UTAH DEPARTMENT OF HEALTH

Clostridium difficile

Disease Plan

Quick Links

Written: July 16, 2018, by Maureen Vowles.

Questions about this disease plan?

Contact the Utah Department of Health Bureau of Epidemiology: 801-538-6191.

✓ CRITICAL CLINICIAN INFORMATION

Clinical Evidence
Individuals can be colonized with *Clostridium difficile* bacteria and show no symptoms. Reliably differentiating between colonization and infection is an important clinical challenge in the diagnosis of *Clostridium difficile* infection (CDI). Signs/Symptoms of primary CDI • Watery diarrhea (three or more loose stools per day for two days or more) • Fever • Loss of appetite • Nausea • Abdominal pain/tenderness Complications secondary to CDI • Pseudomembranous colitis (PMC) • Toxic megacolon • Sepsis • Perforations of the colon • Death
Period of Communicability • Unknown and variable. However, since there is evidence that the *C. diff* organism continues to be shed in the feces beyond symptom resolution, many facilities continue contact precautions for the duration of the stay (CDC, 2012a).
Incubation Period • The incubation period is not well defined, however, research suggests an incubation period of around seven days with a median of two to three days (CDC, 2012b).
Mode of Transmission • *C. diff* is shed in feces and primarily spread by the fecal-oral route or via rectal thermometer use. • *C. diff* bacteria and spores can survive and persist for up to five months on environmental surfaces and medical equipment, and, therefore, contamination of hands of healthcare personnel becomes an important transmission factor.
Laboratory Testing
Type of Lab Test Various methodologies: • Toxigenic culture – slow turn-around time but considered the gold-standard • Molecular tests (FDA-approved PCR assays which test for the gene encoding toxin B) – highly specific and sensitive • Antigen detection of *C. diff* – non-specific, but often employed with PCR testing for toxin detection in a two-step algorithm • Toxin testing for *C. diff* Timing of Specimen Collection and Testing: • Because *C. diff* toxin degrades at room temperature in as short as two hours, ideally testing should be performed within two hours of collection or samples should be refrigerated until able to test. • The sudden onset of three or more diarrheal stools in a patient (who is not receiving laxatives) within a 24-hour period provides sufficient grounds to alert a facility to collect a stool sample for testing (APIC, 2014).
Type of Specimens • Soft, unformed and diarrheal stools are suitable for *C. diff* testing. • In general, hard and formed stool samples are not suitable for *C. diff* testing and should be

rejected and excluded from testing.

- Most *C. diff* tests require fresh, unpreserved stool. However, some contemporary PCR testing methodologies such as the *GI FilmArray*^{R} utilize stool preserved in Cary Blair transport media.

Treatment Recommendations

Type of Treatment

- Antibiotic treatment and primary CDI – *Vancomycin or fidaxomicin is the preferred treatment, however, CDI returns in about 20% of antibiotic-treated patients.
- Stool transplant – transfer of stool from a healthy patient to the colon of a patient with repeated CDI appears to be an effective long-term treatment (CDC, 2012a).

(*Metronidazole not FDA-approved; sometimes recommended for mild CDI)

Time-Period to Treat

- Antibiotics used to treat CDI should be administered orally and continued for a period of at least 10 days.

Prophylaxis

- Hand washing, proper hygiene practices, the wearing of PPE and environmental cleaning are the best ways to prevent spread of *C. diff* in healthcare settings.
- Since alcohol-based hand sanitizers do not kill *C. diff* spores, hand washing is more effective against CDI.

Contact Management

Isolation of Case

- The CDC (HICPAC, 2007) recommends contact and standard precautions for the **duration of the illness,** which is generally considered that of a resolved case, i.e., the patient has had no diarrhea for at least 48 hours and has had a formed or normal stool for that patient (HPSC, 2014). However, there is no set rule and this is generally dependent upon the **patient setting** and **length of stay**. Many facilities continue isolation for either several days following symptom resolution or until patient discharge because *C. diff*-infected patients continue to **shed organism** for a number of days following resolution of diarrhea (CDC, 2012a).
- Healthcare workers and food handlers with CDI are considered high-risk for spreading the disease and should be excluded from work for at least 24-48 hours beyond symptom resolution.

Quarantine of Contacts

- Evidence links cohorting patients with CDI at increased risk of symptomatic recurrence and therefore discourages shared rooming of cases (Islam et al, 2013).

