



A Statistical Model for Attributing Human Salmonellosis to Meat, Poultry, and Eggs

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on behalf of the
FoodNet Attribution Working Group Modeling Subgroup

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Attributing Human Salmonellosis to Food Sources

- The approach quantifies the contribution of major food sources to human salmonellosis
- *Salmonella* serotyping provides a link between public health endpoint and source of infection
- Compare the number of reported human cases caused by different *Salmonella* serotypes with the distribution of *Salmonella* serotypes isolated from food sources

Danish Attribution Model

- Developed by Hald, Vose, Wegener, and Koupeev, *Risk Analysis* (2004)
- Model quantifies the contribution of animal-food sources to human salmonellosis
- Bayesian approach uses Markov Chain Monte Carlo simulation to estimate the number of human salmonellosis cases
- Software: WinBugs

Adapting Danish Model to U.S. Data

- Joint effort by FSIS, CDC, FDA, and state partners under the FoodNet Attribution Working Group and Modeling Subgroup. Objectives:
 - Estimate the number of cases of human salmonellosis attributable to various food sources
 - Support risk managers and regulators when deciding how to allocate resources
 - Identify data needs and gaps for future attribution studies



Model

Key Model Parameters

- *Salmonella* prevalence by serotype in a food source (p)
- Amount of particular food consumed (M)
- Food source dependent factor (a)
- Serotype dependent factor (q)

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$$\lambda_{yij} = p_{yij} M_{yj} a_j q_i$$

- Expected number of salmonellosis cases (λ)

