

The Challenge of Communicating Data that Attribute Foodborne Illnesses to Particular Commodities Or: “Going Beyond the Pie Chart”

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FDA Risk Communication Advisory Committee

FDA White Oak Campus, Silver Spring, MD



Outline

- Attribution
 - Goals
 - Questions
 - Process
- Challenges to Communication
 - The “Multiples” issue
 - Questions
 - Data sources
 - Sources of uncertainty
 - Combinations of questions, data, and methods
 - Going beyond the pie chart
- Summary

Attribution Goals

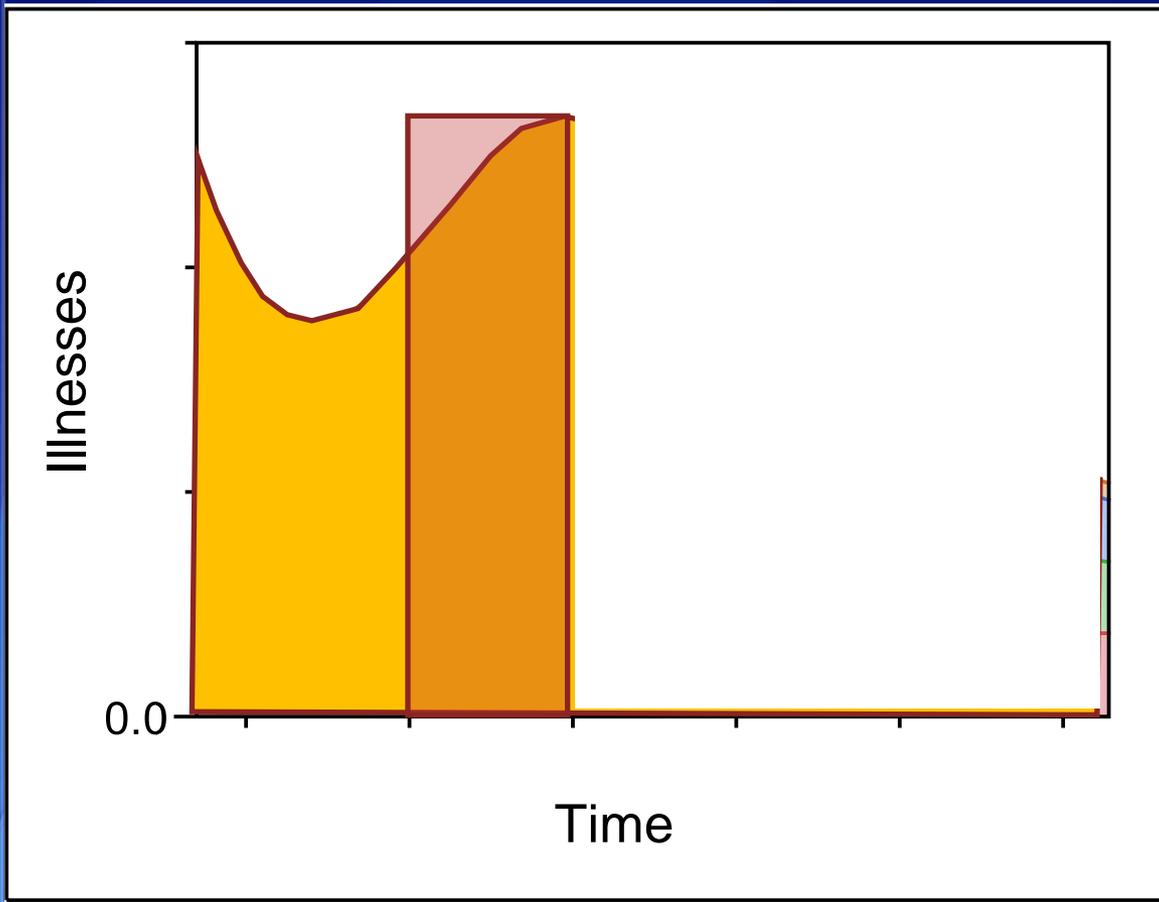
- ❑ **Attribution goal: determine the proportion of illnesses that are foodborne and, more specifically, due to specific foods or food preparation settings**
- ❑ **Overarching goal: reduce the burden of foodborne illnesses**
 - Targeted interventions needed to be successful
 - Science-based data that attributes foodborne disease to specific food sources and preparation settings contributes to success

Some Major Attribution Questions

- What is the public health impact of illness caused by contaminated food?
- What % illness is caused by specific food commodities?
- At what point in the food production/distribution/consumption chain will intervention be most effective?
- How effective have specific interventions been in reducing the foodborne illness?