Infection Control Procedures

- Since *C. diff* spores persist in the environment for up to five months, high-touch surfaces and shared patient equipment should be cleaned daily, when soiled and between use.
- Patient rooms should be thoroughly cleaned upon patient discharge and before new occupancy (terminal cleaning) with EPA-approved List K cleaning products effective against *C. diff* spores (Link to List K 2018: https://www.epa.gov/pesticide-registration/list-k-epas-registered-antimicrobial-products-effective-against-clostridium)
- Link to CDC terminal cleaning checklist: https://www.cdc.gov/HAI/toolkits/Environmental-Cleaning-Checklist-10-6-2010.pdf

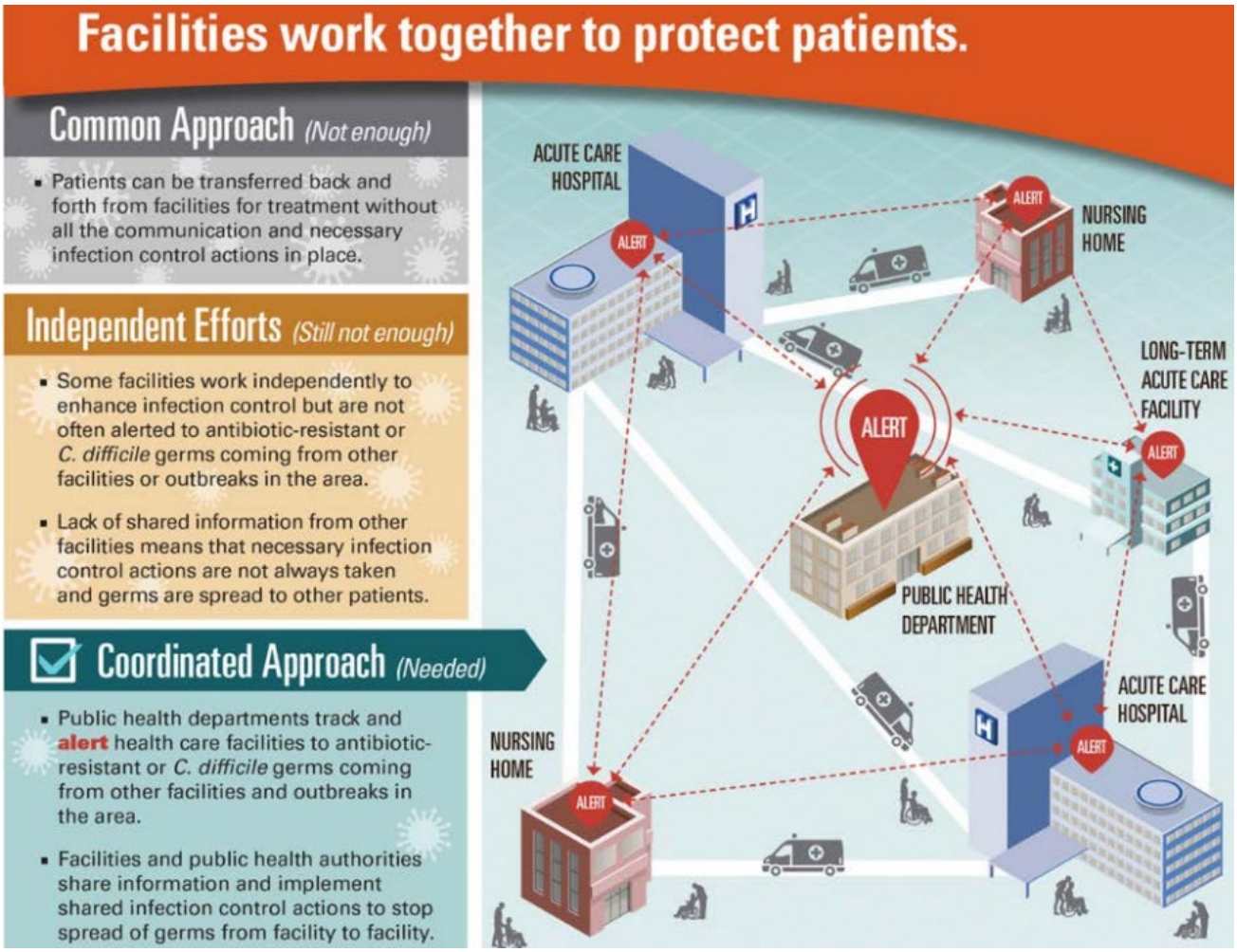
✓ WHY IS CLOSTRIDIUM DIFFICILE IMPORTANT TO PUBLIC HEALTH?

