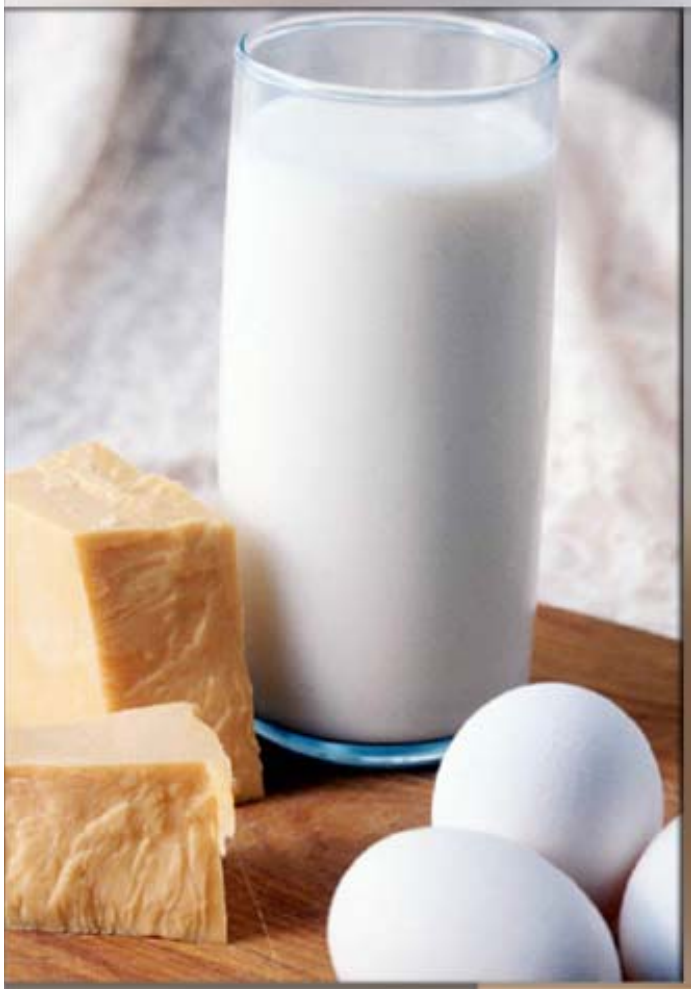

Non-O157 STEC: New Challenges / Practical Limitations / Next Steps

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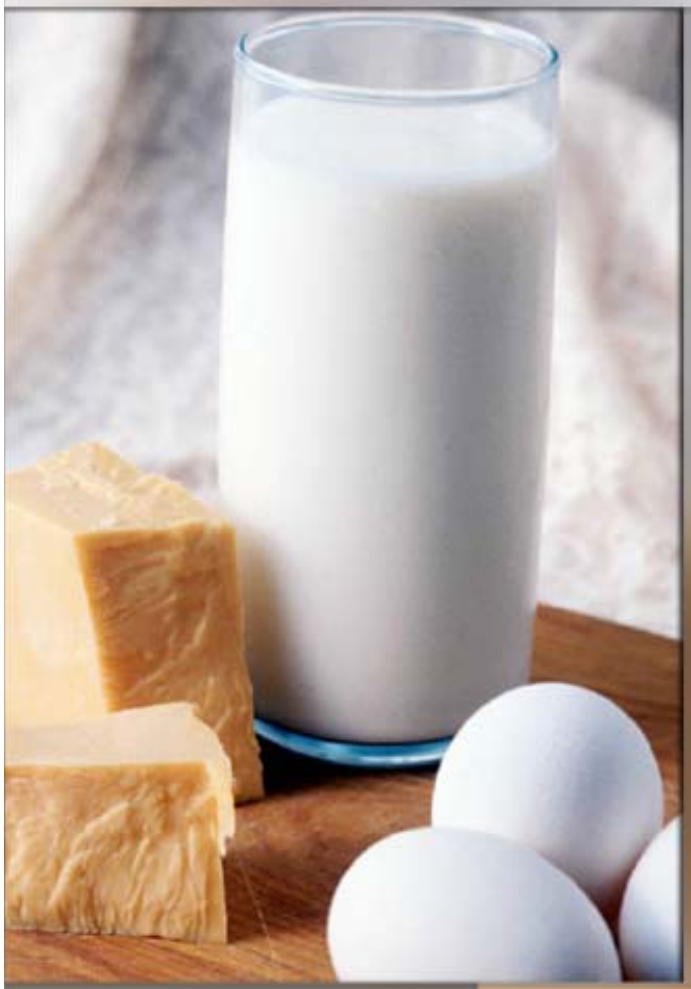
Presentation

