

The Connecticut Experience with non-O157 STEC “Seek and Ye Shall Find”

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Background

Shiga toxin-producing *Escherichia coli* (STEC)

- **STEC infections are an important public health problem**
 - *E. coli* O157 most widely recognized STEC in U.S.
- **Clinic-based studies suggest infection caused by non-O157 STEC may be as prevalent as O157**
- **Standard culture methods for O157 do not detect non-O157 STEC**
 - Incidence and trends of infection with non-O157 STEC not well established
- **Increasing use of Shiga toxin (ST) testing by clinical laboratories provides an opportunity to evaluate occurrence of non-O157 STEC and monitor trends over time**

Objectives

- Describe how/why Connecticut (CT) began testing for STEC
- Describe the frequency of non-O157 STEC compared to O157 STEC
- Describe trends in incidence of STEC infections over past seven years of surveillance
- Describe some clinical and epidemiologic features of non-O157 vs. O157 infections
- Share preliminary data from the STEC laboratory survey
- Make recommendations based on findings

***E. coli* in Connecticut 1999**

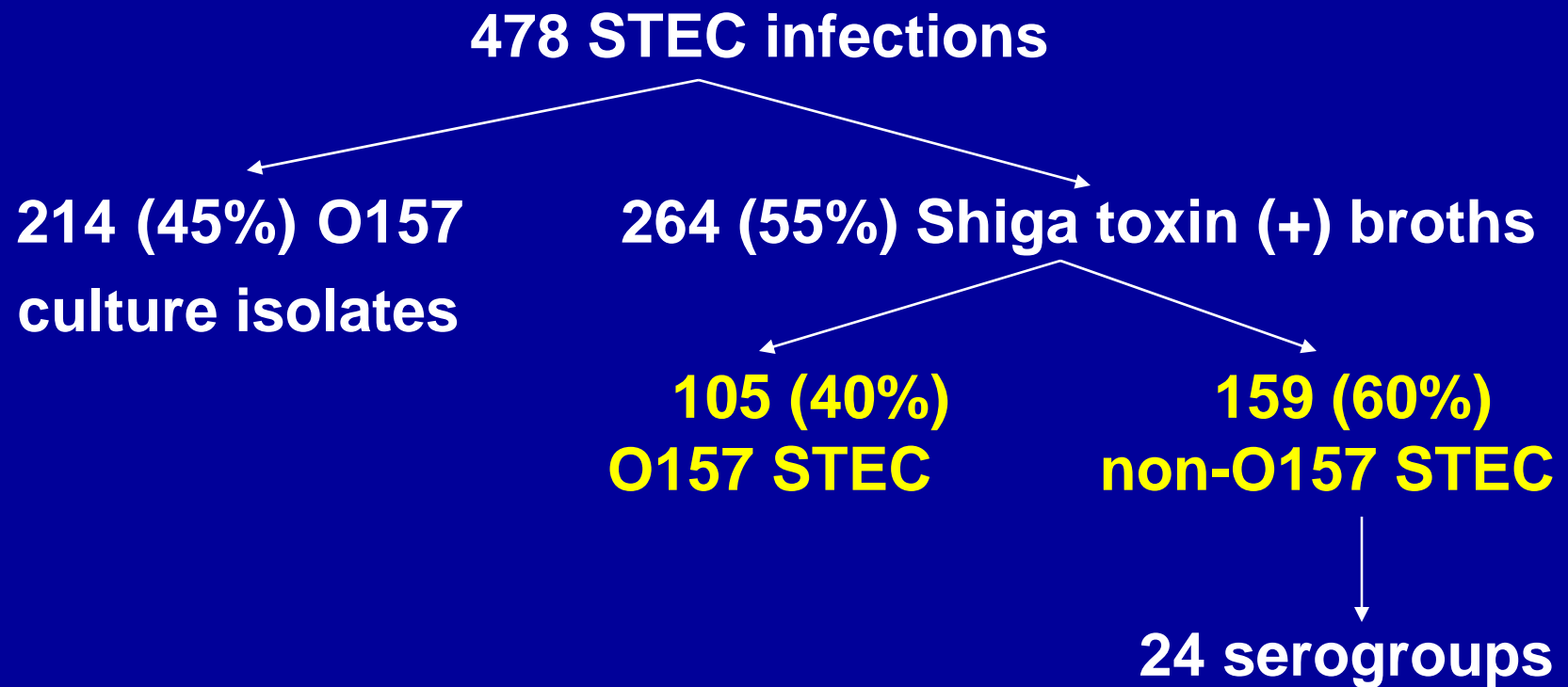
- **Several clinical laboratories began using Shiga toxin testing in place of culture for O157**
 - **ST-positive results not reportable at time**
 - **No isolates available for further testing (serotyping, PFGE)**
 - **Impacted ability to detect/investigate outbreaks**
- **Outbreak of *E. coli* O121***
 - **11 cases, including 3 cases of HUS**
 - **Illness associated with swimming in lake and swallowing water while swimming**
 - ***E. coli* O121:H19 isolated from a toddler who swam in lake**
 - **6 cases serologically confirmed (O121 antibody titers)**
 - **Outbreak possibly detected sooner if ST screening was done**
 - **1st outbreak of non-O157 STEC in Connecticut**

