I. Statement of the Problem

*Campylobacter* is estimated to be the most common cause of bacterial diarrheal illness in the United States, and the incidence of reported infections has been increasing since the early 2000s. To facilitate tracking national trends and assessing the impact of control measures, this position statement proposes to add campylobacteriosis to the CSTE Nationally Notifiable Conditions (NNC) list.

II. Background and Justification

*Campylobacter* is estimated to be the most common cause of bacterial diarrheal illness in the United States. An estimated 1.3 million cases occur each year, of which 845,000 are estimated to be foodborne [1]. *Campylobacter* generally causes a self-limited clinical illness typically characterized by diarrhea (frequently with bloody stools), abdominal cramps, malaise, fever, nausea, and vomiting; asymptomatic infection also occurs frequently. Severe symptoms and invasive infections can also occur, and persons with *Campylobacter* infections are at increased risk for three post-infectious complications: Guillain-Barre syndrome (GBS), reactive arthritis, and irritable bowel syndrome. *C. jejuni* is the most commonly identified antecedent of GBS, preceding paralysis in 30% of GBS patients [2]. Reactive arthritis is estimated to occur in 2-5% and irritable bowel syndrome in 33% of patients following *Campylobacter* infection and can last for months to years after infection [3,4]. Immunocompromised persons have a higher risk of *Campylobacter* infection, recurrence, severe disease, and death. Medical care and lost productivity due to campylobacteriosis in the United States each year are estimated to cost $1.7 billion [5]. The incidence of infection is increasing; the overall rate measured in FoodNet sites in 2013 was 13% higher than in 2006–2008 [6]. The number of reported outbreaks has also increased from an average of 27 per year from 2000–2008 to 44 per year from 2009–2011 [7, 8].

*Campylobacter* infection is transmitted by the fecal-oral route, usually through ingestion of contaminated food or water or through direct contact with infected animals. Person-to-person transmission is uncommon. Raw (unpasteurized) milk and dairy products are the most common outbreak vehicles, and poultry is the food most commonly associated with sporadic infections [7,9]. Most *Campylobacter* infections are acquired domestically, but *Campylobacter* is a major cause of traveler’s diarrhea [10]. Because foodborne transmission is responsible for most infections, *Campylobacter* is of great concern to federal regulatory agencies. In 2011, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA) implemented measures targeted at decreasing poultry-associated *Campylobacter* infections and outbreaks. Also, the Food Safety Modernization Act (FSMA) gives the US Food and Drug Administration (FDA) additional authority to regulate food facilities, establish standards for safe produce, recall contaminated foods, oversee imported foods, and requires CDC to strengthen surveillance and response to outbreaks. Lacking national surveillance data limits the ability to assess the impact of control measures outside of FoodNet sites.

Active, sentinel-based surveillance for culture-confirmed *Campylobacter* infections has been conducted in the Foodborne Diseases Active Surveillance Network (FoodNet) since 1996. The FoodNet catchment area covers approximately 15% of the U.S. population. Any state can voluntarily report *Campylobacter* data to CDC’s Nationally Notifiable Diseases Surveillance System (NNDSS), but because campylobacteriosis is not a nationally notifiable condition, these data are not consistently reported and are not validated. The limited information available from NNDSS suggests that the states with the highest burden are not included in FoodNet (CDC, unpublished data). However, campylobacteriosis was included in the reporting rules of 49 states or territorial jurisdictions in 2010, according to the State Reportable Conditions Assessment [11]. Because almost all states collect data on *Campylobacter*...
infection, designating campylobacteriosis nationally notifiable would allow CDC to be routinely notified of these illnesses and the reported data validated.

In 2012, CSTE position statement 11-ID-10 created a national campylobacteriosis definition to facilitate standardized case reporting and ascertainment across jurisdictions. This definition considers both traditional culture-based methods and culture-independent diagnostic tests (CIDT) for diagnosis of Campylobacter infection; currently, ill persons with positive results only from CIDTs are assigned a suspect case status [12]. There is evidence that the demographics of reported culture-confirmed cases differ from those with positive CIDTs [13]. CIDT uptake is increasing rapidly. FDA-approved tests with improved performance characteristics are steadily coming on the market with two multiplex nucleic acid tests approved in May 2014, and public health case definitions must keep pace, or surveillance will suffer [13–15]. In 2013, 13% of Campylobacter cases reported to FoodNet were diagnosed only by CIDTs [16]. This position statement proposes that illnesses with positive results from CIDTs for Campylobacter be reported as probable cases. Illnesses among persons who are epidemiologically linked to a confirmed or probable case will be classified as probable cases.