- Food safety policies for pathogenic microorganisms
- Virulence markers versus ability to cause disease
- Practical aspects of implementing a microbial food safety program for non-O157 STEC
- Concluding remarks

Presentation

- Will focus on enterohemorrhagic *Escherichia coli* (EHEC) but the problem may not be limited to this subgroup of *E. coli* that are capable of causing disease in humans



Food Safety Policies for Pathogenic Microorganisms

FDA Food Safety Policies

- Food safety policies represent the application of scientific knowledge within a framework of laws that defines the risk management options (and their limits) that are available to regulatory agencies and industry
- Within FDA this is articulated in the Federal Food Drug and Cosmetic Act (FFDCA)

FDA Food Safety Policies

- A food shall be deemed to be adulterated—
  - (a) (1) If it bears or contains any poisonous or deleterious substance which may render it injurious to health; but in case the substance is not an added substance such food shall not be considered adulterated under this clause if the quantity of such substance in such food does not ordinarily render it injurious to health

FDA Food Safety Policies

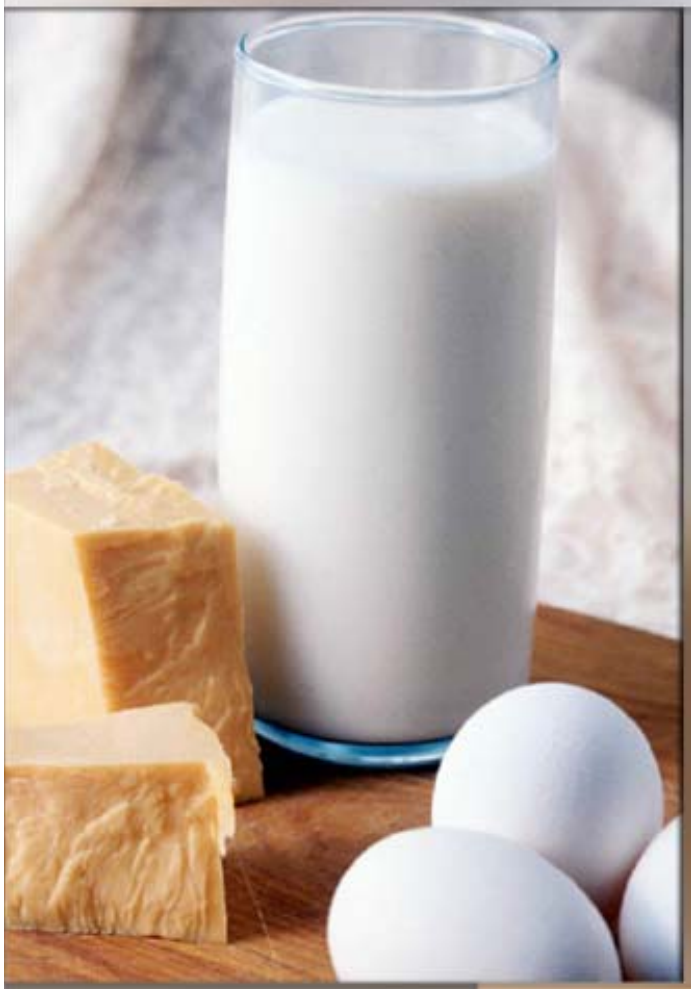
- A food shall be deemed to be adulterated—
  - (a) (4) if it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health

Microbiological Hazards

- Evidence (isolation or epidemiology) of a pathogenic microorganism in the food is the basis for (a)(1) for a microbial hazard
  - Enterohemorrhagic *Escherichia coli*
- Evidence of an indicator microorganism or physical attribute indicative of a condition that would support pathogens is basis for (a)(4).
  - Non-pathogenic *Escherichia coli* as indicator of fecal contamination