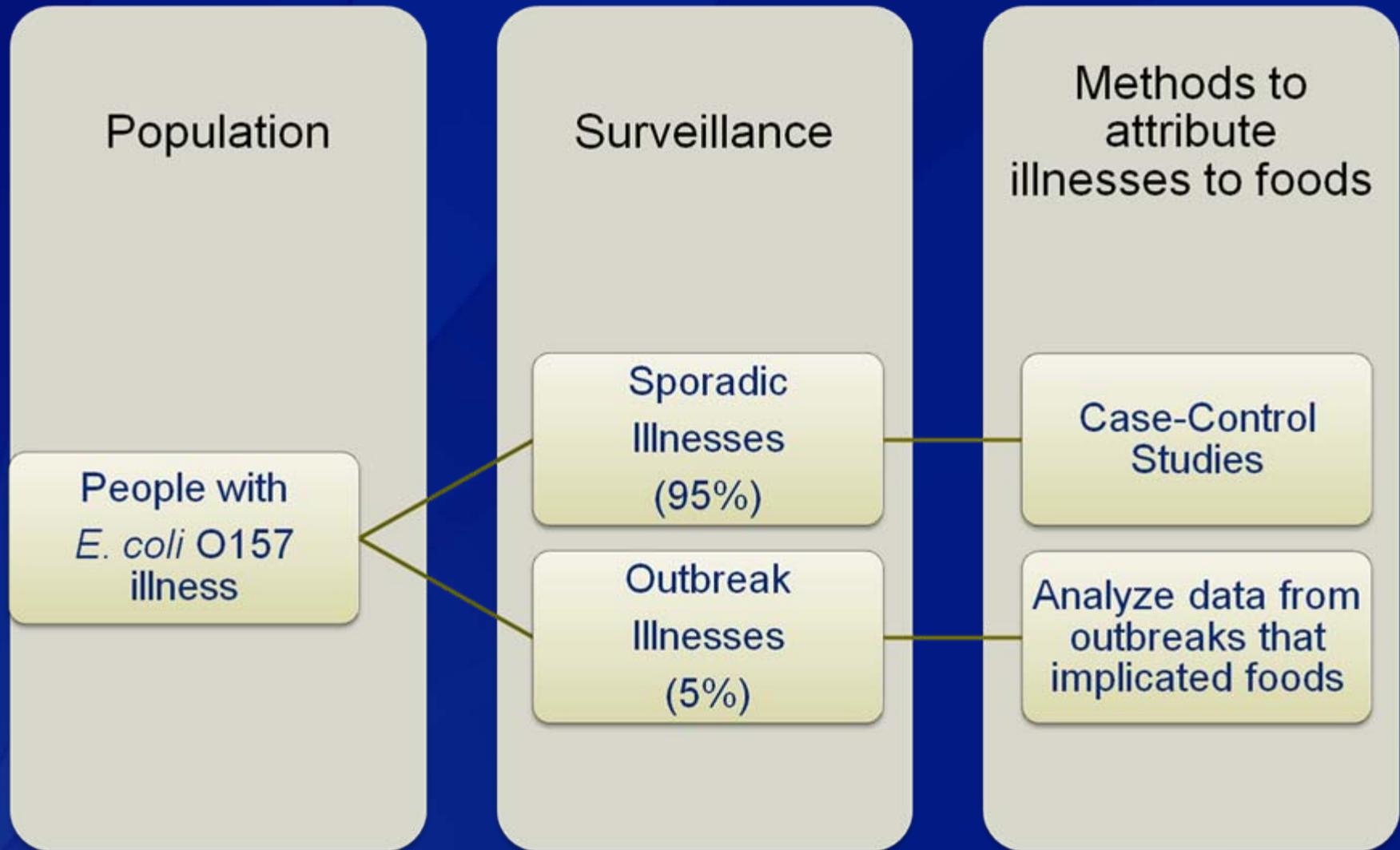
The Attribution Process: Example

Shiga toxin-producing *E. coli* (STEC) O157 illnesses



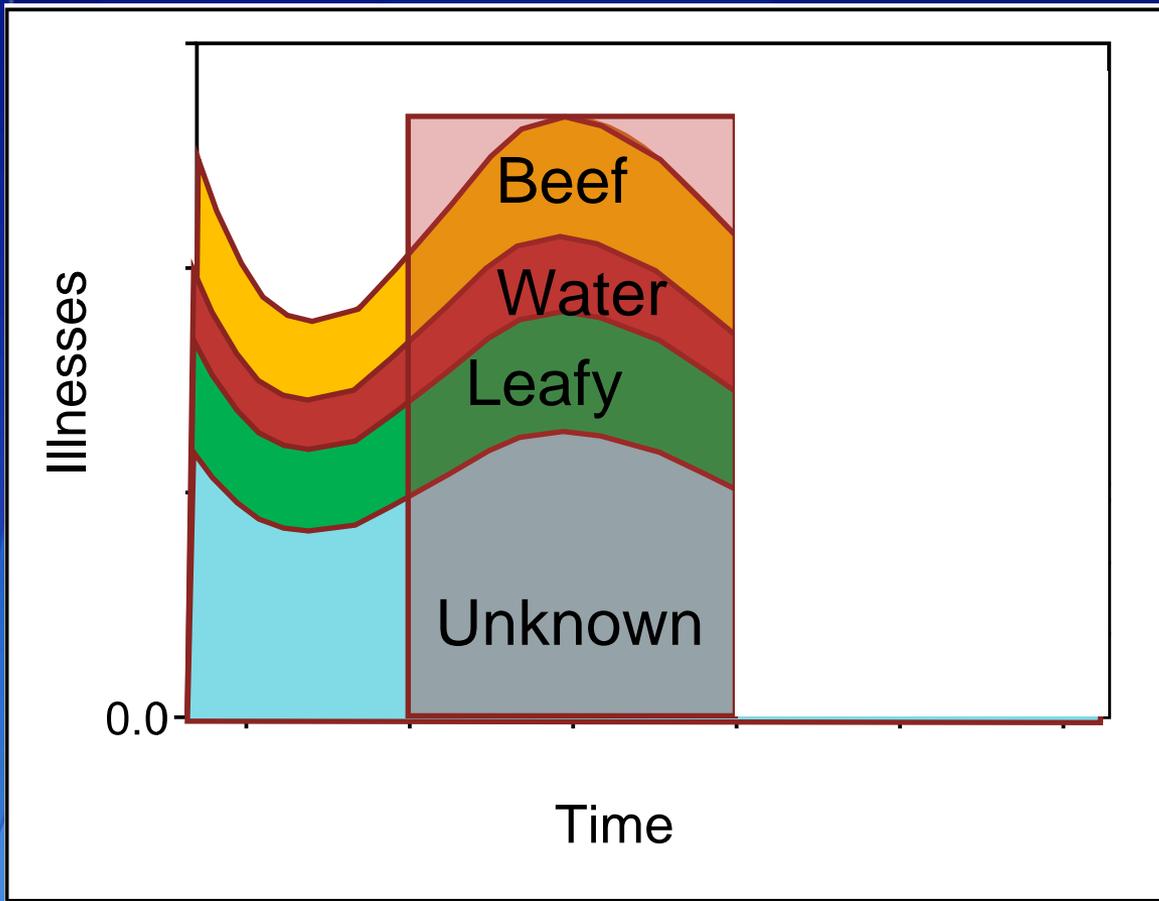
Let's
imagine:
The annual
number of
reported
illnesses
increases

The Attribution Process: Example (cont.)



The Attribution Process: Example (con.)

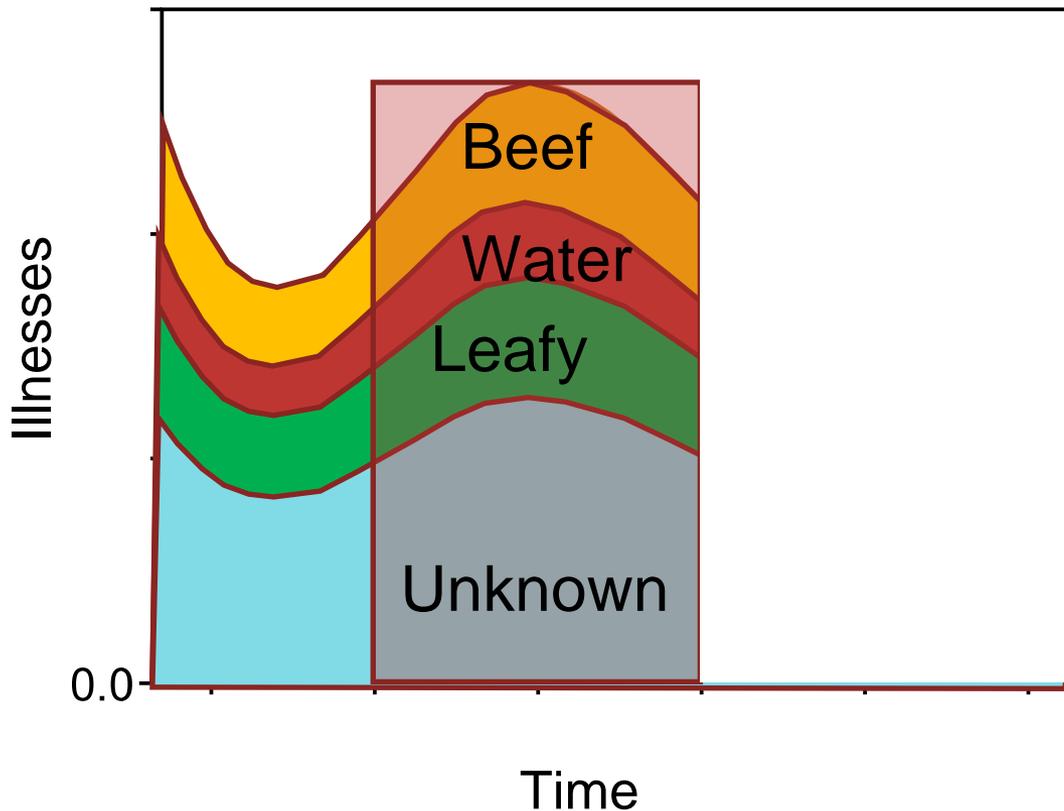
STEC O157 illnesses



Data from case-control studies and outbreak investigations suggest that beef and leafy greens are major foodborne sources of illnesses

The Attribution Process: Example (cont.)

