Campylobacteriosis in Pennsylvania, 2003-2012

Campylobacteriosis is an infectious disease that is caused by *Campylobacter* bacteria. In humans, illness is caused primarily by one species of the bacteria, *Campylobacter jejuni*. The common symptoms of campylobacteriosis include diarrhea (often bloody), cramping, abdominal pain and fever. These symptoms typically occur two to five days (range one to 10 days) after exposure and often last about one week; however, more serious and long-lasting events such as arthritis, blood-stream infections, and the development of Guillain-Barré Syndrome (acute paralysis caused by an autoimmune response to the bacterial infection) can occur. Treatment generally consists of rehydration and electrolyte replacement. Antibiotics are of value to eliminate the carrier state or for invasive disease.

Although the majority of *Campylobacter* infections are sporadic and not part of an outbreak, large outbreaks can occur and are often the result of drinking contaminated unpasteurized milk. Milk can become contaminated if a cow has a *Campylobacter* infection in its udder or the milk comes into contact with contaminated manure. Thus, a number of *Campylobacter* outbreaks, as well as sporadic cases, are likely associated with the consumption of unpasteurized dairy products, particularly in states like Pennsylvania, where sales of unpasteurized milk are legal.

Data obtained from Pennsylvania’s National Electronic Disease Surveillance System (PA-NEDSS) was used to describe the 10-year burden of *Campylobacter* within the commonwealth. From 2003 to 2012, Pennsylvania had 15,017 reported cases of campylobacteriosis, with an overall average incidence of 12 cases per 100,000 people. Per county, the 10-year average incidence of *Campylobacter* ranged from a high of 48.5 cases per 100,000 people in Mifflin County to a low of 3.7 cases per 100,000 people in Cameron County (Figure 1). The causes of such widely varying incidence by county are

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*Campylobacter* exposure occurs through the fecal-oral route. Transmission is thought to be most often foodborne, whether through undercooked animal products (especially chicken) or cross-contamination during food preparation (for example, a cutting board contaminated by raw meat and then used for other foods that are not later cooked). Infection with *Campylobacter* can also occur from consumption of unpasteurized (raw) dairy products, as well as fresh produce or contaminated water. The bacteria can be transmitted directly from animals to people by contact with manure from farm animals; family pets, especially puppies and kittens, have also been documented to transmit this pathogen through their feces. *Campylobacter* can also be transmitted directly from person to person.

Figure 1: Ten-year average *Campylobacter* incidence
unclear but may reflect in part differences in testing, diagnosis and reporting across jurisdictions. By year, the largest number of cases occurred in 2011, with 1,807 cases and an incidence of 14.2 cases per 100,000 people; 2006 had the lowest number of cases (1,264) and an incidence of 10.2 cases per 100,000 people. In general, the number of cases increased from 2006 to 2011 before dropping to 1,472 cases in 2012 (Figure 2). The southeast (SE) region of Pennsylvania had the highest burden of Campylobacter cases at 5,681, or 37.8 percent of all cases from 2003 to 2012 (Figure 3), reflecting the concentration of population in that corner of the commonwealth.

Of the total cases, 47 percent occurred in females and 53 percent in males. Children 10 years of age and younger had the highest number of reported Campylobacter cases over the 10-year period, followed by the 40 to 49 and 50 to 59 age groups. Ten- to 19-year olds had the lowest total number of reported cases (Figure 4).

Historically, Campylobacter in Pennsylvania is strongly seasonal, with a peak typically seen during June and July but waning numbers of cases during the winter months. One exception was a large outbreak in January 2012 (Figure 5).

Risk factor and clinical data for Philadelphia residents were not available in PA-NEDSS; therefore, Philadelphia cases (N=147) were excluded from additional analyses. Of the remaining 14,870 reported cases, 2,930 (19.7 percent) reported Campylobacter-associated hospitalizations (hospitalization status was missing or unknown for 3,325 cases). By age group, individuals aged 70 and above had the highest percentage of hospitalizations (25.6 percent), and those aged 10 to 19 had the lowest (6.1 percent) [Table 1]. Two cases of Guillain-Barré Syndrome were identified; however, because an estimated one in every 1,000 reported Campylobacter illnesses leads to Guillain-Barré syndrome, it is likely that other unreported cases occurred.1