With acute healthcare hospitalization costs of *Clostridium difficile* infection (CDI) exceeding $4 billion per year, *C. diff* is the most common microbial cause of healthcare-associated infections (HAI) in the U.S. Of the almost half a million cases of CDI annually, almost 30,000 patients died within 30 days of their primary diagnosis. Approximately one out of every 10 elderly patients over the age of 65 years, died within one month of being diagnosed with *Clostridium difficile* infection (CDI). The high mortality, morbidity and medical costs associated with CDI coupled with recurrence in 1 in 5 cases, warrant prompt diagnosis and effective measures to prevent spread of the disease. Hand washing has been identified as the most important factor to prevent spread of the disease in health care settings.

Most CDI cases occur during an inpatient stay in a healthcare facility or nursing home with several occurring in the community within one month of discharge from a facility. The disruption of normal fecal flora in the human gut due to the overuse of broad spectrum antibiotics also adds to the disease burden by providing a breeding ground for *C. diff* bacteria. In fact, recent studies conducted by the Centers for Disease Control and Prevention (CDC) have shown that a 30% decrease in broad spectrum antibiotic use could reduce the *C. diff* infection rate by over 25% in hospitalized patients (CDC, 2015). This has in turn led to the development of “antibiotic stewardship” programs within healthcare facilities. (ARHQ toolkit to help hospitals implement antibiotic stewardship programs to reduce *C. diff* infections – CDC, 2015). Evidence also points to significantly lower rates of community-acquired CDI cases in outpatient settings when antibiotics are prescribed only for bacterial infections, and not used unnecessarily for upper respiratory viral infections against which they are ineffective.

An **interconnected facility approach** is the most effective way to protect patients and lower the *C. diff* disease burden. This involves the sharing of information with public health and between facilities on transfer using transfer forms and implementing joint infection control actions to prevent the spread of *C. diff* from facility-to-facility. Facilities cannot work independently and public health plays a central role in this process by providing support and tracking antibiotic resistant *C. diff* bacteria coming in from other facilities and outbreaks in the area (Figure 1). The importance of communicating patient CDI status upon patient transfer cannot be underscored. See the Utah Inter-facility Transfer Form.

Figure 1. Outline of an interconnected facility approach to CDI prevention and containment highlighting the central role of public health



(Source: APHL 2017 Annual Meeting)

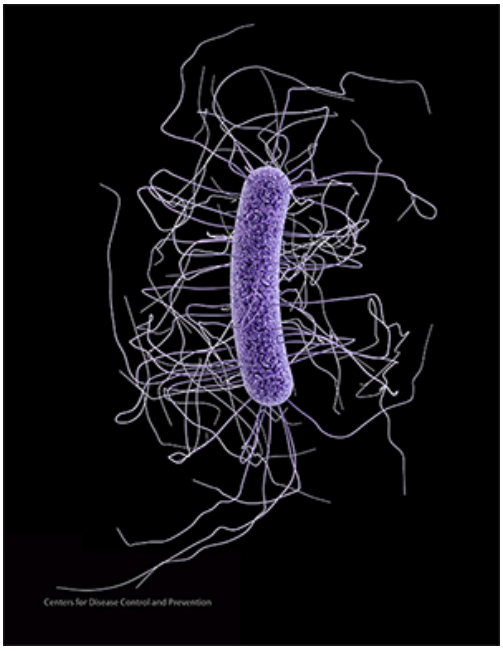
✓ DISEASE AND EPIDEMIOLOGY

Clinical Description

CDI typically presents with symptoms of nausea, watery diarrhea, malaise, fever and abdominal pain. In fact, three or more diarrheal stools within a 24-hour period should provide high suspicion for CDI, in a person not receiving laxatives, and provide a facility alert for patient testing (APIC, 2014). Dehydration is a common complication especially among elderly and immunocompromised hospitalized patients. Furthermore, secondary and more serious disease complications of CDI include, but are not limited to: pseudomembranous colitis (PMC), toxic megacolon, bacteremia, perforations of the colon and even death.