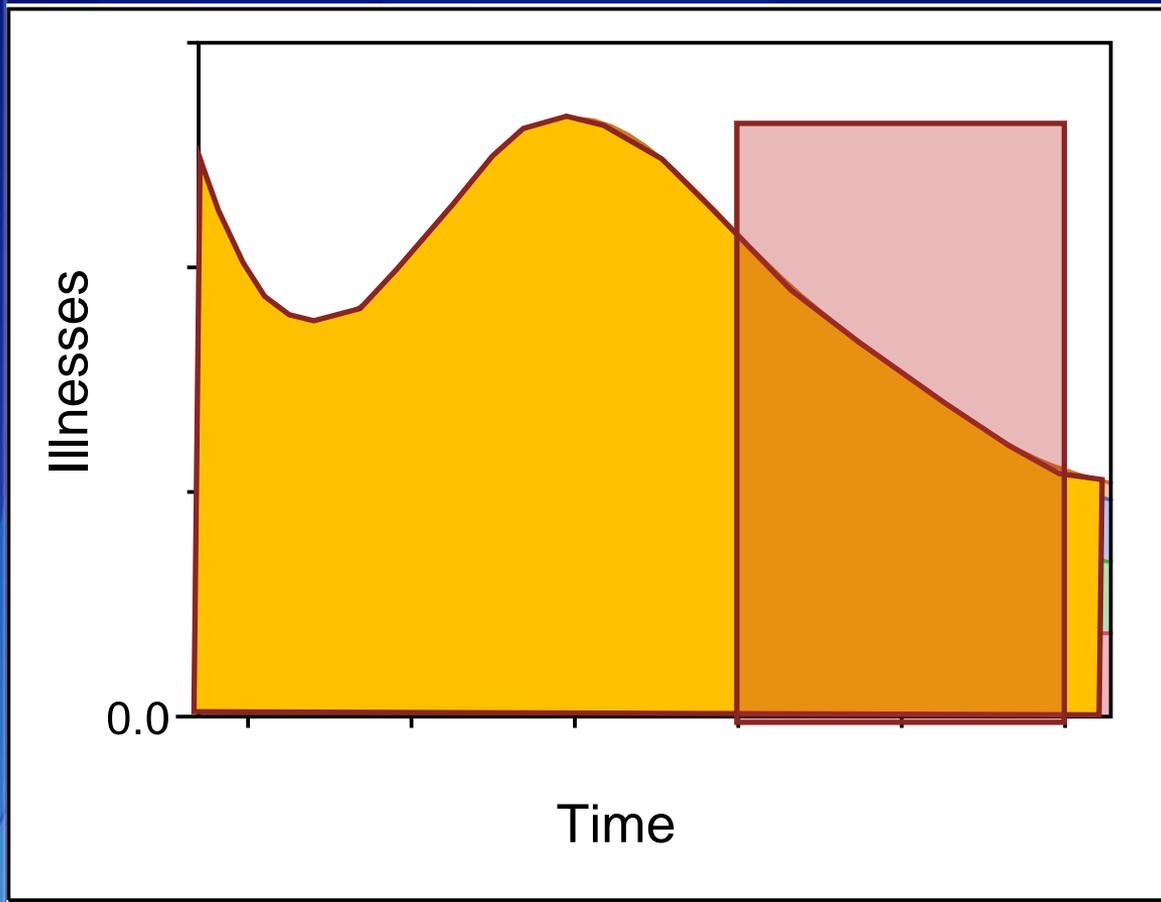
STEC O157 illnesses



Interventions target reducing STEC O157 in beef products

The Attribution Process: Example (cont.)

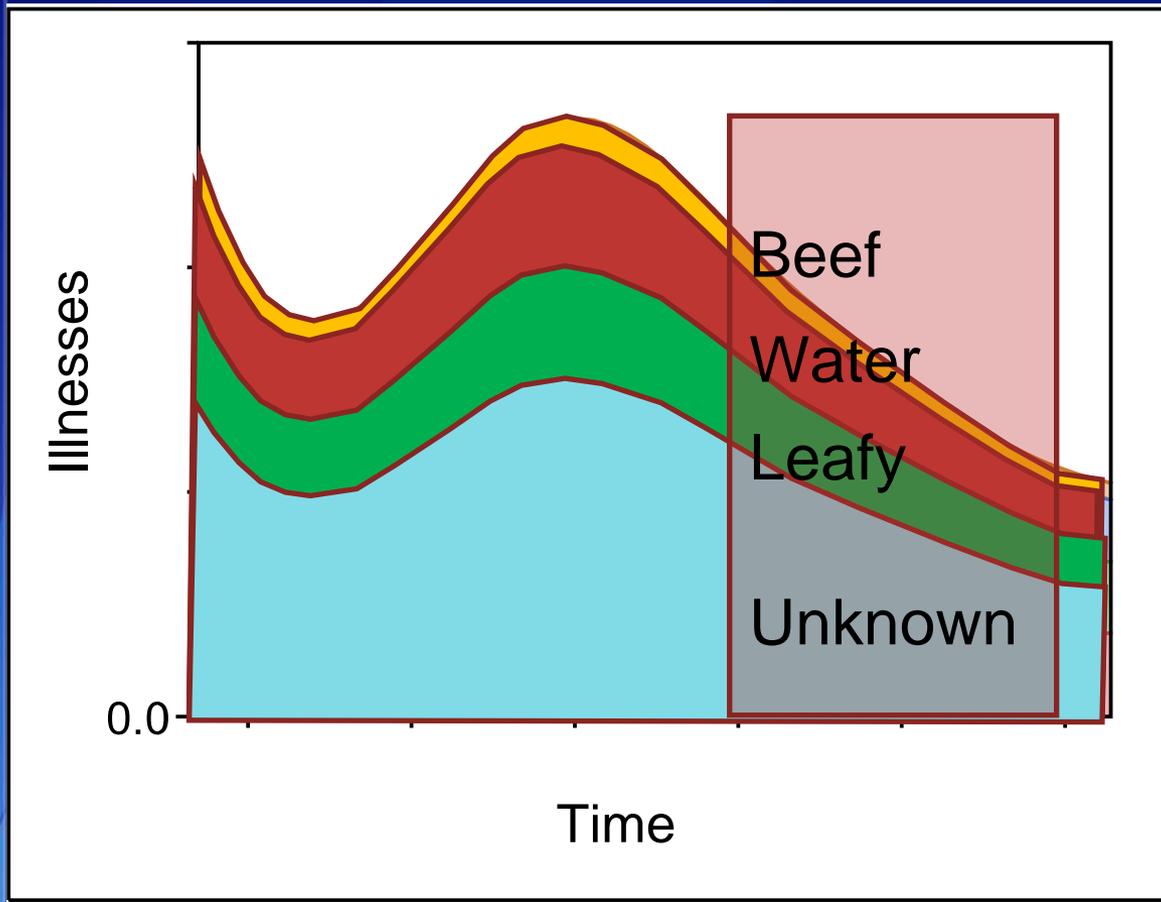
STEC O157 illnesses



The number of reported illnesses is observed to decrease. Is this the result of intervention?