Of the well-established risk factors for Campylobacter infection, slightly over half of patients (53.6 percent) reported having been around an animal, 7.6 percent of patients reported consuming raw or undercooked meat, 6.7 percent reported exposure to raw or undercooked egg products, and 6.2 percent of patients reported consuming unpasteurized milk or juice. Furthermore, 9.3 percent of patients stated that they traveled outside of the U.S. or Canada in the 10 days prior to illness onset (Table 2). These categories are not exclusive, as some case-patients reported more than one risk factor. Interestingly, children 10 years of age and younger had the highest percentage of patients who consumed unpasteurized milk or juice (30.2 percent), followed by a consistent decrease with increasing age. The 40 to 49 age group had the highest percentage of patients reporting consumption of raw or undercooked meat (19.4 percent) as well as raw egg products (17.9 percent) compared to all other age groups (Table 1).
A total of 71 *Campylobacter* outbreaks occurred from 2003 to 2012, representing only 2.4 percent (N=360) of all reported cases. No *Campylobacter* outbreaks were reported in 2003, and only one outbreak each was reported in 2004 and 2005. We may be missing outbreaks because *Campylobacter* isolates in Pennsylvania (and most other U.S. states) are not routinely subtyped by Pulse-Field Gel Electrophoresis (PFGE) or similar techniques. The highest numbers of outbreaks occurred in 2011 and 2012, each with 14 *Campylobacter* outbreaks (Figure 6). Over the 10-year period, the number of outbreaks per county ranged from a low of zero outbreaks in 30 of Pennsylvania’s 67 counties to a high of eight outbreaks in Crawford County. Of the total cases in the southeast, only 1.2 percent were associated with an outbreak, whereas 6.2 percent of the 1,209 cases in the northwest region were associated with an outbreak.

**Campylobacteriosis prevention:**
- Refrain from consuming unpasteurized milk, especially among young children, pregnant women and immunocompromised persons.
- Avoid consumption of untreated surface water.
- Wash hands with soap and water before, during and after handling raw food.
- Cook poultry products completely, to a minimum temperature of 165°F.
- Avoid cross-contamination during food preparation, for example, by using separate cutting boards for raw and cooked items. Wash hands with soap and water before, during and after coming into contact with both pets and farm animals, especially those with diarrhea.
- Exclude symptomatic persons from food handling.
- In healthcare settings, restrict symptomatic workers from patient care/contact and properly clean and disinfect areas contaminated with stool.

<table>
<thead>
<tr>
<th>Hospitalized (N=2930)</th>
<th>Consumed unpasteurized milk/ juice (N=921)</th>
<th>Consumed raw meat (N=1130)</th>
<th>Consumed raw egg product (N=998)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 9 years</td>
<td>224 (7.7)</td>
<td>278 (30.2)</td>
<td>53 (4.7)</td>
</tr>
<tr>
<td>10 to 19 years</td>
<td>179 (6.1)</td>
<td>140 (15.2)</td>
<td>80 (7.1)</td>
</tr>
<tr>
<td>20 to 29 years</td>
<td>261 (8.9)</td>
<td>143 (15.5)</td>
<td>165 (14.6)</td>
</tr>
<tr>
<td>30 to 39 years</td>
<td>305 (10.4)</td>
<td>113 (12.3)</td>
<td>185 (16.4)</td>
</tr>
<tr>
<td>40 to 49 years</td>
<td>392 (13.4)</td>
<td>91 (9.9)</td>
<td>219 (19.4)</td>
</tr>
<tr>
<td>50 to 59 years</td>
<td>449 (15.3)</td>
<td>79 (8.6)</td>
<td>210 (18.6)</td>
</tr>
<tr>
<td>60 to 69 years</td>
<td>369 (12.6)</td>
<td>36 (3.9)</td>
<td>147 (13.0)</td>
</tr>
<tr>
<td>≥70 years</td>
<td>751 (25.6)</td>
<td>41 (4.5)</td>
<td>71 (6.3)</td>
</tr>
</tbody>
</table>