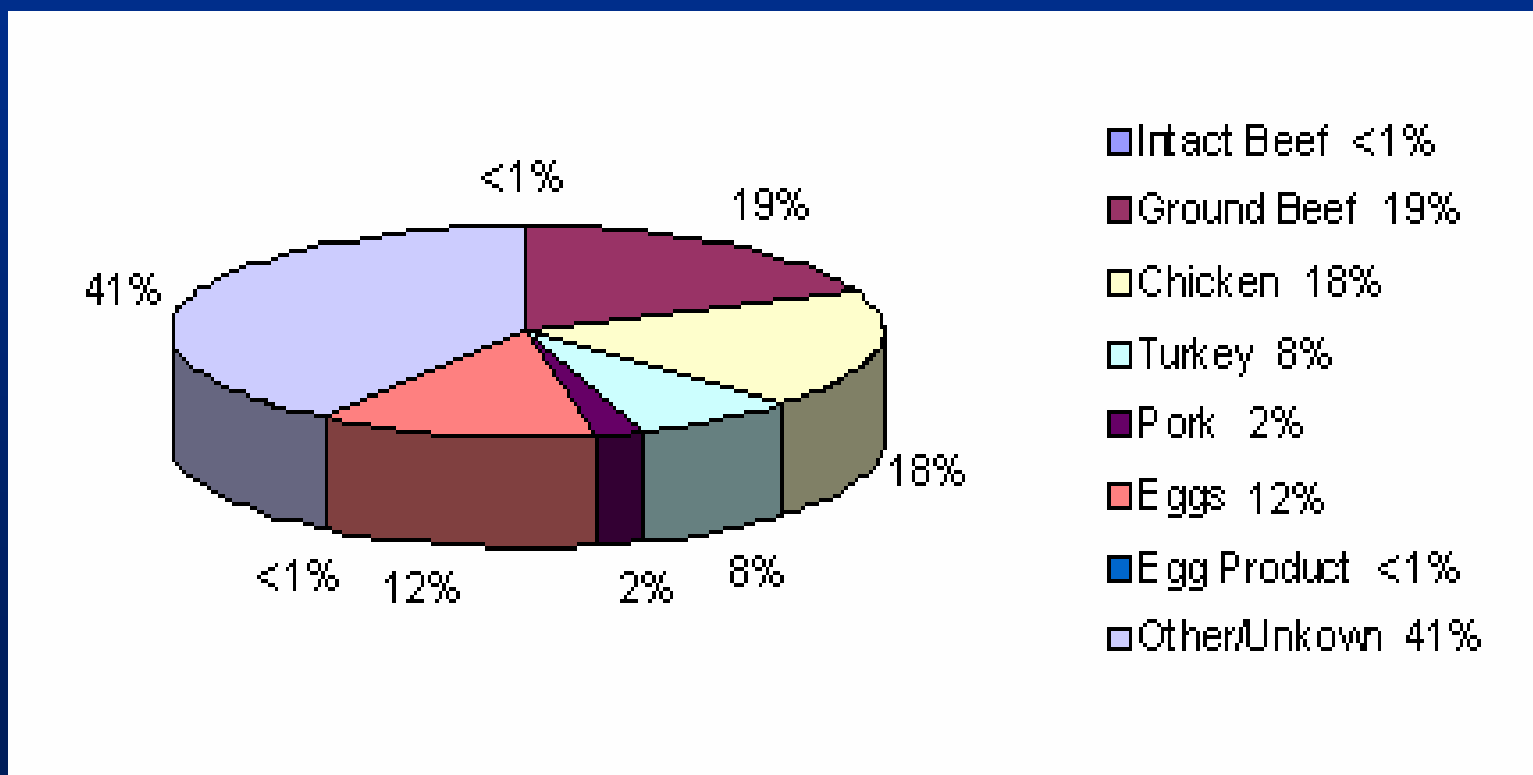
Attribution Data Sources

- Human salmonellosis cases, by serotype
 - Public Health Laboratory Information System (PHLIS), 1998-2003
- Foods - *Salmonella* prevalence, by serotype
 - Beef, ground beef, chicken, turkey, pork, and processed egg products, FSIS in-plant samples, 1998-2003
 - Shell eggs, Pennsylvania SE Pilot Project, 1993-1995
- Food consumption data
 - USDA/Economic Research Service, 1998-2003
- Outbreak and travel information
 - Salmonellosis cases reported to FoodNet, 2004