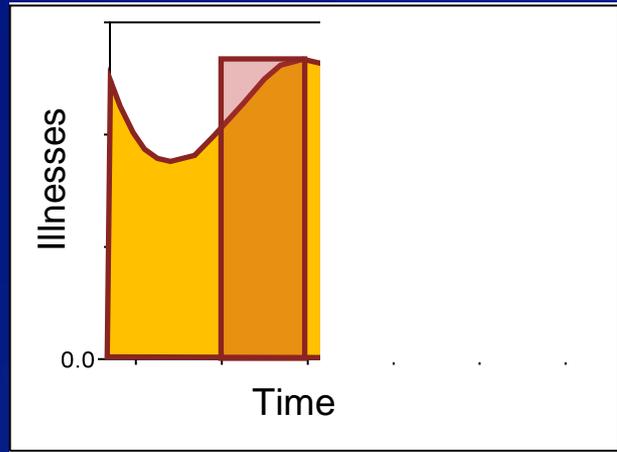
The Attribution Process: Example (cont.)

STEC O157 illnesses

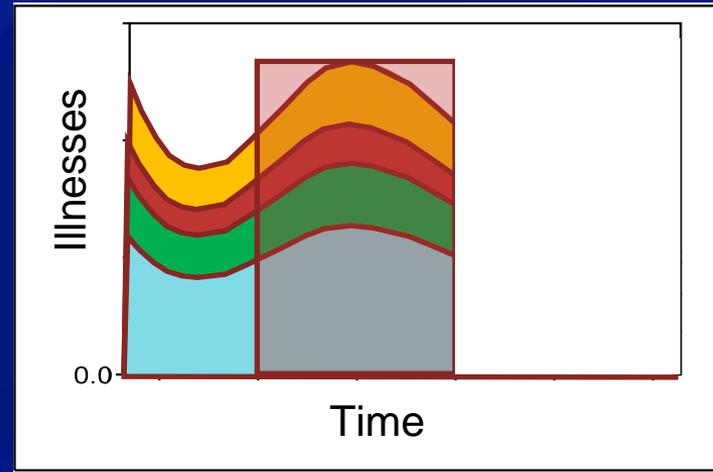


New attribution estimates may show that the % due to beef has decreased, but the % due to water increased (increased recognition?)

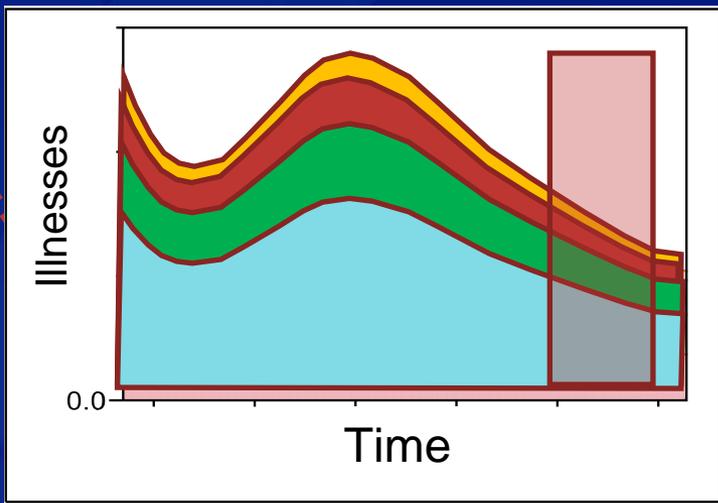
The Attribution Process: Example (cont.)