Causative Agent

C. diff bacteria are anaerobic gram positive bacilli that produce spores. These bacteria are shed in feces and take hold and multiply in the colons of patients whose normal bowel flora has been disrupted by recent antibiotic treatment, producing toxins. The two toxins (A and B) are responsible for the diarrheal symptoms and sequelae attributed to CDI. This bacterium is recognized as the most common cause of healthcare-associated gastroenteritis

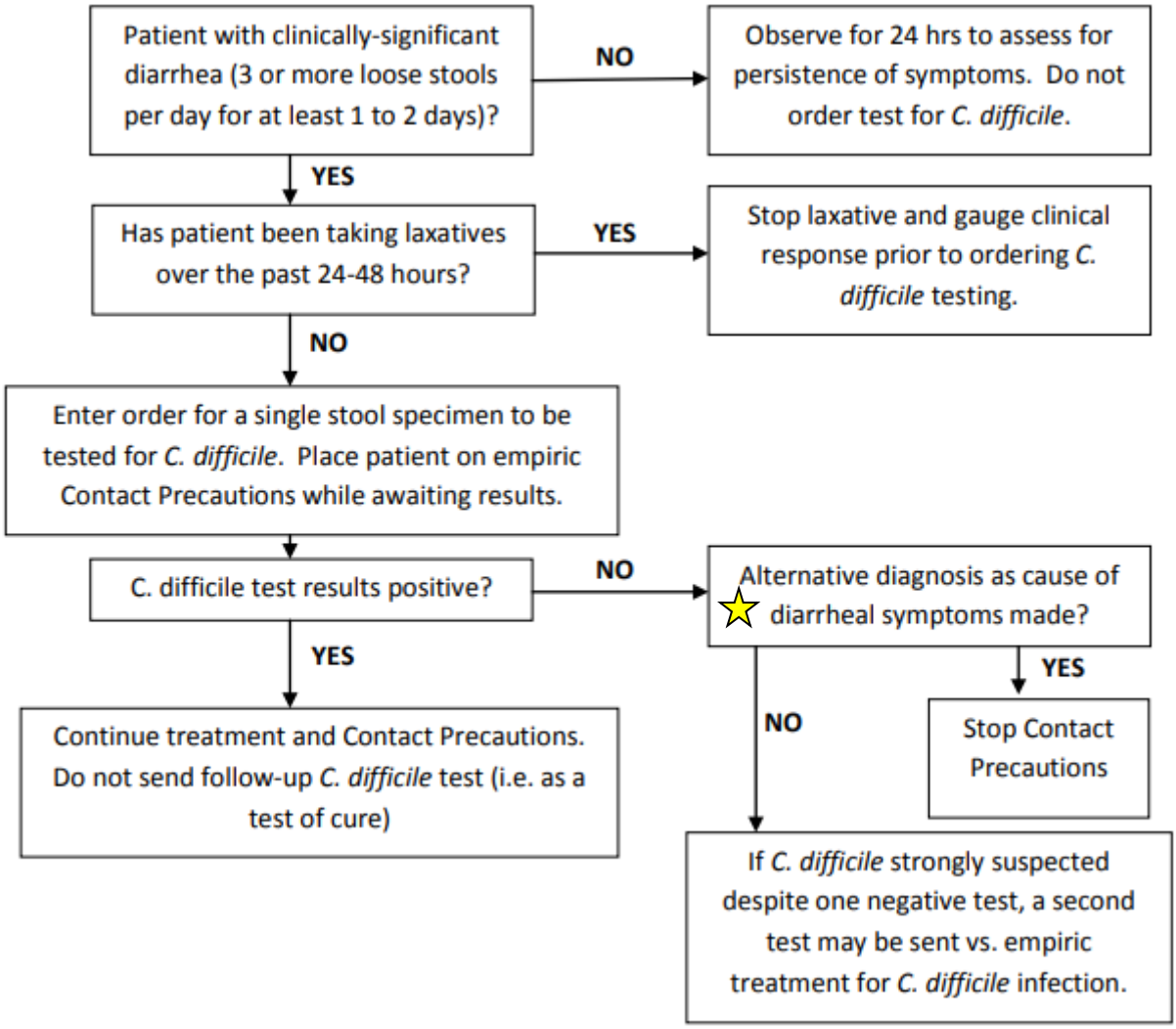


Medical illustration of *Clostridium difficile* bacteria (CDC Photo, 2012)

Differential Diagnosis

The differential diagnosis for CDI includes other bacterial and viral agents of gastroenteritis such as *Salmonella* spp., *Shigella* spp., *Campylobacter* spp., norovirus and rotavirus. However, since *C. diff* is not the causative agent in over 60% of facility-onset diarrheal cases (CDC, 2009), the whole clinical picture should be considered before testing for this agent. To this end, many facilities have produced diagnostic stewardship protocols which include considering factors such as: ruling out other causes of diarrhea; laxative-use; and deviations from what is considered 'normal' stool consistency for the patient. An example of a diagnostic stewardship algorithm for CDI is shown in the flowchart in Figure 2.

