Informing source attribution of enteric disease: an analysis of public health inspectors’ opinions on the “Most Likely Source of Infection”

Danielle Dumoulin
September 19, 2012
Outline

• Study Background/Objective
• Methods
• Results
• Benefits of Data
• Conclusion
C-EnterNet

Sentinel Site 1: Waterloo Region, Ontario
- Wellesley
- Woolwich
- Waterloo
- Kitchener
- Cambridge
- North Dumfries

Sentinel Site 2: Fraser Health Region, British Columbia
- Burnaby
- Abbotsford
- Chilliwack
C-EnterNet

Integrated Surveillance

Food

Humans

Food Animals

Water
C-EnterNet Enhanced Questionnaire

Giardia Worksheet

Most Likely Source: (PHI opinion)

Interview Completion Date:       PHI Signature
Study Background

Objective: Develop a better understanding of source attribution and enteric disease risk factors

Source attribution is an important objective of C-EnterNet
What is Source Attribution?

Source Attribution: Proportion of cases caused by a specific source

E.g. water, food
Source Attribution Methods

- Case-Control Studies
- Quantitative Microbial Risk Assessment
- Expert Elicitation
- Descriptive Epidemiology
- Comparative Exposure Assessment
- Microbial Subtyping Comparison
- Outbreak Data Analysis
- Intervention Studies

Adapted from: http://www.phac-aspc.gc.ca/c-enternet/source-eng.php
Importance

• Need for source attribution information identified

• Limited information in literature using similar methodology

• First study to use this approach
Methods

Two Parts

1. Analysis of MLSI field

2. Comparison of study results to literature
Methods

Two Parts

1. Analysis of MLSI field
2. Comparison of study results to literature
Methods

- Open text “Most Likely Source of Infection” (MLSI) field
- Region of Waterloo, 2006-2010
- Endemic cases only
- Analyzed by 5 disease groups
- MLSI classified under nine categories
Five Disease Groups

1. Overall enteric disease
2. Campylobacteriosis
3. Salmonellosis
4. VTEC infection
5. Parasitic disease
Nine MLSI Categories

1. Water
2. Food
3. Food Safety Practices
4. Unpasteurized
5. Occupational
6. Environmental
7. Animal
8. Person-to-Person
9. Other
MLSI Category Definitions

Water
- Consumption or physical contact with water through activities such as swimming

Food
- Any beverage or food item for human consumption

Food Safety Practices
- Unsafe food safety practices including issues regarding food handling, hand hygiene, cross contamination, temperature (e.g. undercooking) and thawing meat
MLSI Category Definitions

**Unpasteurized**
- Unpasteurized, raw or untreated milk, juice, cheese

**Occupational**
- Implied or directly stated work/occupational exposure

**Environmental**
- Exposure from the external physical environment, such as exposure to animal feces, sewage backup and indirect animal contact
MLSI Category Definitions

Animal
- Potential animal contact

Person-to-Person
- Implied or directly stated person to person transmission, including sexual transmission

Other
- MLSI that did not fit in other eight categories
Categorization

- Multiple MLSI per case coded to capture each response

- 'well water or unpasteurized milk'

  - Water

  - Unpasteurized

- 'wading pool or conservation water'

  - Water
Punctuation

Complicated analysis

• E.g. ‘camping/water source’

General Rules:

• Slash, semi-colon, comma → divider
• Dash → continuous
Punctuation

Exceptions:

• Grammatically part of entry
  • E.g. ‘client indicated x-contamin w/in home-meat’

• MLSI divided clearly related
  • E.g. ‘exposure to lizard; handles regularly’

• Additional scenarios
  • E.g. ‘x-contamination; apples and turkey’
Methods

Two Parts

1. Analysis of MLSI field
2. Comparison of study results to literature
Literature Comparison

• Some studies in Ontario have used RDIS

• Several limitations

• Data adapted into five groups for comparison purposes
Literature Comparison

1. Food
2. Food Safety Practices
3. Unpasteurized
4. Water
5. Person-to-Person
6. Animal
7. Occupational
8. Environmental
9. Other

1. Food
2. Water
3. Person-to-Person
4. Animal
5. Other
Results

Two Parts

1. Analysis of MLSI field
2. Comparison of study results to literature
Results

• 2,219 recorded cases (2006 – 2010)
  • Endemic: 1,529 (68.90%)
  • Travel: 643 (28.98%)
  • Outbreak: 47 (2.12%)