It is likely that many Campylobacter outbreaks are not detected in part because the available molecular subtyping techniques have low discriminatory power and are not widely applied; however, advanced molecular techniques such as multilocus sequence typing and whole genome sequencing (WGS) offer promising pathways to better understand sources of Campylobacter infections in humans and to improve outbreak detection. WGS is quickly becoming cost-effective. It is anticipated to be useful for outbreak detection and surveillance, as well as for detection of antibiotic resistance and virulence determinants [17, 18]. The availability of comprehensive, national surveillance data paired with advanced molecular subtyping has led to dramatic reductions in the incidence of Campylobacter in other countries. The most notable example is New Zealand, where identification of a specific multilocus sequence subtype that was linked to a specific poultry producer led to interventions which resulted in a 54% decline in national incidence of campylobacteriosis [19]. Designating campylobacteriosis as nationally notifiable may make implementation of national Campylobacter subtyping by WGS or other advanced molecular methods more feasible and effective.

In summary, there are multiple reasons to include campylobacteriosis in the NNC list and to report CIDT-diagnosed illnesses as probable cases. National surveillance for campylobacteriosis can help in measuring the burden of illness, its geographic variation, and trends over time; this information will help in estimating the proportion of illnesses associated with specific foods and settings. The incidence of infection is increasing, and more outbreaks are being recognized. National notification would contribute to understanding the evolving epidemiologic profile of the disease in the United States, enable health officials to develop targeted education and prevention programs for the public and healthcare providers, provide regulatory agencies information related to the effectiveness of interventions, and enhance surveillance and data sharing between local and state health entities.

III. Statement of the desired action(s) to be taken

1. Utilize standard sources (e.g. reporting*) for case ascertainment for campylobacteriosis. Surveillance for campylobacteriosis should use the following recommended sources of data to the extent of coverage presented in Table III.

<table>
<thead>
<tr>
<th>Source of data for case ascertainment</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population-wide</td>
</tr>
<tr>
<td>Clinician reporting</td>
<td>X</td>
</tr>
<tr>
<td>Laboratory reporting</td>
<td>X</td>
</tr>
</tbody>
</table>
2. Utilize standardized criteria for case identification and classification (Sections VI and VII) for campylobacteriosis and add campylobacteriosis to the Nationally Notifiable Condition List.

   - 2a. Immediately notifiable, extremely urgent (within 4 hours)
   - 2b. Immediately notifiable, urgent (within 24 hours)
   - X 2c. Routinely notifiable

CSTE recommends that all States and Territories enact laws (statute or rule/regulation as appropriate) to make this disease or condition reportable in their jurisdiction. Jurisdictions (e.g., States and Territories) conducting surveillance (according to these methods) should submit case notifications** to CDC.

3. CDC should publish data on campylobacteriosis as appropriate in MMWR and other venues (see Section IX). Both confirmed and probable cases should be published in MMWR summaries.

CSTE recommends that all jurisdictions (e.g., States or Territories) with legal authority to conduct public health surveillance follow the recommended methods as outlined above.

Terminology:
* Reporting: process of a healthcare provider or other entity submitting a report (case information) of a condition under public health surveillance TO local or state public health.
**Notification: process of a local or state public health authority submitting a report (case information) of a condition on the Nationally Notifiable Condition List TO CDC.

4. State health departments should create a variable to distinguish CIDT-diagnosed probable Campylobacter cases from probable cases that are epidemiologically linked to a culture-confirmed or CIDT-diagnosed case. This differentiation of probable cases will facilitate assessment of the impact of CIDT on surveillance.

5. Likewise, CDC should create a variable to distinguish CIDT-diagnosed probable cases from probable cases that are epidemiologically linked to a culture-confirmed or CIDT-diagnosed case, to assess the impact of CIDT on surveillance.

6. State health departments should create a variable to document the Clinical Laboratory Improvement Amendments (CLIA) number for the laboratory that conducted the testing for each case. This will provide information that can help determine the diagnostic test used and thus facilitate assessment of performance, uptake and impact of CIDTs on surveillance.

7. Likewise, CDC should create a variable to collect the CLIA number for the laboratory that conducted the testing for each case. This will provide information that can help determine the diagnostic test used and thus facilitate assessment of the uptake and impact of CIDTs on surveillance.
IV. Goals of Surveillance
To provide information on the temporal, geographic, and demographic occurrence of campylobacteriosis to facilitate its prevention and control. Surveillance for campylobacteriosis can help to identify and control outbreaks and determine sources of public health concern (e.g., a commercial raw milk dairy or public water supply); this work leads to measures that stop transmission.