Microbiological Hazards

- The stringency of policies for specific microbiological hazards dependent on
  - Severity of the disease (e.g., HUS vs. simple diarrhea)
  - Infectious vs. toxigenic pathogens (e.g., EHEC vs. *Staphylococcus aureus*)
  - Foods with which the pathogen is associated (RTE vs. non-RTE foods)
  - Dose-response relationship (e.g., EHEC vs. *Vibrio parahaemolyticus*)



Policy Challenges Related to the Pathogenicity of *Escherichia coli*

STEC as a Cause of Foodborne Disease

- The FDA recognizes that
  - Non-O157 STEC can be an important threat to public health
  - Science related to the ability of any individual STEC strain to cause disease is complex
  - Likely continuum of STEC strains in relation to potential public health impact
  - Substantial uncertainty in the science which impacts food safety policies for STEC
  - There is need for unifying concepts that allow the science to lead our food safety policies

Pathogenicity of *E. coli*

- **Challenge: Food safety policy dependent on linking agent to disease**
  - **Pathogenic *E. coli* categorized by their disease manifestations, (e.g., EHEC, ETEC)**
  - **STEC designation based on presence of a specific virulence marker, and not ability to cause disease**
  - **Presence of virulence marker does not necessarily mean an isolate is capable of causing disease**

Pathogenicity of STEC

- The ability of STEC is cause disease is dependent on combination of virulence genes and the ability to express them
- Based on the current state of the science (high uncertainty) it is unlikely that the simple detection of an isolate with a *stx* gene would be sufficient to take action against food

Pathogenicity of STEC

- What "evidence" needed?
  - Isolation of an STEC from a patient showing typical EHEC-related symptoms, or
  - In absence of epidemiology link would likely need supplemental evidence that STEC is an EHEC

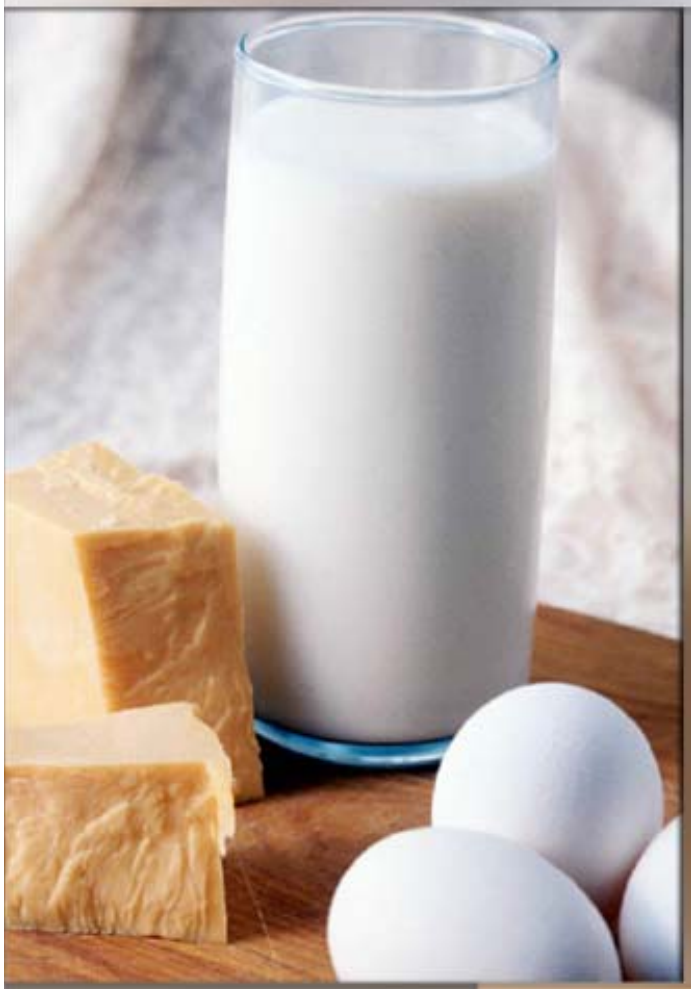
Pathogenicity of STEC

- Most likely approach is to determine if isolate possesses and <u>expresses</u> additional virulence genes/characteristics associated with EHEC (e.g. *eae*, *tir*, *hly*, acid resistance)
- Provide strong evidence that STEC isolate likely to be an EHEC that is capable of causing disease

