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# Risk assessment modeling of seven major serogroups of Shiga toxin-producing Escherichia coli (STEC) in the beef production chain.

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Purpose

Shiga-toxin producing E. coli are foodborne pathogens with an important reservoir in cattle. They are responsible for an estimated 175,000 illnesses, 20 deaths and more than $1 billion in direct and indirect illness costs each year in the U.S. The aim of this study is to develop a farm-to-fork risk assessment of the public health threat of seven serogroups of STEC - O26, O45, O103, O111, O121, O145, and O157 - (known as STEC-7) in the beef production chain.

Methods

This application is programmed in R 3.1 as a second order Monte Carlo model that simultaneously simulates variability and uncertainty for STEC-7 prevalence and concentrations through a series of steps: pre-harvest, post-harvest, retail, and consumption. The model is parameterized from ongoing targeted research and from systematic review and meta-analysis of published literature. The model accounts for cattle types, seasonal variation in levels of STEC-7, and on-farm control strategies such as vaccination and direct-fed microbials. Furthermore, the model simulates different processing plant sizes and interventions employed at various stages in the slaughtering process, consumer handling, including STEC-7 growth during storage, reductions through cooking and serving size effects. Intact, ground and mechanically tenderized product risk is estimated.

Results

Final model output is an uncertainty distribution of the risk of illness per serving for each STEC-7 strain and beef product simulated. Intermediate results include carcass contamination levels which can be simulated specific to pre-harvest and harvest interventions.

Conclusions, Relevance

Expected outcomes from the model include: (1) A valid, flexible farm-to-fork probabilistic STEC-7 quantitative risk assessment that integrates prevalence and concentration changes from live cattle to consumer consumption to inform policy implementation. (2) An epidemiologically informed intervention strategy for diverse sized plants that minimizes public health risk across all STEC-7 simultaneously. (3) Identification of STEC-7 data gaps and uncertainties to guide future needed research.