STEC O157 in cattle: What can we do about it?  
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Human STEC O157 infection

Based on FoodNet data, FSIS risk modelers estimate 70,874 human STEC O157 infections each year in the United States.

Approximately 33% of human STEC O157 infections are attributed to consuming beef.

So, 23,388 E. coli O157:H7 illnesses are caused each year from beef consumption.

(Withee et al. 2009. Foodborne Pathogens and Disease 6(7))

Beef industry post-harvest interventions

- Hide treatments
- Careful evisceration
- Carcass washes
- Steam pasteurization
- Test and hold

$2.7 Billion
The cost of E. coli 0157:H7

MMWR 2011 60(22) 749-755
Seasonal pattern of human STEC O157 infection

Adjusted by six months for the southern hemisphere.

What are the key determinants of human STEC infection?

Seasonal variation for human STEC O157, prevalence of STEC O157 in cattle and ground beef, and ground beef supply (expressed as a percentage of the mean)

What are the key determinants of human STEC infection?

Seasonal variation for human STEC O157 illness, prevalence of STEC O157 in cattle and ground beef, and ground beef supply (expressed as a percentage of the mean).


What affects the probability for cattle to shed E. coli O157:H7?

1) a pen environment when it favors bacterial survival and fecal-oral transmission, and/or

2) a gut environment when it favors its colonization and replication.

What can we do about it?

Strategies for intervention:
- Limiting direct environmental exposure - Seasonal differences
- Reducing the duration of infection - Target of current interventions

Making the gut unfavorable to STEC infection

Primary Sites of E. coli O157:H7 colonization:
- rumen
- colon
- terminal rectum

Feed components
- Chemicals
- Competing microflora
- Immune response

Probiotics / Direct-Fed Microbials
- Lactobacillus acidophilus NP51 10⁹CFU/head daily
- e.g. Bovamine® Nutrition
- Physiology Inc.
**Cattle vaccines**

**World's First Cattle Vaccine to Reduce E. coli O157 Threat Receives Full Licensing Approval in Canada**

Econiche™ now available to reduce risk of food and water contamination

BELLEVILLE, ON, October 27, 2008 – Bioniche Life Sciences Inc. (TSX: BNC), a research-based, technology-driven Canadian biopharmaceutical company, today announced that Econiche™, the world’s first vaccine designed to reduce the shedding by cattle of Escherichia coli (E. coli) O157:H7, has received full licensing approval from the Canadian Food Inspection Agency (CFIA). Econiche is now available for unrestricted use by Canadian cattle producers and their veterinarians.

**Cattle vaccines**

**Beef safety takes a new step**

By Drovers news source | Weds, March 11, 2009

Production-level food safety interventions have been a long time in coming, but a conditional license for an E. coli vaccine may be a step in the right direction. The United States Department of Agriculture has granted a conditional license to Epitopix, LLC for an E. coli O157 vaccine. The new vaccine is labeled for use in cattle to reduce the prevalence of the E. coli O157-carrier state and for reduction in the amount of E. coli O157 shed in feces to minimize E. coli exposure and infection of herd-mates. Although the product license is conditional while additional efficacy studies are completed, USDA approval allows Epitopix to make the vaccine immediately available for use by the beef industry.

**Do pre-harvest interventions work?**

Efficacy of vaccination and DFM has been demonstrated by various relevant biological outcomes

Should we use them?...
Do they work?

**Efficacy** – does the intervention have a biological effect?

**Effectiveness** – will it be useful?

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Are pre-harvest interventions **USEFUL**?

- What level of efficacy is worthwhile?
- To whom?
- How best to use in commercial applications
- Will they be useful in the food **system**?
- How to implement, document, validate…
- Transfer of value

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Cattle vaccines

*Stochastic Simulation Model Comparing Distributions of STEC O157 Fecal Shedding Prevalence Between Cattle Vaccinated With Type II Secreted Protein Vaccines and Non-Vaccinated Cattle.*

**Abstract**

Prevalence of cattle with high E. coli O157:H7 prevalence at harvest may present a greater risk to food safety than prevalence at slaughter. Vaccination of live cattle against STEC O157 has been proposed as an approach to reduce STEC O157 prevalence in live cattle. Our objective was to create a stochastic simulation model to compare STEC O157 prevalence between vaccinated and non-vaccinated cattle populations. Evaluating the impact of vaccination with STEC O157 vaccines under different vaccination strategies on STEC O157 prevalence and shedding levels for cattle at harvest.

"...vaccination [of cattle] mitigated the risk of STEC O157 faecal shedding to levels comparable to winter..."

PNAS | October 1, 2013 | vol. 110 | no. 40 | 16265–16270

Cattle vaccines

*Predicting the public health benefit of vaccinating cattle against Escherichia coli O157.*

**Abstract**

We show that adoption of these vaccines by the livestock industry could prevent substantial numbers of human *E. coli* O157 cases.

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Conclusions

Science is beginning to deliver tools to control STEC O157 in live cattle

The question of whether these tools will be used remains unanswered