• 1,484 involved diseases of interest

• 1,008 cases removed from analysis

• 476 cases met study criteria
Overall Enteric Disease

- Food
- Animal
- Water
- Person-to-Person
- Food Safety Practices
- Environmental
- Unpasteurized
- Occupational
- Other
Campylobacteriosis

- Animal
- Food
- Food Safety Practices
- Unpasteurized
- Water
- Environmental
- Occupational
- Person-to-Person
- Other
Salmonellosis

- Food: 40%
- Animal: 20%
- Food Safety Practices: 15%
- Person-to-Person: 10%
- Environmental: 5%
- Other: 5%
- Water: 5%
- Occupational: 5%
- Unpasteurized: 5%
VTEC Infection

- Food
- Water
- Person-to-Person
- Environmental
- Unpasteurized
- Animal
- Food Safety Practices
- Occupational
- Other

Percentage distribution:

- Food: 30%
- Water: 20%
- Person-to-Person: 15%
- Environmental: 13%
- Unpasteurized: 13%
- Animal: 10%
- Food Safety Practices: 6%
- Occupational: 6%
- Other: 0%
Parasitic Disease

- Water
- Person-to-Person
- Animal
- Environmental
- Food
- Unpasteurized
- Occupational
- Food Safety Practices
- Other

0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%
Results

Two Parts

1. Analysis of MLSI field

2. Comparison of study results to literature
# Overall Enteric Disease

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[^i]: Terminology varies by study  
[^ii]: Keegan et al. (2009)  
[^iii]: Lee et al. (2003)  
[^iv]: Rajda et al. (2004)  
[^v]: Rajda et al. (2006)
# Campylobacteriosis

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<td>18.3</td>
<td>20.0</td>
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<td>15.2</td>
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[^i] Terminology varies by study  
[^ii] Lee et al. (2003)  
[^iii] Rajda et al. (2004)  
[^iv] Rajda et al. (2004); *Campylobacter* specific study  
[^v] Rajda et al. (2006)
## Salmonellosis

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<td>12.3</td>
<td>13.1</td>
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[^ii]: Terminology varies by study
[^iii]: Ford et al. (2003); numbers specifically for *Salmonella* serotype typhimurium
[^iv]: Lee et al. (2003)
[^v]: Rajda et al. (2004)
[^vi]: Rajda et al. (2006)
## VTEC Infection

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<td>%</td>
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<tr>
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<td>59.9</td>
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<td>13.0</td>
<td>7.4</td>
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</tbody>
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[^i]: Terminology varies by study
[^ii]: Michel et al. (1998)
[^iii]: Lee et al. (2003)
[^iv]: Rajda et al. (2004)
[^v]: Rajda et al. (2006)
Overall Picture

Frequency

- Endemic: 69%
- Outbreak: 2%
- Travel: 29%
Overall Picture

Frequency

- Endemic

69%
Overall Picture

Campylobacteriosis

- Food: 45%
- Water: 24%
- Person to Person: 15%
- Animal: 11%
- Other: 5%

Salmonellosis

- Food: 54%
- Water: 19%
- Person to Person: 13%
- Animal: 11%
- Other: 4%
Overall Picture

**Verotoxigenic E. coli**
- Food: 44%
- Water: 17%
- Person to Person: 17%
- Animal: 14%
- Other: 8%

**Parasites**
- Food: 41%
- Water: 20%
- Person to Person: 15%
- Animal: 14%
- Other: 10%
Limitations

• Cannot confirm true infection source

• Ambiguity

• May not reflect unreported cases or other geographical regions
Benefits of Data

• Local Public Health Level
  » Establish links and enhance investigations
  » Identify key areas for public education

• Broader Level
  » Generate source attribution hypotheses
  » Inform public health policy and practice
  » Identify and address high risk sources
  » Conduct research studies
Benefits of Data

• Potential research studies:
  » Additional factors: age, gender, seasonality
  » Examine geographical differences
  » Outbreak and travel-related cases
  » Changes over time
Conclusion

• MLSI field provides unique perspective on source attribution

• Benefits of using specific categories

• Specific details in the MLSI field are important
Conclusion

- Case-Control Studies
- Quantitative Microbial Risk Assessment
- Expert Elicitation
- Descriptive Epidemiology
- Comparative Exposure Assessment
- Intervention Studies
- Microbial Subtyping Comparison
- Outbreak Data Analysis

Adapted from: http://www.phac-aspc.gc.ca/c-enternet/source-eng.php
Thank you

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Region of Waterloo Public Health
Ms. Nancy Sittler
Ms. Brenda Miller
PHIs
Questions?