Figure 2. Example of diagnostic stewardship algorithm for CDI



★ If *C. difficile* test results are negative and an alternative diagnosis is made, stop Contact Precautions (if appropriate), and follow recommendations for alternative diagnosis

(Source: CDC, 2011)

Laboratory Identification

The diagnosis of CDI, i.e., reliably differentiating between infection and colonization, remains an important clinical challenge. Molecular tests (i.e., nucleic acid amplification tests [NAATS]) are commonly used to test for CDI and do not differentiate between colonization and infection. Such tests have the potential to misdiagnose patients. Therefore, testing algorithms have been developed to increase the likelihood of a correct diagnosis (see Figure 2).

Laboratory testing for *C. diff* should be limited to soft or liquid diarrheal stools that conform to the shape of the specimen container; and hard and formed stools should be rejected. In addition, because the toxin degrades at room temperature within two hours of sample collection leading to false-negative results, stools for toxin testing should be tested promptly or refrigerated until testing can be performed.

Since positive identification of *C. diff* bacteria and/or its associated toxins plays a central role in defining cases of CDI, it is important that laboratory testing methods are both sensitive and specific. Coupled with patient clinical presentation, several different methodologies are currently employed by laboratories to screen for CDI in diarrheal stools. Table 1 outlines current testing methodologies along with advantages and disadvantages.

Table 1. Summary of common laboratory testing methodologies for *C. diff* testing

Testing Methodology	Sensitivity	Specificity	Advantages and Disadvantages
Stool culture for *C. difficile*	Very high	Low	• Labor-intensive and slow turnaround time (48-96 hours) - *less clinically useful for routine testing* • High sensitivity - *few false negative results* • Low specificity - *false positive results due to nontoxigenic strains*
"Toxigenic" culture – isolates are screened for toxin production	Very high	Very high	• Highly labor-intensive and slow turnaround time (48-96 hours) - *less clinically useful for routine testing* • High sensitivity - *few false negative results* • Gold-standard - *against which other test methodologies are compared in clinical trials of performance*
Molecular tests: FDA-approved PCR assays (test for the gene encoding toxin B)	Very high	High	• Simple • Fast turnaround time (typically 1-2 hours) • High sensitivity and high specificity - *few false-negative and -positive results* • Detects the gene encoding toxin B, but not the production of toxin
Antigen detection for *C. difficile* (latex agglutination or immune-chromatographic assay)	High/Moderate	Very low*	• Simple • Rapid turnaround time (<1 hour) • Very low specificity - *high rate of false positive results* • **specificity can be improved by combining this test with another methodology such as toxin detection, PCR, or toxigenic culture in a two-step testing algorithm* • Historical gold-standard for *C. diff* testing
Toxin testing for *C. difficile* testing: Tissue culture cytotoxicity assay[4]	High	High	• High complexity (requires technical expertise to perform) • Costly • Slow turnaround time (24-48 hours) - *less clinically useful for routine testing* • Detects toxin B only
Toxin testing for *C. difficile* testing: Enzyme immunoassay (EIA) (detects toxin A, toxin B, or both A and B)**	Low	High	• Rapid turnaround time (<1 hour) • Low cost • Simple • Low sensitivity - *high rate of false negative results* • ** *due to concerns over toxin A-negative, B-positive strains causing disease, most laboratories employ a toxin B-only or A and B assay*

(Source: CDC, 2012a)

Treatment

Although asymptomatic individuals colonized with *C. diff* bacteria can still pose an infection risk to others, they should not be formally treated. However, recent studies recommend that CDI be treated with vancomycin or fidaxomicin orally for at least 10 days. CDC guidelines do mention using metronidazole as a treatment option for first-line treatment of mild/moderate CDI in adults, but this new recommendation is based on several clinical trials showing higher risk of recurrence with the use of metronidazole (McDonald, 2018). Furthermore, because CDI returns in about 20% of antibiotic-treated patients, stool transplant – transfer of stool (fecal microbiota transplantation or FMT) from a healthy patient to the colon of a patient with repeated CDI appears to be an effective long-term treatment (CDC, 2012a). FMT should now be strongly considered in such patients based on several recent clinical trials (McDonald, 2018).