Pathogenicity of STEC

- The absence of one or more of these additional markers associated with EHEC does not necessarily mean the isolate is not pathogenic, just that it is less likely to be an EHEC and harder to support an (a)(1)

- Emphasizes importance of demonstrating epidemiological link and reliance of FDA on the Federal - State disease surveillance network



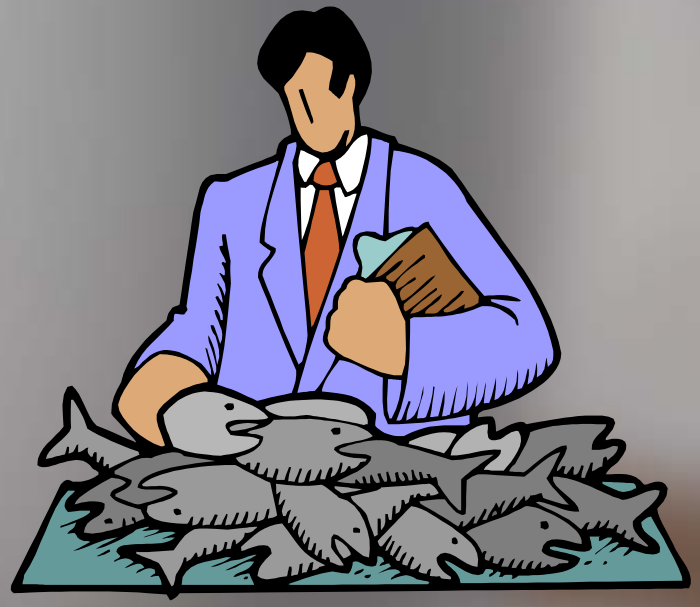
Challenges for Implementing a Food Safety Risk Management Program for STEC

STEC Risk Management

- Many of the barriers and interventions put into place to prevent *E. coli* O157 should help reduce the risk of non-O157 STEC

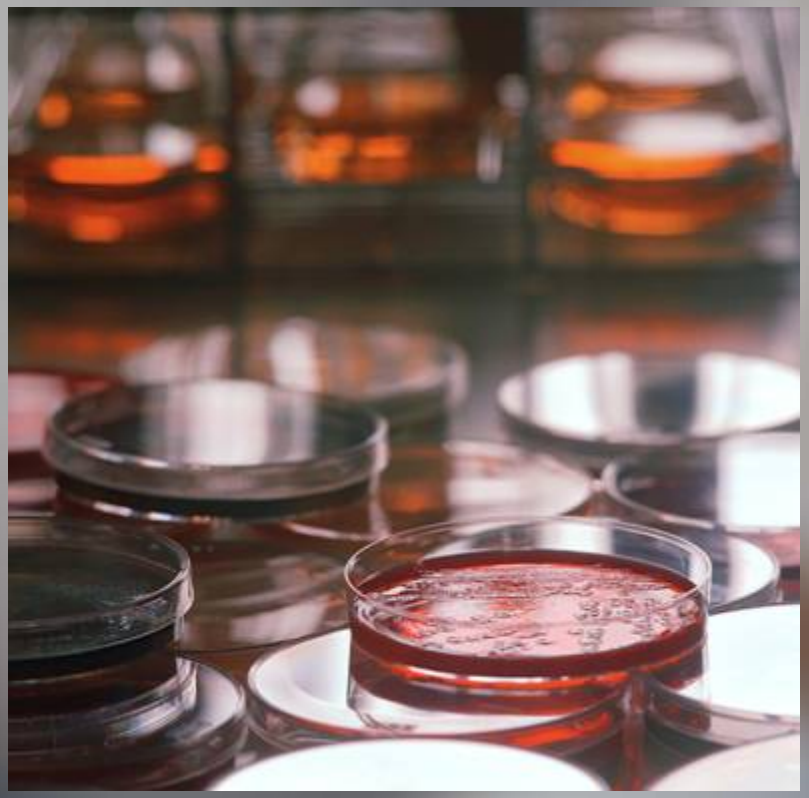
STEC Risk Management

- Continued use of *E. coli* as a primary sanitation assessment tool
  - Restricts sources of fecal contamination
  - High levels evidence for an (a)(4) determination