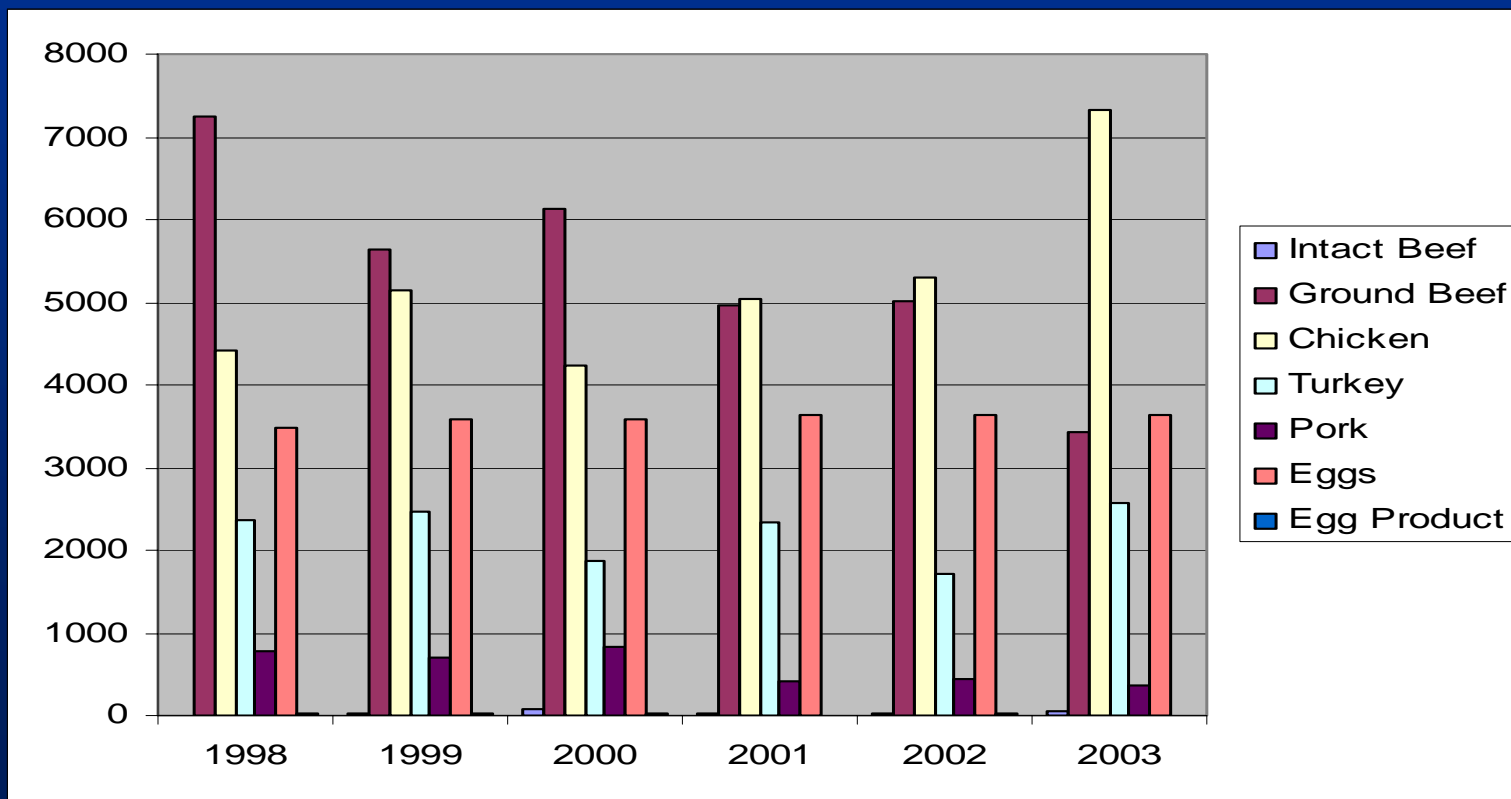
Preliminary Model Results

Estimated Percentage Distributions of Human Salmonellosis Cases, 1998-2003



* Shell egg data from the Pennsylvania Pilot Project, 1993-1995

Estimated Attribution for Meat, Poultry, and Eggs Based on Numbers of Culture Confirmed Human Salmonellosis Cases, 1998-2003*



* There have been approximately 28,000 to 30,000 culture confirmed salmonellosis cases each year, 1998-2003.

Summary

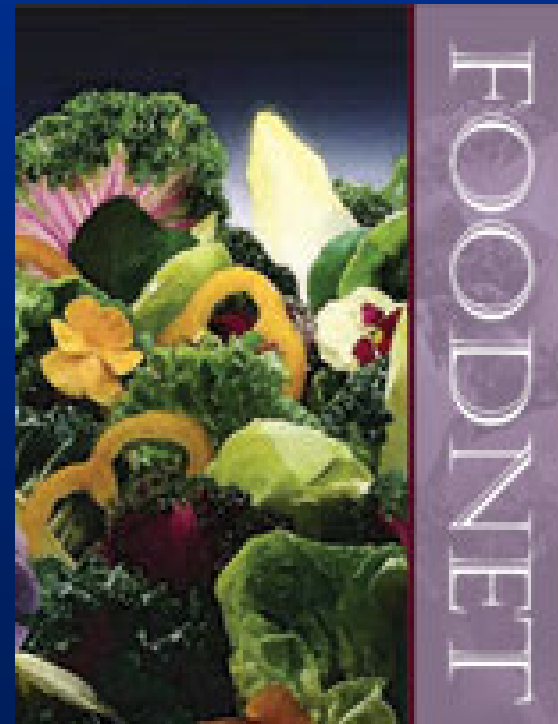
- This statistical model, adapted from the one developed in Denmark, may be used to attribute human cases of salmonellosis to specific food commodities
- This model does not attribute all observed human cases of salmonellosis to specific food commodities (e.g., produce, seafood, etc) because of limitation in data for these foods
- The model does not attribute human cases to non-food source, environmental exposures, pets, farm animals, etc
- Shell egg data are limited, model results are preliminary

Future Efforts

- We started with the best data we have, data for meat and poultry, explore how to obtain better data from produce and other food sources by working with other government agencies e.g. FDA and industry
- Model currently treats annual serotype prevalence in foods as a constant
 - Updated versions could represent *Salmonella* prevalence in foods by probability distributions
- Explore the use of *Salmonella* subtyping (PFGE, antimicrobial susceptibility patterns, phage typing, etc.)
- Model will be updated with 2004 and 2005 data
- Model will undergo further technical and scientific review

Contributors

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Thank You