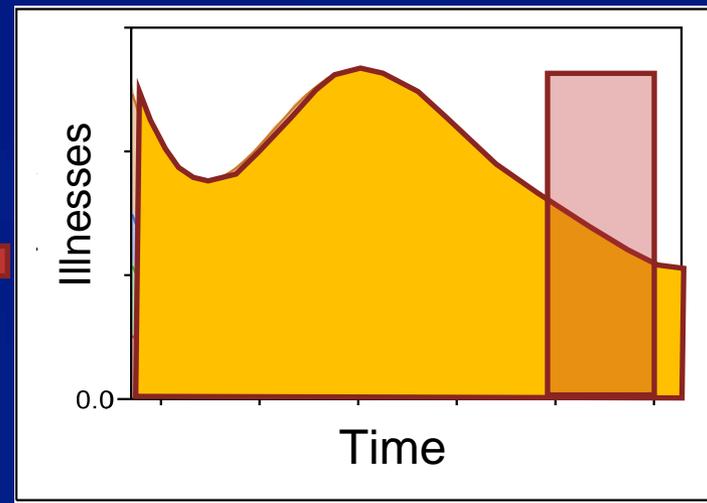
1. Track Illnesses



2. Attribute Illnesses



4. Attribute Illnesses



3. Track Illnesses

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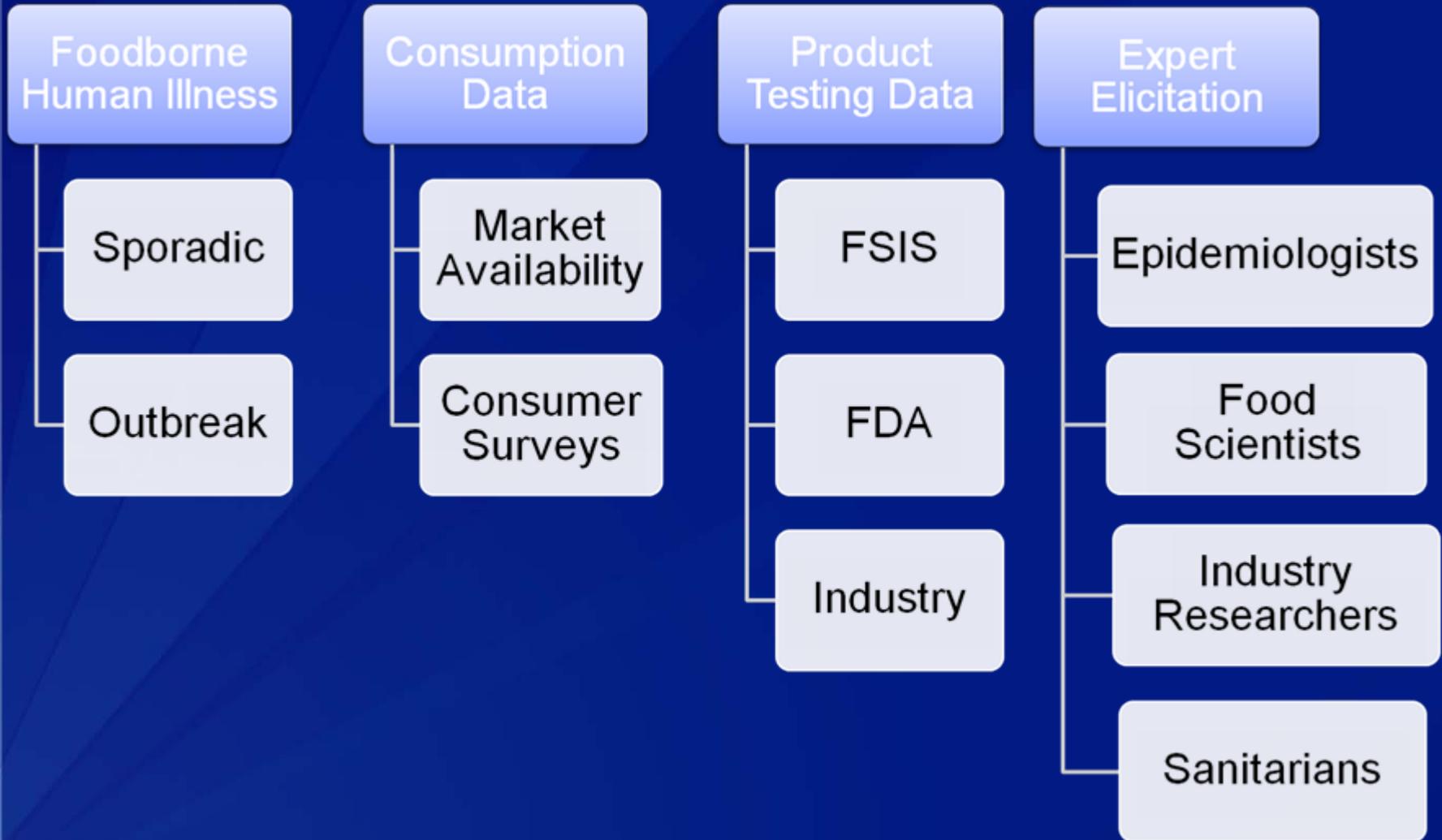
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Multiple Questions

- How many illnesses are related to beef cattle farming practices?
- How many illnesses may be linked to contaminated irrigation water in produce packing facilities?
- What proportion of illnesses may be prevented by FSIS regulations limiting carcass contamination in processing plants?
- What proportion of foodborne illness is attributable to unsafe food preparation practices in restaurants?

Multiple Data Sources



Multiple Methods for Estimating Attribution

Human Illness

Sporadic

Outbreak

Source
Subtyping

Case-Control Studies

Blending
Sporadic
and
Outbreak
Data

Simple
Commodity
Attribution

Complex
Commodity
Attribution

Danish Model
Adaptation:
Salmonella

Campylobacter

Toxoplasma

Listeria

Salmonella

Shiga toxin-
producing
E. coli

E. Coli studies in
1996 and 1999
?

Annual
Outbreak
MMWR

Outbreak-based
attribution
using simple
and complex
foods

Multiple Sources of Uncertainty

- True number of illnesses is not known
 - Most cases of illness are not reported
 - Most ill persons do not seek healthcare (recover without treatment)
 - Reports dependent upon physicians and diagnostic labs
- Sources of illness are usually not known
 - Ill people are not routinely interviewed unless part of an outbreak or a special study (e.g., case-control study)
 - People who are sick cannot determine what food (or other exposure) made them sick, and interviewer can't either
 - Exposure to contaminated source often days, even weeks, before illness
 - Outbreak investigations can determine the source of an individual illness, but not always
 - Case-control studies ask about many exposures, compare exposures of ill persons and non ill persons to identify likely sources, but do not identify the source of an individual illness

Multiple Sources of Uncertainty

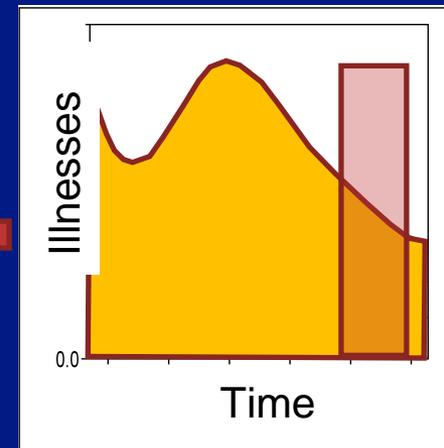
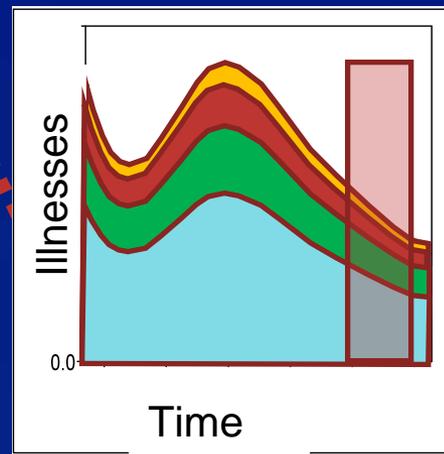
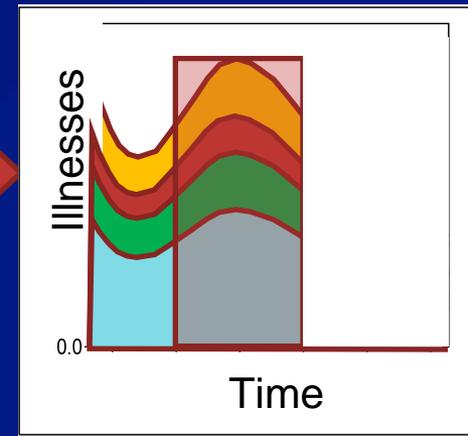
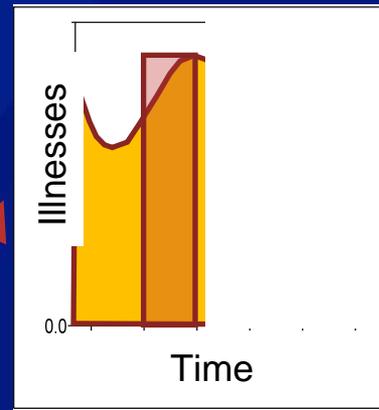
- Product testing is not comprehensive
 - Do not have data from all foods or from multiple points in the food production system
 - Available data risk-based, does not reflect contamination levels from all foods
 - Data collection not consistent over time

All attribution data are estimates

Multiple combinations of questions, data, and methods

Questions are different, depending upon where in the iterative process the question is being asked:

- What food vehicles are responsible for most foodborne illnesses? VS.
- Did the change in regulations result in the observed drop in illnesses?