*McCarthy et. al., *Pediatrics*, Vol. 108, No. 4, 2001

Laboratory Methods

- *E. coli* O157 reportable since early 1990's
- ST-positive tests made reportable in 2000
- Laboratories required to submit ST-positive broths to the State Laboratory
- Broths plated on SMAC & CT-SMAC
- Sorbitol-negative colonies tested for O157
- If O157-negative, sorbitol-positive colonies and sweep of plate tested for ST
- Non-O157 STEC isolates sent to CDC for serotyping

Laboratory Surveillance for STEC Connecticut 2000 – 2006



Incidence* of STEC Infections by Year Connecticut 2000-2006

	2000	2001	2002	2003	2004	2005	2006	% Change from 2000 to 2005
All STEC Infections	2.9	1.9	1.8	1.9	1.6	1.8	2.2	- 45%
<i>E. coli</i> O157	2.5	1.1	1.3	1.1	0.9	1.3	1.2	- 52%
Non-O157 STEC	0.4	0.7	0.5	0.8	0.7	0.6	1.0	+ 150%

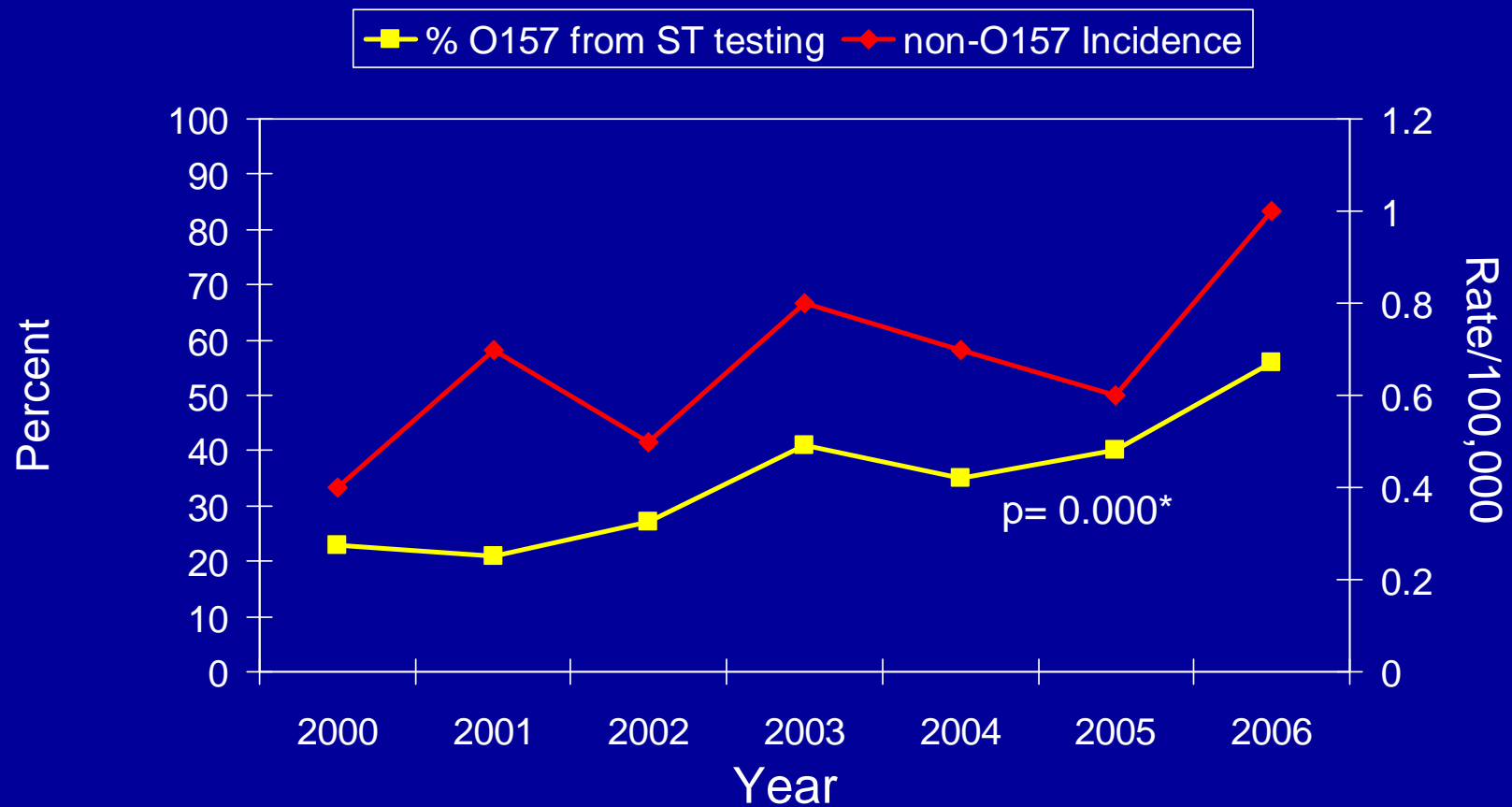
*Rate per 100,000 population

Trends in STEC Isolates by Year Connecticut 2000-2006

	2000	2001	2002	2003	2004	2005	2006	p-value*
All STEC isolates	97	63	62	63	55	63	75	