*Only includes ‘yes’ responses obtained from PA-NEDSS questionnaires
*Excludes Philadelphia
Table 2: Percentage of Patients Reporting Risk Factors for *Campylobacter*
Infection (N=14,870)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>Unknown (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumed unpasteurized milk/juice</td>
<td>6.2</td>
<td>76.8</td>
<td>17.0</td>
</tr>
<tr>
<td>Consumed raw meat</td>
<td>7.6</td>
<td>72.4</td>
<td>20.0</td>
</tr>
<tr>
<td>Consumed raw egg product</td>
<td>6.7</td>
<td>74.6</td>
<td>18.7</td>
</tr>
<tr>
<td>Contact with animal</td>
<td>51.0</td>
<td>33.4</td>
<td>15.6</td>
</tr>
<tr>
<td>Travel outside U.S./Canada</td>
<td>9.3</td>
<td>77.0</td>
<td>13.7</td>
</tr>
<tr>
<td>Consumed meals outside home</td>
<td>53.6</td>
<td>24.8</td>
<td>21.6</td>
</tr>
</tbody>
</table>

*Unknown = Either did not answer the question or were not interviewed
*Excludes Philadelphia

Figure 6: Number of *Campylobacter* outbreaks per year, Pennsylvania, 2003-2012

References:
Summary of Enteric Outbreaks in Pennsylvania, 2009-2012

The Pennsylvania Department of Health, along with six county and four municipal health departments, conducts surveillance of communicable diseases and investigates outbreaks in Pennsylvania. Outbreak control and management are critical elements to ensure the safety and health within a population. In Pennsylvania, all disease outbreaks and/or unusual occurrences of disease are reportable within the commonwealth (by healthcare practitioners, healthcare facilities, clinical laboratories or other entities) under Pennsylvania Code, Title 28, Chapter 27. Pennsylvania utilizes the National Outbreak Reporting System (NORS) to report disease outbreaks to the Centers for Disease Control and Prevention (CDC). NORS captures select de-identified data on outbreaks reported by local, state and territorial health departments in the United States. Data reports in NORS include enteric disease outbreaks of waterborne disease, foodborne disease, person-to-person transmitted disease, animal contact disease, environmental contamination disease and also enteric disease outbreaks of unknown origin.

Outbreaks involve at least two or more individuals who experience illness and share a common risk or exposure. Disease outbreaks are complex, unique events that can involve an array of settings, etiologies, and individuals. Details reported into NORS include specific outbreak-related data such as time, location, number of people ill, symptomatology and pathogen details if known.

The following is a summary of enteric outbreaks that occurred in the state of Pennsylvania (with the exclusion of waterborne outbreaks) as reported to NORS from 2009 to 2012. The report includes outbreaks in which the exposure occurred in Pennsylvania but may include residents of other states. The outbreaks reported herein do not include multi-state outbreaks in which exposure occurred in multiple states.

Number of outbreaks

From 2009 to 2012, Pennsylvania reported a total of 698 outbreaks to NORS. These outbreaks included 26,065 cases of disease, 418 hospitalizations and 14 deaths (Table 1). This report includes only those outbreaks reported to Pennsylvania public health agencies. Pennsylvania was also involved in 49 multi-state outbreaks in which the exposure occurred in multiple states; these outbreaks involved an additional 233 Pennsylvania residents.

There has been a steady increase in the total number of outbreaks reported annually. The increase may be attributed to the use of electronic tools for surveillance of disease. Each year, surveillance techniques are enhanced and provide a more time-sensitive and efficient means for data collection and identification of outbreaks.

Table 1: Pennsylvania outbreaks, illnesses, hospitalizations and deaths reported, 2009-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>No. Outbreaks</th>
<th>No. Illnesses</th>
<th>No. Hospitalizations</th>
<th>No. Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>139</td>
<td>5243</td>
<td>63</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>152</td>
<td>5416</td>
<td>80</td>
<td>6</td>
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<tr>
<td>2011</td>
<td>192</td>
<td>7297</td>
<td>130</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>215</td>
<td>8109</td>
<td>137</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>698</td>
<td>26065</td>
<td>418</td>
<td>14</td>
</tr>
</tbody>
</table>

Etiology

An etiologic agent was identified in 544 (78 percent) of the 698 outbreaks reported from 2009 to 2012 (Table 2). Norovirus accounted for 378 (70 percent) of the total outbreaks where etiology was identified. Other pathogens identified as sources of outbreaks are shown in Table 2.