V. Methods for Surveillance:
Surveillance for campylobacteriosis should use the recommended sources of data and the extent of coverage listed in Table III.

VI. Criteria for case identification

A. Narrative: A description of suggested criteria for case ascertainment of a specific condition.
Report any illness to public health authorities that meets any of the following criteria:

1. Any person with Campylobacter spp. isolated from a clinical specimen.
2. Any person with Campylobacter spp. detected in a clinical specimen using culture independent diagnostic tests (CIDT).
3. Any person with at least one gastrointestinal symptoms of illness such as diarrhea, abdominal cramping, nausea, vomiting and who is either a contact of a confirmed case of campylobacteriosis or a member of a risk group as defined by the public health authorities during an outbreak.
4. A person whose healthcare record contains a diagnosis of campylobacteriosis.
5. A person whose death certificate contains campylobacteriosis as a contributing or underlying cause of death.

Other recommended reporting procedures:
All cases of campylobacteriosis should be reported according to state regulations.
Reporting should be ongoing and routine.
Frequency of reporting should follow the state health department's routine schedule.

B. Table of criteria to determine whether a case should be reported to public health authorities

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Campylobacteriosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical Evidence</strong></td>
<td>Campylobacteriosis</td>
</tr>
<tr>
<td>Clinically compatible illness</td>
<td>N</td>
</tr>
<tr>
<td>Healthcare record contains a diagnosis of campylobacteriosis</td>
<td>S</td>
</tr>
<tr>
<td>Death certificate contains campylobacteriosis as a contributing or underlying cause of death</td>
<td>S</td>
</tr>
<tr>
<td><strong>Laboratory Evidence</strong></td>
<td></td>
</tr>
<tr>
<td>Isolation of Campylobacter spp. from a clinical specimen</td>
<td>S</td>
</tr>
<tr>
<td>Detection of Campylobacter spp. in a clinical specimen using a CIDT</td>
<td>S</td>
</tr>
<tr>
<td><strong>Epidemiological Evidence</strong></td>
<td></td>
</tr>
<tr>
<td>Epidemiologically linked to a confirmed or probable laboratory-confirmed case of Campylobacter</td>
<td>S</td>
</tr>
</tbody>
</table>
Notes:
S = This criterion alone is Sufficient to report a case.
N = All “N” criteria in the same column are Necessary to report a case.
O = At least one of these “O” (Optional) criteria in each category (e.g., clinical evidence and laboratory evidence) in the same column—in conjunction with all “N” criteria in the same column—is required to report a case.

C. Disease-specific data elements
Disease-specific data elements to be included in the initial report are listed below.

   Basic demographics

   Clinical Information
   • Date of onset and outcome
   • Reported symptoms and signs of illness
   • Hospitalized

   Epidemiological Risk Factors
   • International travel in past 10 days
   • Consumption of undercooked meat or contact with raw meat, especially poultry
   • Consumption or exposure to implicated vehicle (suspected or confirmed food vehicles and locations where implicated food vehicle(s)) was/were prepared and eaten
   • Drinking untreated water or contact with untreated recreational water including location and dates of exposure
   • Consumption of raw milk or an unpasteurized dairy products including date(s) of exposure
   • Contact with pets, farm animals with Campylobacter spp.
   • Contact with a confirmed or probable case of campylobacteriosis

   Laboratory Information
   • CLIA number of laboratory that conducted the testing
   • Method(s) of laboratory testing (e.g., culture or CIDT [FDA-approved or not FDA-approved PCR or antigen-based test])
   • Type of antigen testing (e.g., EIA test format [e.g., lateral flow or microplate]) and manufacturer
   • Name of test and manufacturer, as available

VII. Case Definition for Case Classification

A. Narrative: Description of criteria to determine how a case should be classified.

   Clinical Criteria
   An illness of variable severity commonly manifested by diarrhea, abdominal pain, nausea and sometimes vomiting. The organism may also rarely cause extra-intestinal infections such as bacteremia, meningitis or other focal infections.

   Laboratory Criteria
   Probable: Detection of Campylobacter spp. in a clinical specimen using a CIDT.
   Confirmed: Isolation of Campylobacter spp. from a clinical specimen.
Epidemiologic Linkage

Probable: A clinically compatible case that is epidemiologically linked to a case that meets the probable or confirmed laboratory criteria for diagnosis.

