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Potential impacts of a zero tolerance policy for *Salmonella* on raw meat and poultry

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Brief reviewed by a multidisciplinary, multi-sector team of experts.

Summary of Findings:

- Despite progress in reducing the prevalence of *Salmonella* in raw meat and poultry, human illness due to *Salmonella* has not decreased over the past 15 years.
- High-profile outbreaks and the proportion of *Salmonella* cases that are attributed to raw meat and poultry products have created a demand for new strategies to control *Salmonella* in these products.
- The United States Department of Agriculture Food Safety and Inspection Service (FSIS) previously used zero tolerance policies to control *E. coli* O157 in ground beef. Some have suggested that this serves as precedent for similar action for *Salmonella* in meat and poultry products.
- Enacting zero tolerance policies for *Salmonella* will not necessarily produce the desired public health outcomes and may lead to unsustainable increases in the number of meat and poultry products that would be held and recalled, with the potential for increased costs for producers, distributors, and consumers.

Background

Salmonella is one of the leading causes of foodborne illness, hospitalization, and death in the United States (US). Each year, an estimated 1,000,000 illnesses, 19,000 hospitalizations, and more than 350 deaths are attributed to *Salmonella*¹. In contrast to most other foodborne pathogens tracked by the US Centers for Disease Control and Prevention (CDC) Active Surveillance Network for Foodborne Illnesses (FoodNET), the incidence of human illnesses due to *Salmonella* has not declined over the past 15 years². Estimates of the proportion of *Salmonella* cases attributed to meat and poultry products range from 33% based on outbreak data to 52% based on expert opinion^{3,4}. The lack of reduction in the population levels of human *Salmonella* infections likely reflects the emergence and growing importance of new sources of *Salmonella*². However, the occurrence of high profile outbreaks, such as the year-long outbreak of *S. Heidelberg* infections linked to chicken, reinforces the demand for new strategies to control *Salmonella* in raw meat and poultry^{5,6,7}.

Zero tolerance used to reduce *E. coli* O157:H7

A zero tolerance policy means that the presence of an agent on a food product, at any level, is considered adulteration, and therefore that product is subject to regulatory action. Following a 1993 outbreak that involved > 700 illnesses and 4 deaths, FSIS determined that ground beef with any detectable *E. coli* O157:H7 should be considered adulterated⁸. The implementation of this policy, combined with the concerted efforts of multiple food industry segments, regulatory, and public health officials, led to a drop in the incidence of *E. coli* O157:H7 infections from 2.6 cases per 100,000 population in 1996 to 1.1 cases per 100,000 in 2012². Since the enactment of zero tolerance, far less than 1% of raw ground beef samples test positive for *E. coli* O157:H7 each year⁹. However, an average of 11 recalls of ground beef products continue to occur each year, 3 associated with human illness and 8 more associated with the presence of *E. coli* O157:H7 detected by microbiological sampling¹⁰.

Would zero tolerance be effective in controlling *Salmonella*?

Controlling *Salmonella* on raw meat and poultry is considerably more complex than controlling *E. coli* O157:H7. In addition to environmental and surface contamination issues, strains of *Salmonella* may contaminate internal tissues, and this may vary by type of *Salmonella* and food animal species. Implementing a zero tolerance policy alone is not sufficient to reduce the public health burden of illness. For example, despite an existing zero tolerance for *Salmonella* on ready-to-eat foods, including fresh produce, outbreak data suggests that 41% of *Salmonella* infections in the US may be attributed to

fruits, nuts, and vegetables^{3,4,11}. Enacting a zero tolerance for *Salmonella* on raw meat and poultry products would result in a dramatic increase of recalls and market withdrawals of these products. Based on results of FSIS Pathogen Reduction/Hazard Analysis and Critical Control Point (PR/HACCP) verification testing for *Salmonella* in 2013, as many as 1.6% of ground beef samples, 3.9% of retail chicken, and 15% of ground turkey samples could be subject to regulatory action¹². Given the length of time required to confirm presumptive results, this policy shift will undoubtedly increase the cost of producing these products and result in many more meat and poultry recalls. This potential impact would be several orders of magnitude greater than is currently seen with *E. coli* O157:H7 in ground beef.

Possible alternatives to zero tolerance policy for *Salmonella* on raw meat and poultry

Research based on monitoring *Salmonella* in various production systems has helped reduce the prevalence of *Salmonella* contamination of raw meat and poultry over the past decade. For example, the percent of positive *Salmonella* tests for young chickens in the PR/HACCP verification testing program decreased from an original baseline of 20% in 1995 to 3.9% in 2013¹². Furthermore, the rate of positives is considerably less in large processing plants (1.5%) than in small (6.5%) or very small (17%) plants¹². This suggests that having more resources to put into monitoring and managing *Salmonella* in processing plants leads to more effective control. Under a zero tolerance policy, identification of *Salmonella* would be self-incriminating and a barrier for companies interested in continuing effective performance monitoring standards.

Eliminating consumer exposure to *Salmonella* on raw meat and poultry products at the retail level would require use of a terminal treatment such as irradiation. Although approved for use for the control of *Salmonella* in ground meat and poultry products, resistance from certain advocacy groups and the lack of consumer demand for irradiation represents an important barrier to its use. Other pathogen reduction treatments such as high-pressure treatment may be more acceptable alternatives.

Methods that quantify levels of *Salmonella* on raw meat and poultry can more fully characterize the risk of human illness at different levels of exposure. In outbreaks associated with ready-to-eat foods, higher levels of contamination have been associated with higher rates of illness among persons who ate the food. Similar relationships likely occur with raw meat and poultry products. An alternative to zero tolerance is to develop enforceable performance standards based on levels of *Salmonella* contamination associated with illness, rather than on the qualitative presence or absence of *Salmonella*. Models of disease transmission based on actual outbreaks and dose-response models can help improve our understanding of the relationship between levels of contamination in raw meat and poultry products and the risk of illnesses in consumers exposed to the products. This approach to risk assessment can be used to develop tolerance levels that prevent illness transmission without creating regulatory barriers that prevent companies from monitoring *Salmonella* in their facilities.

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