Epidemiology of *Campylobacter* Infection in Maryland

Maryland FoodNet 2002-2004
Campylobacter

- Gram-negative, spiral or curved rods with polar flagellae
- Most common species clinically isolated are *C. jejuni* and *C. coli*.

Source: USDA Agricultural Research Service. Photo by De Wood.
Clinical Illness

- Gastroenteritis
  - Similar symptoms to infectious gastroenteritis caused by *Salmonella* and *Shigella*
  - Disease is usually self-limiting in 2-7 days
- Complications can include bacteremia and relapsing enteritis
  - Neonates, the elderly and the immunocompromised at highest risk
- Chronic sequelae
  - Guillian-Barré Syndrome, autoimmune disorder causing acute flaccid paralysis
Risk Factors

- Foreign travel
- Poultry, especially if undercooked
- Unpasteurized milk
- Swimming in natural waters
- Contact with domestic or farm animals
- Prior antibiotic use
Reservoirs

- Birds, especially domestic poultry
  - Spreads rapidly in chicken flocks
  - *Campylobacter* isolated from 71% of retail chicken samples in Washington, DC area.¹
    - Wild birds also carriers
- Mammals
  - Rodents
  - Domestic cattle
  - Household pets
- Surface waters

Campylobacter Surveillance
Foodborne Diseases Active Surveillance Network (FoodNet)

- Collaboration between CDC, USDA, FDA and 10 states
- Active surveillance of foodborne pathogens, including *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria*, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia*, and *Shiga* toxin-producing *E. coli*
- Only includes laboratory-confirmed cases
Underreporting of Cases

- Individual is exposed to foodborne pathogen
- Individual develops diarrheal illness
- Individual seeks medical attention
- Physician requests and obtains stool specimen from patient
- Laboratory receives and processes specimens
- Organism is isolated
- Case is reported

Maryland FoodNet

- Maryland joined FoodNet in 1998
  - Surveillance catchment area: Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties and Baltimore City
- Expanded to include Montgomery and Prince George’s counties in 2000
- Expanded to include entire state in 2002
Methods
Case Identification

- Health care providers and clinical laboratories report confirmed cases to local health departments
- Active surveillance of laboratories by Maryland Department of Health and Mental Hygiene
Case Information

- Local health departments interview all cases with standard case-report forms
- Case reports entered into the Maryland Electronic Reporting and Surveillance System (MERSS)
Population Information

- Annual estimated population from U.S. Census Bureau
  - Census estimates were not yet available for 2004
  - Used 2003 population estimates for 2004
Analysis

- Statewide incidence
  - Including sex-, age-, race-, and ethnicity-specific incidence
- County- and region-specific incidence
- Association with residence in a high-poultry county
- Logistic regression used to estimate associations and test for significance
Results and Discussion
## Campylobacter Infection 2002-2004

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Average 2002-2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland</td>
<td>6.81</td>
<td>7.77</td>
<td>5.17</td>
<td>6.58</td>
</tr>
<tr>
<td>United States*</td>
<td>13.4</td>
<td>12.6</td>
<td>12.9</td>
<td>13.0</td>
</tr>
</tbody>
</table>

*Estimated from data from all 10 FoodNet sites*
Incidence of *Campylobacter* by Sex

FoodNet, Maryland 2002-2004

<table>
<thead>
<tr>
<th></th>
<th>Incidence per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002</td>
</tr>
<tr>
<td>Males*</td>
<td>7.51</td>
</tr>
<tr>
<td>Females†</td>
<td>6.15</td>
</tr>
</tbody>
</table>

*Reference Category

†Significantly different from the reference category (p<0.05). Logistic regression used to test for significance.
Campylobacter Incidence by Age
Maryland 2002-2004