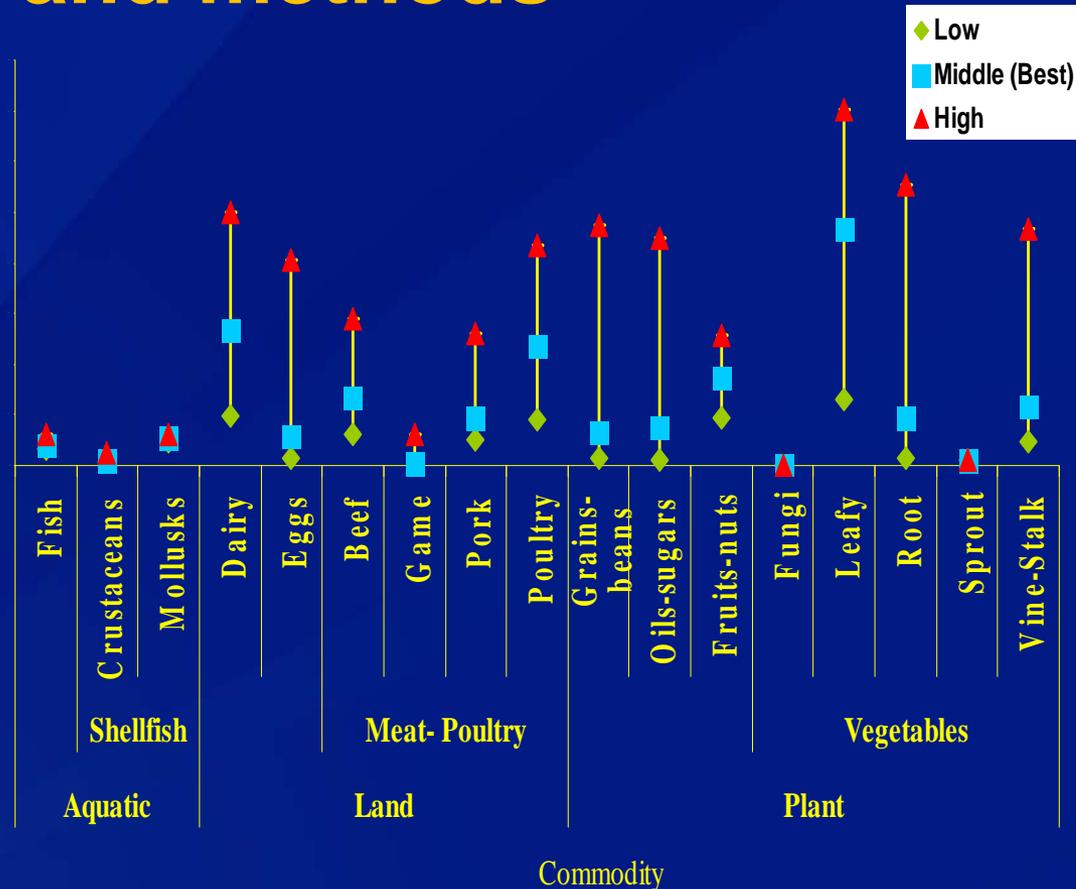


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Multiple combinations of questions, data, and methods

Questions and data are different, depending who is asking:

Point of consumption model using data from outbreaks

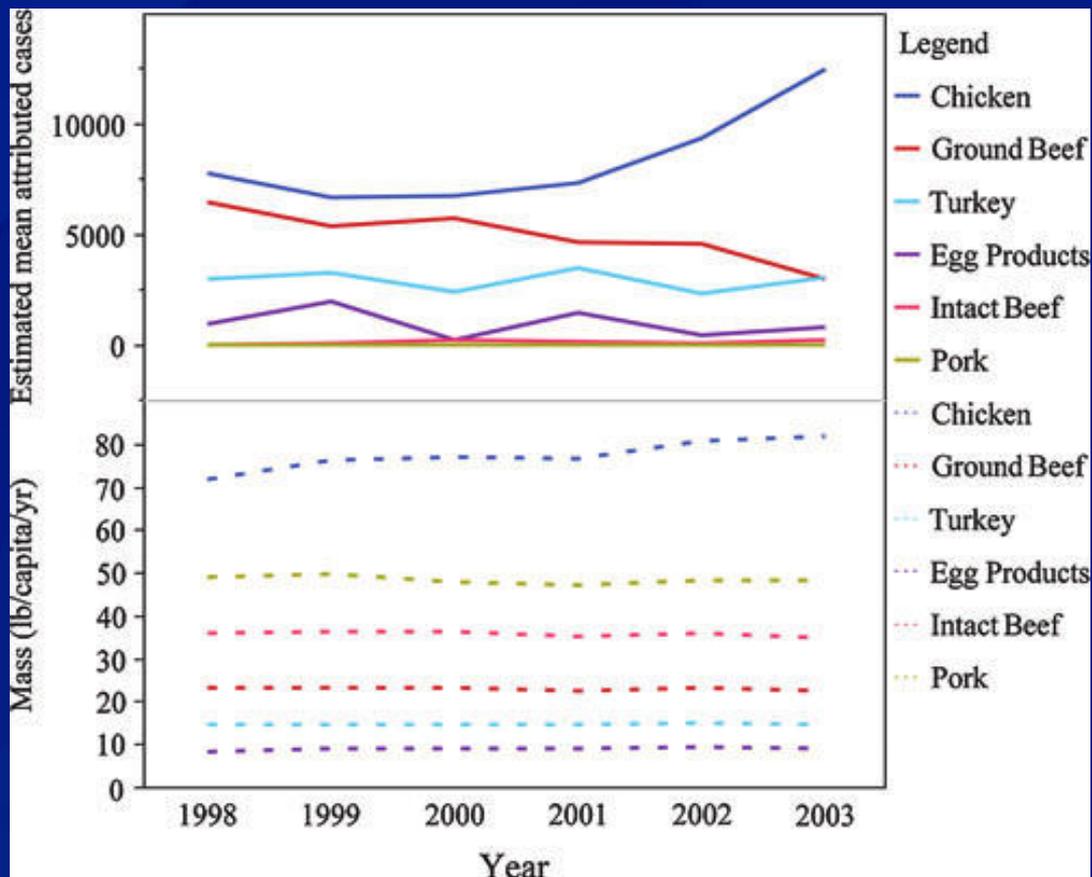


Estimates of illnesses attributed to food commodities, 1998-2004, John Painter et al. (Preliminary data, relationships among commodities may change)

Multiple combinations of questions, data, and methods

Questions and data are different, depending who is asking:

Point of processing model using data from FSIS verification testing and human laboratory-confirmed illnesses



Multiple combinations of questions, data, and methods

- Relatively new field with rapidly evolving methods
 - Increasingly complex analytic tools emerging
 - Increasing access to data by a variety of researchers and stakeholders
- Different approaches to estimating attribution result in varying outcomes and different sources of uncertainty