Case Fatality

A 2011 study conducted by the CDC sets U.S. case fatality rates around 6.5%. Each year, almost 30,000 patients die within 30 days of their primary diagnosis, with 80% of these deaths occurring in elderly patients 65 years and older.

Reservoir

C. diff bacteria are ubiquitous in the environment. Humans and animals can serve as a reservoir of this organism.

Transmission

Primary transmission of *C. diff* bacteria is via the fecal-oral route. Additionally, because *C. diff* spores persist on hard environmental surfaces for up to five months and can survive the acidity of the stomach, significant patient-to-patient transmission can occur via healthcare workers. Isolates can also be directly inoculated into the digestive tract via gastronomy tube (G-tube) feedings or by rectal thermometer use.

Susceptibility

Persons of all ages are at risk for CDI, however, adults over 65 years of age, immunocompromised patients are at elevated risk for severe disease complications and death. Other important host-specific CDI risk factors include prolonged hospitalization, other co-morbidities and extensive antimicrobial use.

Incubation Period

The incubation period is not well-defined, however, research suggests an incubation period of around seven days with a median of two to three days given optimal conditions for bacterial proliferation (CDC, 2012b).

Period of Communicability

The period of communicability is unknown and variable, but there is evidence that the *C. diff* organism continues to be shed in the feces beyond symptom resolution. Therefore, many facilities continue contact precautions for the duration of the stay (CDC, 2012a).

Epidemiology

The epidemiology of *C. diff* infection is a complex inter-play of host-specific factors, previous patient antibiotic treatment regimens, facility factors, i.e., healthcare workers compliance to PPE-use and hand washing, terminal environmental cleaning and organism virulence factors.

Although studies of adults and children have shown asymptomatic colonization rates below 3%, 50% of infants below the age of one year shed the organism and toxin without displaying any symptoms. Evidence also suggests that CDI results from infection with *C. diff* bacteria acquired during a hospital stay as opposed to endogenous spread from asymptomatic colonization (APIC, 2014).

Healthcare workers with CDI can return to work after 24-48 hours without diarrhea. Food handlers with CDI are also considered high-risk for spreading the disease and should be excluded from work for at least 24-48 hours beyond symptom resolution.

✓ PUBLIC HEALTH CONTROL MEASURES

Public Health Responsibility

Although decreasing CDI rates is a shared responsibility between facilities and healthcare providers, public health can play a central role. Following is a list of ways in which public health can support and facilitate this process:

- Facilitate communication between acute care, long-term care and nursing homes, i.e., encouraging the use of transfer forms to communicate *C. diff* disease status on discharge and inter-facility transfer. (Utah Transfer Form: http://health.utah.gov/epi/diseases/HAI/resources/Interfacility_Transfer_Form.pdf)
- Identify facilities with high disease burdens of CDI by using national NHSN data and standards, including the Target-Assess-Prevent (TAP) strategy; and offer assistance with targeted prevention activities.
- Assist facilities in identifying and investigating disease outbreaks or clusters of high CDI disease rates.
- Provide education to the general public, clinicians and healthcare personnel regarding disease transmission and prevention.
- Provide terminal cleaning/disinfection guidelines and hand hygiene support to facilities experiencing outbreaks.
- Facility visits and infection control assessments (ICAR).

- Encourage facilities to develop antibiotic stewardship plans (CDC, 2015).
- Promote principles of antibiotic stewardship among healthcare providers.
- Monitor facility-level National Health and Safety Network (NHSN) data against benchmark standards for trends and patterns as a third party.

Prevention

Hand washing, the wearing of personal protective equipment (PPE) and environmental cleaning practices are important control measures to prevent spread of *C. diff* bacteria in facilities. In addition, reduction in broad spectrum antibiotic use coupled with formal antibiotic stewardship programs aid in the prevention of CDI cases that take a hold through disrupting the balance of normal intestinal flora.

Chemoprophylaxis

None.

Vaccine

None.

Isolation and Quarantine Requirements

Isolation: CDI-diagnosed hospitalized patients or care facility residents should be placed in isolation under contact precautions in separate rooms for the duration of their diarrheal symptoms/illness which is generally considered that of a resolved case, i.e., the patient has had no diarrhea for at least 48 hours and has had a formed or normal stool for that patient (HPSC, 2014). Current evidence links cohorting patients with CDI at increased risk of symptomatic recurrence, and, therefore, discourages shared rooming of cases (Islam et al, 2013). In addition, because *C. diff* spores can persist in the environment for up to five months, rooms occupied by CDI patients should be terminally cleaned with Class K disinfection/cleaning products (EPA, 2018).