% <i>E. coli</i> O157	87%	59%	73%	59%	56%	68%	55%	<0.001
% ST (+) broth	33%	52%	47%	65%	64%	59%	76%	<0.001
ST broth isolates	32	33	29	41	35	37	57	
% <i>E. coli</i> O157	59%	24%	41%	37%	31%	46%	40%	n.s.
% Non-O157 STEC	41%	76%	59%	63%	69%	54%	60%	n.s.
O157 Isolates	84	38	45	37	31	43	41	
Overall % from Broth	23%	21%	27%	41%	35%	40%	56%	<0.001

*Chi-square for trend

Non-O157 STEC Incidence and Percent of O157 Isolates from ST Tests by Year Connecticut 2000-2006



* Chi-square for trend

Top Six Non-O157 Serogroups (N=159) Connecticut 2000-2006

Serogroup	Percent
O103	20%
O111	20%
O26	17%
O45	12%
O121	4%
O145	3%

Epidemiology

- **STEC patients reported between 4/1/04 and 12/31/06 interviewed regarding:**
 - Symptoms and potential exposures
- **Differences between patients with non-O157 and those with O157 STEC were assessed**

Relative Severity of Disease Due to O157 and Non-O157 STEC 2000-2006

	Non-O157 n=159	O157 n=319	p-value
Hospitalized	15%	45%	< 0.0001*
Hemolytic uremic syndrome	0	9%	
Died	0	2%	