Criteria to distinguish a new case of this disease or condition from reports or notifications which should not be enumerated as a new case for surveillance:
A case should not be counted as a new case if laboratory results were reported within 30 days of a previously reported infection in the same individual.

Comment:
The use of CIDTs as stand-alone tests for the direct detection of Campylobacter in stool is increasing. Data regarding their performance indicate variability in the sensitivity, specificity, and positive predictive value of these assays depending on the manufacturer (CDC unpublished data). It is therefore useful to collect information on the laboratory conducting the testing using the laboratory's unique CLIA number, and when possible, type and manufacturer of the CIDT used to diagnose each case. Culture confirmation of CIDT-positive specimens is ideal, but not practical to achieve in most jurisdictions.

B. Classification Tables

Table VII-B. Criteria for defining a case of campylobacteriosis.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Confirmed</th>
<th>Probable Laboratory Evidence</th>
<th>Probable Epi-linked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhea</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Abdominal cramping</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Nausea</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Vomiting</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Febrile bacteremia</td>
<td>O</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>Meningitis</td>
<td>O</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>Focal infection</td>
<td>O</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>Healthcare record contains a diagnosis of campylobacteriosis</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death certificate containing campylobacteriosis as a contributing or underlying cause of death</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory Evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detection of Campylobacter spp. in a clinical specimen using a CIDT</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation of Campylobacter spp. from a clinical specimen</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epidemiological Evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epidemiologically linked to a confirmed or probable laboratory-confirmed case of campylobacteriosis</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Member of a risk group as defined by the public health authorities during an outbreak</td>
<td>O</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Criteria to distinguish a new case:
Not counted as a new case if occurred within 30 days of a previous reported case in the same individual

| N | N | N |

Notes:
S = This criterion alone is Sufficient to classify a case.
N = All "N" criteria in the same column are Necessary to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype (see below).
A = This criterion must be absent (i.e., NOT present) for the case to meet the classification criteria.
O = At least one of these "O" (Optional) criteria in each category (e.g., clinical evidence and laboratory evidence) in the same column—in conjunction with all "N" criteria in the same column—is required to classify a case. (These optional criteria are alternatives, which means that a single column will have either no O criteria or multiple O criteria; no column should have only one O.) A number following an "O" indicates that this criterion is only required for a specific disease/condition subtype.

VIII. Period of Surveillance.
Surveillance should be ongoing.

IX. Data sharing/release and print criteria
● Data will be used to monitor the burden of illness due to Campylobacter, trends in illness over time, assess the effectiveness of control programs, and monitor progress toward decreasing campylobacteriosis. Data may also be used to compare cases across jurisdictions.
● Information may be distributed among states and territories or to CDC depending on the current epidemiologic situation or jurisdiction specific protocols. Unusual situations may increase the need for communication. For example, results of ad-hoc analyses may be made available to health departments involved in investigations. Frequency of cases, epidemiologic distribution, and other factors will influence communications.
● States and territories will share data with CDC according to jurisdiction specific protocols.
● State-specific data on cases, if shared with CDC, will be verified before publication.

X. References


XI. Coordination

Agencies for Response

(1) Centers for Disease Control and Prevention
Thomas R. Frieden, MD, MPH
Director
1600 Clifton Road, NE
Atlanta, GA 30333
(404) 639-7000
txf2@cdc.gov

XII. Submitting Author:

(1) Kristy K. Bradley, DVM, MPH, DACVPM
State Epidemiologist and State Public Health Veterinarian
Oklahoma State Department of Health
1000 NE Tenth Street, Room 606
Oklahoma City, OK 73117
(405) 271-7637
kristyb@health.ok.gov
Co-Author:

☐ Active Member

(1) Alfred DeMaria, Jr., M.D.
Medical Director, Bureau of Infectious Disease; State Epidemiologist
Massachusetts Department of Public Health; William A. Hinton State Laboratory Institute
305 South Street
Jamaica Plain, Massachusetts 02130
617-983-6550
Alfred.DeMaria@state.ma.us

☐ Associate Member

(2) Aimee Geissler, PhD, MPH
Epidemiologist, Division of Foodborne, Waterborne and Environmental Diseases
Centers for Disease Control and Prevention
1600 Clifton Road, NE MS C-09
Atlanta, GA  30333
(404) 639-2206
ageissler@cdc.gov