Symptomatic contacts should be referred for medical evaluation and testing, as appropriate. Food handlers and healthcare workers with CDI should be excluded from work for at least 24-48 hours beyond symptom resolution.

Quarantine: High-risk contacts such as food handlers and healthcare workers should be followed closely in outbreak situations.

✓ CASE INVESTIGATION

Reporting

CDI cases are reportable to infection control within facilities to ensure initiation of isolation precautions and containment. Additionally, although CDI cases are reportable to public health in Utah as surveillance events by facilities reporting via Electronic Laboratory Reporting (ELR), only outbreaks and not individual cases are investigated by public health.

CDI cases in hospital and long-term acute care (LTAC) units are reportable through NHSN and data can be accessed by public health at the facility level. This population level data can provide important information about rates of CDI against benchmark standards thereby providing a measure of facility healthiness.

Case Definition

Clinical Description

CDI generally presents with symptoms of watery diarrhea, with three or more diarrheal stools within a 24-hour period [in the absence of other clinically significant causes of diarrhea; and in the absence of laxative and stool softener use and tube feedings] (APIC, 2014).

Laboratory Criteria

Identification of *C. diff* toxin (via probe, amplification test or culture) or antigen by EIA or culture or by two-step testing algorithm.

Criterion	Confirmed
Clinical Evidence	
3 or more diarrheal (watery or unformed) stools in 24-hour period	N
Absence of laxative-use	N
Absence of enteral feeding	N
Absence of stool softeners	N
Absence of other clinically–significant causes of diarrhea (i.e. not CDI)	N
Laboratory evidence	
Positive *C. diff* test in patient >1 year*	N
Criteria to distinguish a new case:	
Not counted as a new case if occurred within 14 days of initial case [positive lab test]	N

N = All "N" criteria in the same column are NECESSARY to classify a case.
* = *C. diff* testing should not be performed in children <1 year without first consulting with a GI or ID specialist.

Case Classification

A CDI case can be classified as confirmed in a patient with symptoms of watery diarrhea, with three or more diarrheal stools within a 24-hour period [in the absence of other clinically significant causes of diarrhea; and in the absence of laxative- and stool softener-use and tube feedings]; **AND** a positive *C. diff* laboratory test [via probe; amplification test; culture; EIA antigen; or by two-step testing algorithm].

Working on the assumption that facilities are exercising principles of diagnostic stewardship in ordering *C. diff* tests, it should be noted that only confirmed CDI cases are tracked by surveillance. However, assignment of suspect or probable cases of CDI in individuals may be relevant in potential outbreak situation where laboratory confirmatory testing was either not performed or not available in the index patient(s).

NHSN Case Classifications for Enrolled Reporting Facilities

In acute care settings reporting to NHSN, confirmed CDI cases are subsequently classified as **Incident** or **Recurrent** according to criteria outlined in the NHSN LabID module (CDC 2018a, 2018b). Additionally, CDI cases in hospital or LTAC units can be further stratified as: **Community-Onset (CO)**, **Community-Onset Healthcare Facility-Associated (CO-HCFA)** or **Healthcare Facility-Onset (HO)** (CDC, 2018b). CDI events for long-term care facilities (LTCFs) are further stratified as: **Community-onset (CO), Long-term Care Facility-onset (LO)** or **Acute Care Transfer-Long-term Care Facility-onset (ACT-LO)** (CDC, 2018a). This data allows classification of cases according to standard definitions and comparisons to be made against benchmark standards.

Case Investigation Process

Since CDI is endemic in healthcare settings and many factors impact CDI rates, individual cases are usually not investigated after initiating contact precautions unless an outbreak is suspected or rates deviate significantly from benchmark standards.

Outbreaks

Since CDI rates are dependent upon the patient population and community-associated cases fluctuate, there are no set published guidelines for facility outbreak criteria. Some facilities have set their own outbreak criteria and other jurisdictions have developed special criteria to define outbreaks based on bed numbers, i.e., two and three cases for smaller and larger units respectively within seven days or less (WVDOH, 2018). However, outbreak investigations should be considered in any cases where there are any significant increases from what is considered normal facility/unit rates against benchmark standards. Although ongoing prospective surveillance and monitoring of CDI rates rests upon facilities, public health can provide assistance through infection control assessments (ICAR), terminal cleaning and facility visits in potential outbreak situations.