*RR 3.0 95%CI (2.0, 4.4)

Symptoms Reported by Interviewed Patients

Connecticut, April 2004 – December 2006

	Non-O157 (n=52)	O157 (n=99)	p-value
Bloody stool	71%	89%	0.02
Diarrhea	96%	98%	n.s.
Cramps	87%	87%	n.s.
Nausea	31%	50%	0.05
Fever	31%	43%	n.s.
Vomiting	15%	38%	0.01

Comparison of Non-O157 and O157 Patients by Selected Exposures

Selected Exposures	Non-O157	O157	p-value
	% exposed	% exposed	
Ate hamburger	53%	51%	n.s.
Ate ground beef	21%	30%	n.s.
Visited farm/petting zoo	14%	9%	n.s.
Ate at restaurant, preceding 7 days	71%	81%	n.s.
International travel	12%	7%	n.s.
Suburban residence	29%	58%	0.002

Clinical Laboratory Testing of STEC, 10 FoodNet sites

**STEC lab survey addressed practices related to
culture and non-culture based testing**

- Media, methods, test kits used
- Circumstances for testing (eg., routine, MD request)

- **Preliminary data:**

- 668 laboratories surveyed (only labs testing on-site were analyzed)
- 437 labs (65%) test on site for STEC
- 401 (92%) do culture based testing
- 28 (7%) do non-culture based testing for O157
- 45 (13%) do non-culture based testing for all STEC
- 24 (6%) set up culture and non-culture simultaneously
- Most labs do EIA testing; only 2 report using RT-PCR
- Lateral flow method gaining attention

Clinical Laboratory Testing of STEC, Connecticut

- STEC lab survey conducted in 32 clinical labs
- Results:
 - 27 labs (84%) test on site for any STEC
 - 15 (55%) do only culture based testing
 - all report routine testing
 - 12 (45%) do non-culture based testing for STEC
 - all use EIA methods
 - 6 (50%) report routine testing
 - 5 (19%) report using both culture and non-culture based methods (3 do so simultaneously)
 - Interest expressed in using the new lateral flow test

Clinical Laboratory Testing of STEC, Connecticut

Since 2000, clinical labs in CT are required to report positive ST results and submit all positive ST broths to the CT PHL

# of labs doing Shiga toxin testing						
2000	2001	2002	2003	2004	2005	2006
4	4	5	6	8	10	12*

*Since the survey was completed, 2 additional labs began using a non-culture (EIA) method bringing the total number of labs performing testing which would capture non-O157 STEC to 52%

Conclusions

- **An increasing number of clinical laboratories are conducting ST testing**
 - **By 2006, 56% of all O157 in CT found through ST testing**
- **Incidence of non-O157 has increased**
 - **Increase in non-O157 likely due to an increase in ST testing**
- **Positive ST tests are consistently more often associated with non-O157 STEC than O157**
- **While the severity of illness from non-O157 is somewhat milder, there appear to be no differences between non-O157 and O157 in frequency of exposure to known cattle-beef risk factors for O157**

Conclusions

- **Diagnostic testing has an impact on public health activities**
- **Surveillance activities are an important component for outbreak detection and disease prevention**
- **Isolates are important to successful investigations**
- **Clinical laboratories are increasing their use of non-culture methods**

Recommendations

- **Clinicians should consider non-O157 STEC infection when evaluating patients with diarrhea**
 - **continued education regarding ordering and interpreting test results**
- **Clinical labs currently only culturing for O157 should consider also using ST testing**
- **Public health departments must assure that all labs doing ST testing follow up positive ST tests with culture for at least O157 and/or submission to PHL for isolation of an organism**
- **Ongoing surveillance for both O157 and non-O157 STEC needed to better describe trends and epidemiology of STEC infections**
- **Continued surveys of clinical labs to monitor testing trends**

Acknowledgements

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