Despite investigators’ efforts, in 160 outbreaks (30 percent), an etiology was not identified. A variety of circumstances may have prevented identification of the etiologic agent:
- Patient or environmental specimens may not have been available for testing.
- Specimens may have been collected but not tested for the correct pathogen.
Specimens may have been collected after the patient was treated and the pathogen had been cleared.

Too much time may have elapsed between the patient’s illness and specimen collection.

**Mode of Transmission**

The majority of outbreaks from 2009 to 2012 (68 percent) were due to person-to-person transmission. About 11 percent of outbreaks were attributed to ingestion of a contaminated food or beverage. Approximately 20 percent of outbreaks had an unknown mode of transmission, and the remaining outbreaks were associated with animal contact or environmental contamination (Figure 3). Outbreaks involving animal contact occur when humans have direct or indirect interaction with infected animals, do not adequately sanitize their hands, and develop illness subsequent to that interaction. Outbreaks involving environmental contamination occur when humans develop illness after contact with surfaces that are known to be tainted with vomit, fecal matter or other infectious agents.

**Person-to-Person Transmission**

Person-to-person outbreaks most often occurred in the setting of long-term care facilities or other senior housing facilities. These outbreaks were largely caused by norovirus. Norovirus is highly transmissible; exposure to even a very tiny quantity of norovirus particles can cause illness. Additionally, norovirus can remain viable for weeks on surfaces not properly sanitized. Congregate settings, where people are in close proximity to one another and share common surfaces such as handrails and furniture, foster communicability. Another contributing factor is declining physical and cognitive abilities in elderly residents, which may result in decreased hand hygiene. For more information on norovirus, see CDC’s [Norovirus Key Facts](https://www.cdc.gov/norovirus/index.html) and [Healthcare Facilities Fact Sheet](https://www.cdc.gov/norovirus/pdf/community-guidance-healthcare-facilities.pdf).

Of those person-to-person outbreaks where the etiology was known, 90 percent involved norovirus. The remaining 10 percent involved *Shigella*, *Salmonella*, *Giardia*, *Campylobacter*, or shiga toxin-producing *Escherichia coli (STEC)*.

**Foodborne Transmission**

Food was the probable vehicle in 11 percent of outbreaks between 2009 and 2012. Dairy products were the most commonly reported food vehicle, accounting for nearly 25 percent of outbreaks with a known food vehicle. Many of these outbreaks were associated with consumption of raw milk. Unpasteurized products, like raw milk, may contain bacteria that could lead to human illness following ingestion. Other foodborne outbreaks were caused by beef, poultry, leafy greens and pork. Several outbreaks were related to complex commodities such as “soup” or “sandwich” (where the food item contained multiple ingredients) and a specific ingredient was not implicated. Of the outbreaks caused by complex food items, norovirus was the enteric agent most frequently identified, followed by *Salmonella* and *Campylobacter*.
Additional causes of foodborne outbreaks included toxins (Bacillus cereus, ciguatoxin or mycotoxin), STEC, Staphylococcus, Yersinia and low-level pesticides.

**Animal Contact**
There were three outbreaks involving animal contact between 2009 and 2012. Many outbreaks involving animal contact are due to poor hand hygiene after handling live animals or following contact with animal habitats. Children are particularly vulnerable, as they are not as diligent in hand-washing practices as adults. Salmonella was responsible for two outbreaks involving contact with turtles. The other animal contact outbreak was a Campylobacter outbreak associated with cattle.

To learn more about Salmonella and animals, please refer to CDC’s website on Salmonella Infection and Animals.

**Conclusion**
The Pennsylvania Department of Health and CDC use this outbreak data 1) to gain a better understanding of the magnitude of outbreaks and national trends, the impact on human health, foods causing illness, settings where illness occurs, contributing factors in outbreaks, and 2) to devise a collection of lessons learned for the prevention of future outbreaks.

If you wish to report an outbreak to the Pennsylvania Department of Health, please call 1-877-PA-HEALTH.

**FOOD – A Public Resource**
Outbreak data reported to NORS is available to the public through a CDC tool known as the Foodborne Outbreak Online Database (FOOD). This web-based tool allows users to search for outbreak information by year, state, location, etiology, total ill and severity of illness.

