary requirement for modernizing domestic food retail channels or for high-value exports. Thus, food safety is a market access issue for food producers as they seek to meet requirements in modernizing global food systems. Furthermore, preventing market disruptions from food safety incidents and assuring consumer confidence is an important part of food market development. Second, food safety risks contribute to the burden of illness in middle-income countries. WHO (2013) estimates that foodborne pathogens account for 2.2 million deaths every year in developing countries, but little is known about the importance of many other potential foodborne hazards. WHO is engaged in a multi-year process to estimate the global burden of illness from foodborne disease, with results expected in 2015 (WHO and FDERG 2014).

The purpose of this article is to review the international experiences and lessons regarding food safety management, regulation, and consumer behavior, with the goal of identifying how to improve food safety in middle income countries such as China. We begin by reviewing the internationally accepted approaches to food safety regulation and management that inform current public and private efforts. Next, we consider how an economic perspective can complement this approach. Then we consider the evidence for market-based solutions to improved food safety management. We conclude by considering how these international lessons are relevant to middle income countries such as China.

2. There is an international consensus that food safety risks are best approached through a risk analysis framework

Unsafe food contains hazards that can make people sick, either immediately or by increasing the likelihood of chronic disease. Some hazards that have been addressed by public policies include: microbial pathogens (e.g., *Salmonella* spp.); zoonotic diseases (e.g., highly pathogenic avian influenza or HPAI); parasites (e.g., intestinal worms); adulterants (e.g., melamine); mycotoxins (e.g., aflatoxin); antibiotic drug residues; pesticide residues; and heavy metals (e.g., cadmium). Each of these potential hazards has different sources, poses different kinds of health risks, and carries different challenges for identification and control. Yet a common paradigm can be used to design policy interventions and management systems.

Although food safety regulation in high-income countries dates back to the early twentieth century, reforms since the 1990s reflect better scientific understanding of foodborne risks and approaches to risk management. In the 1980s and early 1990s, the U.S. National Academies issued a series of reports outlining a risk-based approach to food safety management and regulation, beginning with one on meat inspection in 1985 (National Research Council 1985). Advances in foodborne illness epidemiology along with a better understanding of risk assessment informed this new approach.

Although the approach is now well-known, it is useful to give a brief review here. Risk analysis includes risk assessment, risk management and risk communication (FAO and WHO 2006). Risk assessment includes hazard identification and exposure characterization, which results in a quantitative estimate of the adverse effects that are likely to occur in a given population. Comparative risk assessment identifies the most important risks, so as to better focus policy efforts. Risk assessment provides the basis for risk management, which involves making decisions about where to reduce risks. Identification of where and how risks are likely to occur shows what kind of intervention might reduce risk most effectively. Risk management also involves making decisions about acceptable levels of risk, which will depend on social norms, public perceptions, and economic costs, as well as the relative benefit of devoting scarce resources to risk reduction *vs*. other uses. The final step is risk communication, which involves public education regarding what is known about hazards and their risks, uncertainties, and the rationale for interventions to reduce risk.

This general risk analysis approach as applied to food safety has evolved to address the unique aspects of food hazards. In particular, food safety policy in high-income countries has embraced the need for a farm to table preventative approach, often characterized as application of the Hazard Analysis Critical Control Points (HACCP) framework to evaluating and controlling risks. The HACCP system was first developed by the food processing industry in the 1960s. The approach has been adapted for more general application and widely adopted as a regulatory tool (Unnevehr and Jensen 1999). It entails a focus on determining where risks enter the food supply chain, where they are likely to reach unacceptable levels, and what specific control measures will prevent risk. Focusing on "critical control points" provides a scientific basis for food safety management, and improves economic efficiency by focusing control efforts where they will be the most effective.

One example of application of risk assessment to inform risk management is the 2001 *Listeria monocytogenes* risk assessment conducted by the U.S. Food and Drug Administration (FDA) and Food Safety Inspection Service (FSIS) (FDA and FSIS 2003). This pathogen was recognized in the 1990s as a source of infrequent but serious foodborne illness, especially for pregnant women and immune-compromised individuals. The initial risk assessment informed