STEC Risk Management

- Development of food surveillance programs for STEC pose a series of significant challenges

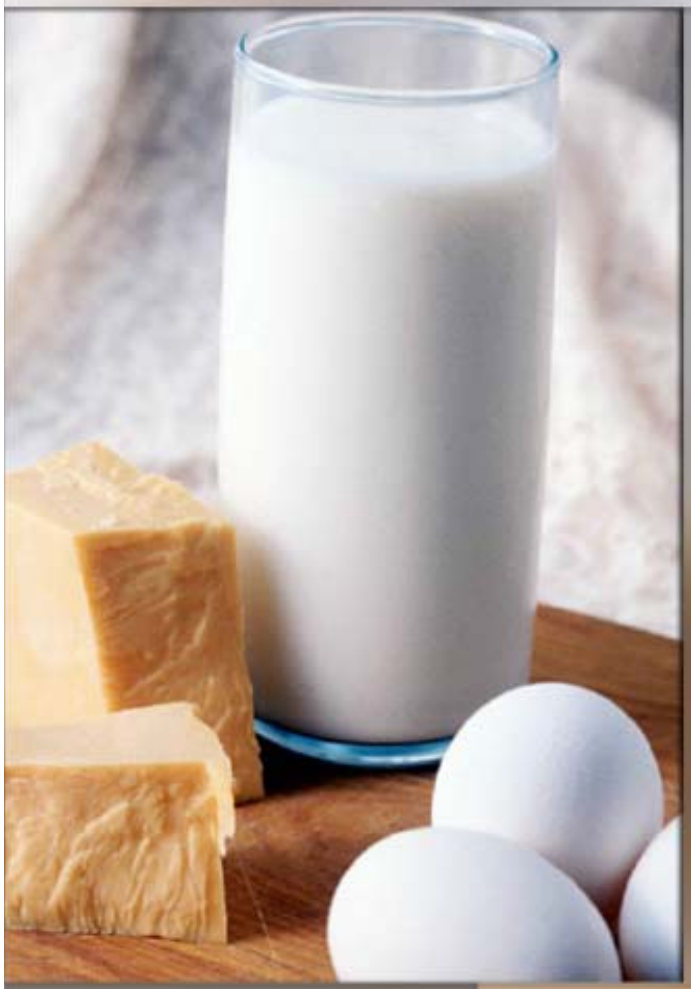


STEC Risk Management

- **Methodological challenges for STEC**
  - Multiple isolates within a single sample
  - No distinguishing phenotypes
  - While STEC most often associated with certain serotypes, these serotypes are not all STEC-positive
  - Need for capture antibodies that target STEC most likely to be EHEC
  - Need to assess additional virulence markers
  - Enrichment techniques may favor non-STEC
- **Methodological considerations would be enhanced with a clear definition of what constitutes a pathogenic STEC**

STEC Risk Management

- While not as complex as the methodological challenges associated with routine food surveillance, there are significant methodological limitations to our ability to conduct tracebacks and investigations in response to outbreaks



Concluding Remarks

Concluding Remarks

- FDA recognizes that non-O157 STEC
  - Are emerging as an important cause of foodborne disease
  - Impacts both the imported and domestic food supply
  - Represent significant scientific and risk management challenges

Concluding Remarks

- FDA is committed to
  - Reducing the burden of foodborne disease in the United States including non-O157 STEC infections
  - Addressing the challenges of non-O157 STEC though the application of sound science-led risk management
  - Seeking the best scientific and food safety policy advice for managing this threat to public health
  - Encouraging the scientific community to develop the analytical and intervention tools needed
  - Ensuring that our investigators, laboratories and outreach programs are prepared