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**Doing More for Chronic Hepatitis in Philadelphia**

The Philadelphia Department of Public Health (PDPH) is excited to announce the 2013 launch of its enhanced viral hepatitis surveillance program, a CDC-funded initiative whose goals are to better understand the burden of chronic hepatitis B and chronic hepatitis C and to determine the level of clinical management for these diseases. The Hepatitis Epidemiology Program (HEP) is comprised of Surveillance Coordinator Kendra Viner, Prevention Coordinator Alex Shirreffs, Epidemiologist Danica Kuncio, and Surveillance Investigators Champagnae Smith, Amy Hueber, and Jasmine Santos. When PDPH receives a positive hepatitis B virus (HBV) or hepatitis C virus (HCV) test report associated with a new case, HEP investigators contact providers and patients to obtain demographic, laboratory, clinical and risk factor information about the patient. The data collected are then used to better inform patient and provider educational efforts and identify additional areas for public health action in Philadelphia.

Since the start of HEP, 395 chronic HBV and 1,064 chronic HCV cases have been investigated. Of these, 56 percent of HBV(+) and 65 percent of HCV(+) individuals were male. While the HBV(+) cases were largely of Asian/Pacific Islander descent (53 percent), the majority of HCV(+) patients were African-American (56 percent) or white (30 percent). The major risk factors for HBV infection included foreign-born status and/or living outside of the US for at least six months (75 percent) and contact with an HBV-positive friend or family member (36 percent). In contrast, the primary risk factors for HCV infection included injection drug use (52 percent), incarceration for at least 48 hours (50 percent) and having at least one tattoo (46 percent). As shown in Figure 1, the majority of HCV(+) cases were in the 45- to 64-year old, or ‘baby boomer’, age range. While fewer than half of HBV(+) patients had multiple risk factors, 67 percent of HCV infected patients had multiple risk factors.
In addition to conducting surveillance, HEP is working closely with key stakeholders in Philadelphia, including the Hepatitis C Allies of Philadelphia (HepCAP, a citywide collective developed by Ms. Shirreffs) and Hep B United in order to improve the continuum of hepatitis prevention, diagnosis, care and support services in Philadelphia. Through its relationships with internal and external stakeholders, HEP has set up a ‘fast-track’ hepatitis A (HAV)/HBV vaccine clinic for uninsured HCV patients, routinely distributes educational materials to patients and providers identified through the investigative process as wanting additional information and has led hepatitis in-service meetings with local health-care providers. HEP is also piloting an HCV testing program at Philadelphia’s only syringe exchange program, Prevention Point.

HEP looks forward to strengthening its community partnerships and continuing expanded hepatitis surveillance in 2014. For more information about the HEP surveillance program, please contact Kendra Viner at kendra.viner@phila.gov.

For information on upcoming HepCAP meetings, contact Alex Shirreffs at alexandra.shirreffs@phila.gov.

Figure 1: Age Distribution of Newly Chronic Confirmed HBV and HCV Cases by Gender, Philadelphia 2013
Disease Reporting

Healthcare practitioners, healthcare facilities and clinical laboratories are required to report certain diseases to the Pennsylvania Department of Health. In addition to the diseases on the list, all disease outbreaks and/or unusual occurrences of disease are reportable within the commonwealth. In most cases, reporting must be done electronically via Pennsylvania's version of the National Electronic Disease Surveillance System (PA-NEDSS).

To request a PA-NEDSS account, healthcare providers may email PA-NEDSS@pa.gov; please include your contact information and the name and address of the facility for which you will be reporting.

Cases of select notifiable diseases in Pennsylvania *
(as of 2/8/14)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Total cases reported for previous 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2014 †</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>5,494</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>1,437</td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>79</td>
</tr>
<tr>
<td>Giardiasis</td>
<td>62</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>55</td>
</tr>
<tr>
<td>Pertussis (whooping cough)</td>
<td>53</td>
</tr>
<tr>
<td>Legionellosis</td>
<td>22</td>
</tr>
<tr>
<td>Varicella (chicken pox)</td>
<td>21</td>
</tr>
<tr>
<td>Cryptosporidiosis</td>
<td>12</td>
</tr>
<tr>
<td>Shigellosis</td>
<td>8</td>
</tr>
</tbody>
</table>

* Confirmed cases only
† Case counts for 2013 and 2014 are provisional and subject to change. Counts for earlier years are for complete years.

For employment opportunities, visit the Pennsylvania State Civil Service Commission website.

Pennsylvania Epi Notes

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