Incidence per 100,000

Age in Years

Campylobacter Incidence by Age and Sex
Maryland 2002-2004

Incidences per 100,000

Age in Years

Male
Female
### Campylobacter Infection by Race
Maryland 2002-2004

<table>
<thead>
<tr>
<th></th>
<th>Average Annual Incidence per 100,000</th>
<th>Average Annual Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian/Pacific Islander‡</td>
<td>3.63</td>
<td>9</td>
</tr>
<tr>
<td>Black‡</td>
<td>2.61</td>
<td>40.3</td>
</tr>
<tr>
<td>White†</td>
<td>6.94</td>
<td>250</td>
</tr>
<tr>
<td>Other*</td>
<td>--</td>
<td>7.3</td>
</tr>
<tr>
<td>Unknown</td>
<td>--</td>
<td>54.6</td>
</tr>
</tbody>
</table>

*Includes cases in Native American and two or more races categories
†Reference Category
‡Significantly different from the reference category (p<0.05). Logistic regression used to test for significance.
<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Average 2002-4</th>
<th>Average Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>4.37</td>
<td>5.34</td>
<td>5.34</td>
<td>5.02</td>
<td>13</td>
</tr>
<tr>
<td>Non-Hispanic*</td>
<td>4.87</td>
<td>5.78</td>
<td>3.79</td>
<td>4.81</td>
<td>251.7</td>
</tr>
<tr>
<td>Unknown</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>96.7</td>
</tr>
</tbody>
</table>

*Reference Category
Geographical Variation in Incidence Rates
# Campylobacter Infection by Region

## Maryland 2002-2004

<table>
<thead>
<tr>
<th>Region</th>
<th>Incidence per 100,000</th>
<th>Average 2002-2004</th>
<th>Average Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002</td>
<td>2003</td>
<td>2004</td>
</tr>
<tr>
<td>Baltimore Metropolitan Region*</td>
<td>8.41</td>
<td>9.10</td>
<td>6.14</td>
</tr>
<tr>
<td>Suburban Washington†</td>
<td>5.44</td>
<td>5.12</td>
<td>4.06</td>
</tr>
<tr>
<td>Southern Maryland†</td>
<td>3.33</td>
<td>4.84</td>
<td>3.23</td>
</tr>
<tr>
<td>Western Maryland†</td>
<td>2.93</td>
<td>9.15</td>
<td>3.33</td>
</tr>
</tbody>
</table>

*Reference Category
†Significantly different from the reference category (p<0.05). Logistic regression used to test for significance.
Residence in a High-Poultry County
Association with Residence in a High-Poultry County

- Association between *Campylobacter* infection and residence in a county with large numbers of poultry was examined
  - Data from the USDA’s 2002 Census of Agriculture
  - High poultry counties were defined to be counties with at least 5% of the broiler and other meat-type chickens in 2002
High poultry counties were Caroline, Dorchester, Somerset, Worcester, and Wicomico. Together these counties have 90% of the broiler chickens in Maryland.
Association with Residence in a High-Poultry County

Maryland 2002-2004

<table>
<thead>
<tr>
<th>High-Poultry Counties Compared to Low-Poultry Counties*</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.96</td>
<td>1.55-2.50</td>
</tr>
</tbody>
</table>

*Adjusted for sex, age in 5-year increments, and race
Conclusion
Summary of Findings

- Lab-confirmed infection occurs more frequently in males than females.
- Lab-confirmed infection occurs most frequently in young children, with a second peak in young adults.
- Lab-confirmed infection occurs more frequently in Whites than Blacks or Asian/Pacific Islanders.
- Lab-confirmed infection varies by county and region.
- Living in a high-poultry county is associated with higher risk of lab-confirmed infection.
Strengths and Limitations

- **Strengths**
  - Laboratory-confirmed cases
  - Active surveillance of clinical laboratories
  - Cases interviewed by local health departments

- **Limitations**
  - Underestimation of incidence
  - Limited information on risk factors
    - Analysis of risk of living near poultry had very limited exposure information
  - Use of 2003 population estimates for 2004
Future Directions

- University of Maryland project geocoding cases
- FoodNet study investigating laboratory methods
- FoodNet study of *Campylobacter* contamination of retail meats
Acknowledgements

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