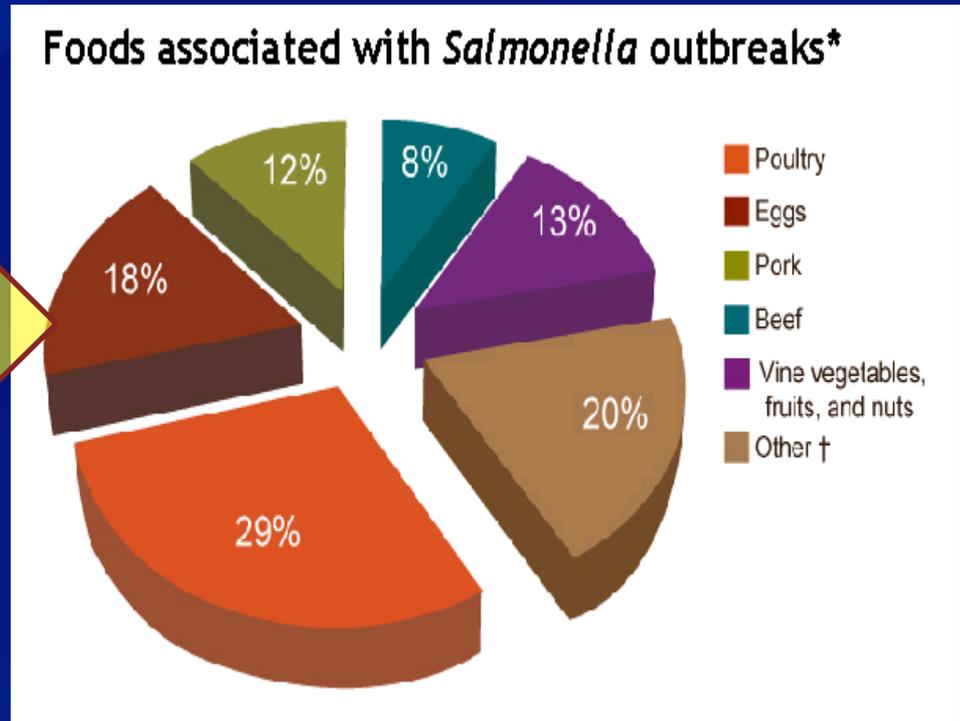
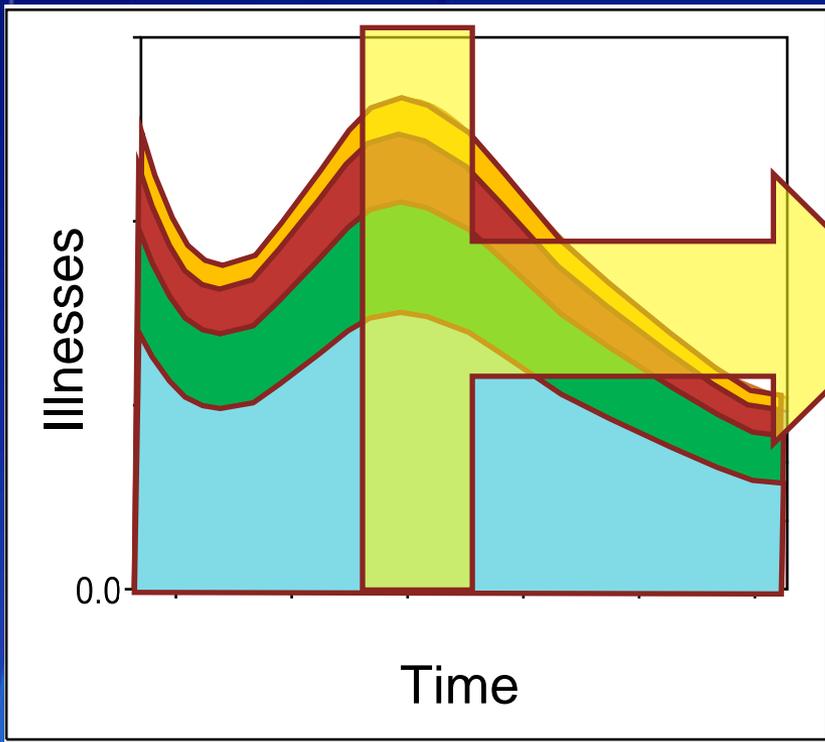
Summary of Communication Challenges

- Estimates are different, based upon questions, methods, and data
- Estimates are always changing over time
 - Iterative process with changing data
 - Surveillance data
 - Attribution estimates
 - New methods and data sources emerge
- Estimates are uncertain

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Going Beyond the Pie Chart

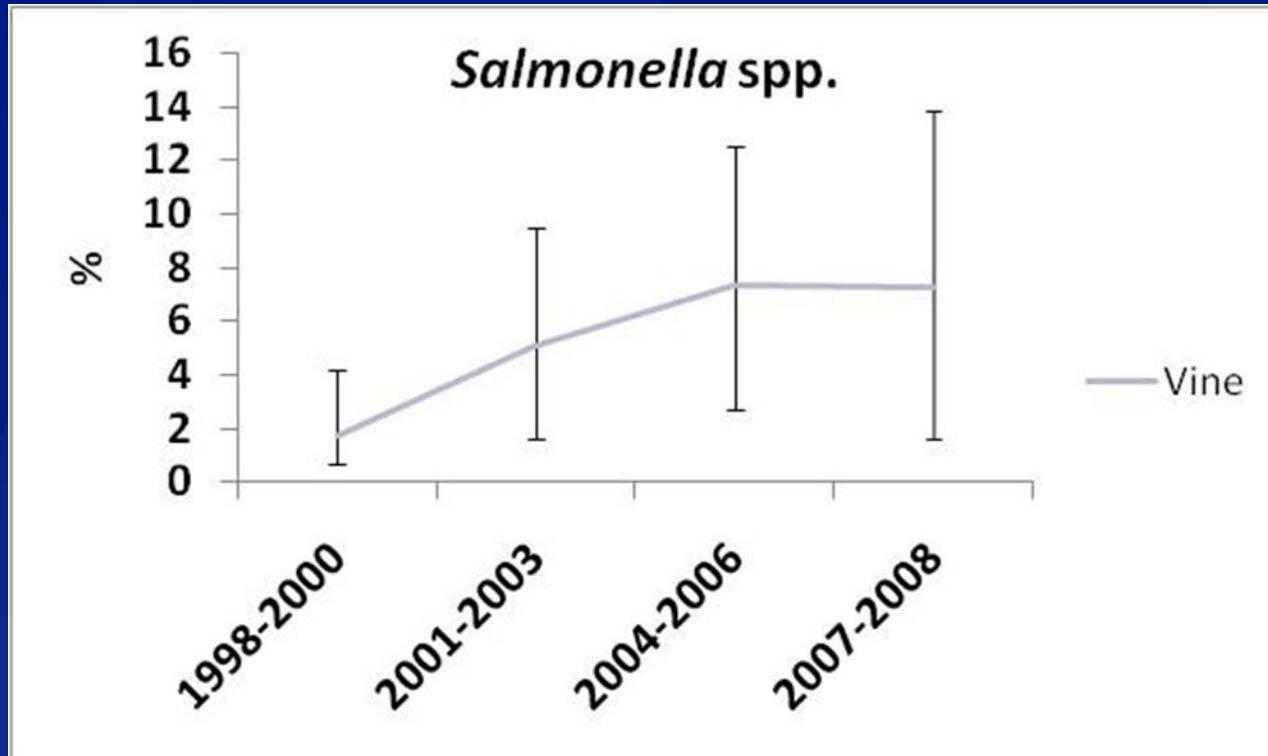


<http://www.cdc.gov/vitalsigns/FoodSafety/index.html>

The pie chart is easily understood method of presenting data

- Does not show uncertainty
- Only represents a single block of time and single point in food system (e.g. point of consumption)

Going Beyond the Pie Chart (cont.)



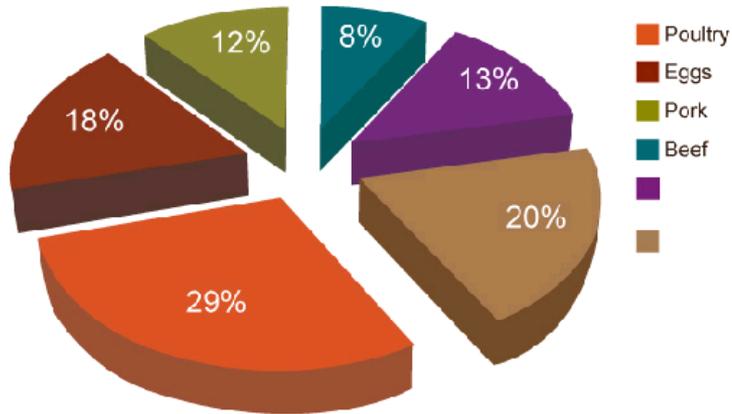
imaginary data

The line can show changes in time and uncertainty in estimates

- Does not show the complete attribution picture
- Only represents a single point in food system (e.g. point of consumption)

From Pie to Basic Framework

Foods associated with *Salmonella* outbreaks*



Entire pie is a single line

<http://www.cdc.gov/vitalsigns/FoodSafety/index.html>

Adapted from the International Journal of Food Micro. 139 (2010) S16–S28

Parasites

Viruses

Bacteria

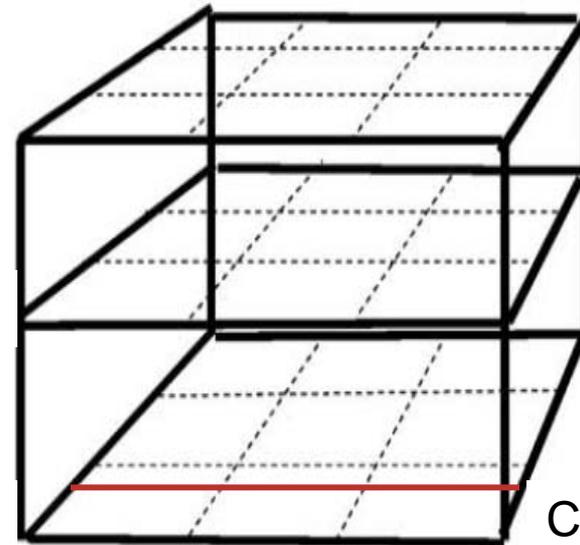
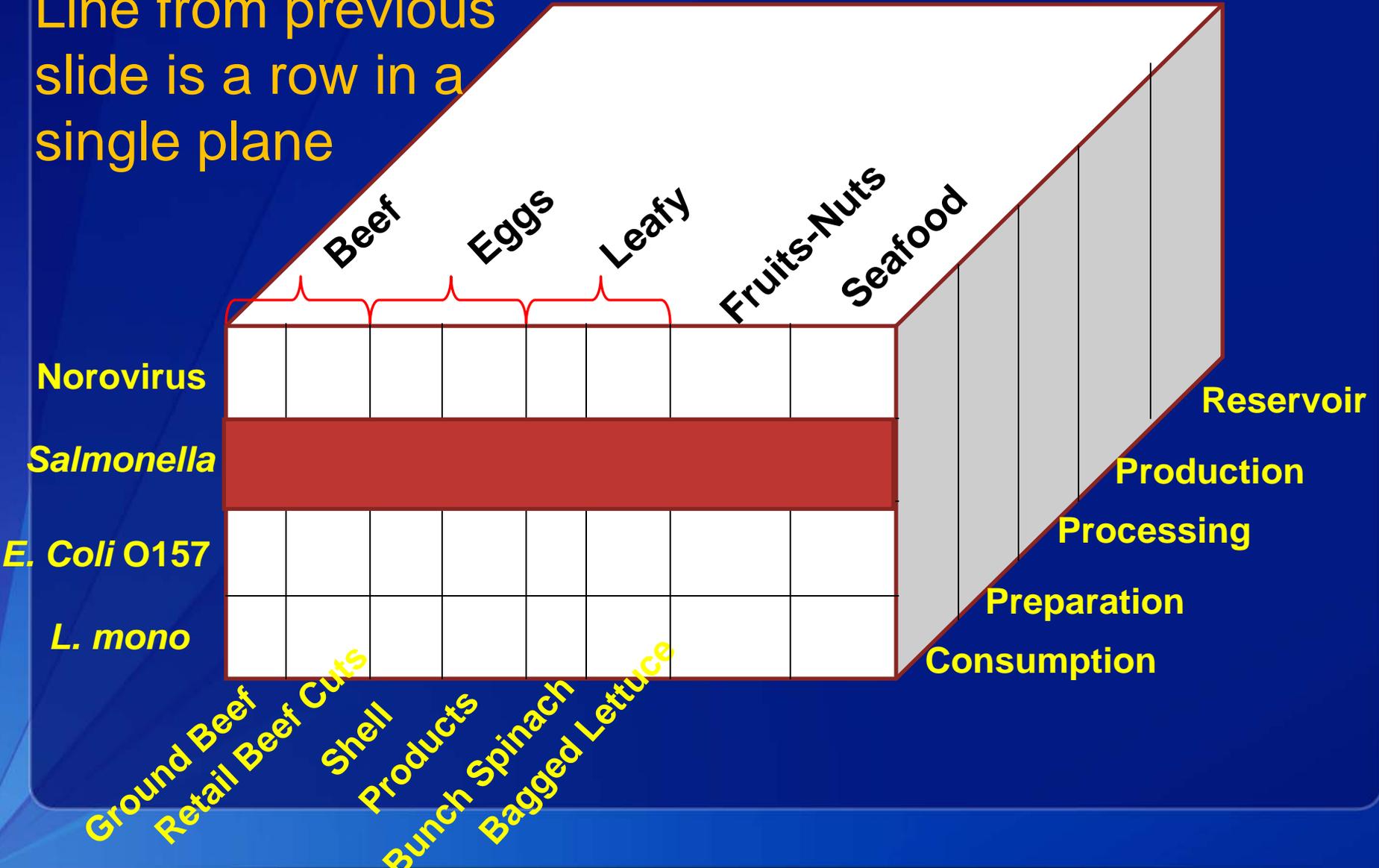


Fig. 5. The food safety box in which problems and solutions can be localized, along with the dimensions of pathogen, food vehicle of transmission, and level of processing.

From Basic to Detailed Framework

Line from previous slide is a row in a single plane



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Summary

- Attributing foodborne illnesses to foods is dynamic and complex
 - Many questions, data sources, and methods
 - Much uncertainty
 - Changing over time, estimates are “the best available”
 - Part of an iterative cycle of public health evaluation

Summary (cont.)

- Communication questions:
 - Can a structural framework, such as the cube, be used to help communicate key messages?
 - What is best way to express the dynamic nature of estimating the foodborne illness attributable to specific foods?

Questions?

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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