Identifying Case Contacts

In general, contact tracing is not done for individual cases. However, in the event of an outbreak, symptomatic contacts should be referred for medical evaluation and testing, if appropriate. High-risk contacts such as food handlers and healthcare workers should be followed closely in outbreak situations.

Case Contact Management

N/A

✓ REFERENCES

Association of Public Health Laboratories APHL (2017). Antibiotic Resistance in the United States. The Antibiotic Resistance Laboratory Network. [Online] Available from: https://www.aphl.org/conferences/proceedings/Documents/2017/Annual-Meeting/01Patel.pdf (Accessed: February 7, 2018).

Association for Professionals in Infection Control and Epidemiology APIC; Grota, P., Allen, V. and Ackiss, E. (2014). APIC text of Infection Control and Epidemiology, Volume 3. Fourth Edition. Washington DC: APIC, 2014.

Centers for Disease Control and Prevention CDC (2009). Clostridium difficile Infections (CDI) Toolkit. Activity C: ELC Prevention Collaboratives. [Online] Available from: https://www.cdc.gov/hai/pdfs/toolkits/cditoolkitwhite_clearance_edits.pdf (Accessed: April 17, 2018).

Centers for Disease Control and Prevention CDC (2011). TAP Clostridium difficile infection (CDI) Implementation Guide: Links to Example Resources. *Guidance to Providers: Testing for C. difficile Infection*. Vanderbilt University Medical Center 31 August, 2011. [Online] Available from: http://www.mc.vanderbilt.edu/documents/infectioncontrol/files/Guidance%20for%20Providers%20FINAL%202011.pdf (Accessed: April 18, 2018).

Centers for Disease Control and Prevention CDC (2012a). Frequently Asked Questions about Clostridium difficile for Healthcare Providers. [Online] Available from: https://www.cdc.gov/hai/organisms/cdiff/cdiff_faqs_hcp.html (Accessed: January 29, 2018).

Centers for Disease Control and Prevention CDC (2012b). Vital Signs: Preventing Clostridium difficile Infections. Morbidity and Mortality Weekly Report MMWR March 9, 2012, 61(09); pp. 157-162. [Online] Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6109a3.htm (Accessed: January 29, 2018).

Centers for Disease Control and Prevention CDC (2015). Nearly half a million Americans suffered from Clostridium difficile infections in a single year. CDC Newsroom. [Online] Available from: https://www.cdc.gov/media/releases/2015/p0225-clostridium-difficile.html (Accessed: February 7, 2018).

Centers for Disease Control and Prevention CDC (2016). Clostridium difficile Infection. [Online] Available from: https://www.cdc.gov/hai/organisms/cdiff/cdiff_infect.html (Accessed: February 7, 2018).

Centers for Disease Control and Prevention CDC (2018a). Laboratory-identified Multidrug-Resistant Organism (MDRO) & Clostridium difficile Infection (CDI) Events for Long-term Care Facilities (LTCFs). Updated January 2018. [Online] Available from:

https://www.cdc.gov/nhsn/pdfs/ltc/ltcf-labid-event-protocol_current.pdf (Accessed: March 28, 2018).

Centers for Disease Control and Prevention CDC (2018b). Multidrug-Resistant Organism (MDRO) & Clostridium difficile Infection (MDRO/CDI) Module. Updated January 2018. [Online] Available from: https://www.cdc.gov/nhsn/pdfs/pscmanual/12pscmdro_cdadcurrent.pdf (Accessed: March 28, 2018).

Gerding, D., Muto, C. and Owens, R. (2008). Measures to Control and Prevent *Clostridium difficile* Infection. *Clinical Infectious Diseases*, Vol. 46, Issue Supplement_1, pp. S43-S49. [Online] Available from: http://www.academic.oup.com/cid/article/46/Supplement_1/S43/457041 (Accessed: October 15, 2018).

Health Protection Surveillance Center HPSC (2014). Case Definitions for C. difficile Enhanced Surveillance. July 2014. [Online] Available from: http://www.hpsc.ie/a-z/gastroenteric/clostridiumdifficile/surveillance/enhancedsurveillance/protocol/File,14699,en.pdf (Accessed: February 5, 2018).

Islam, J., Cheek, E., Navani, V., Rajkumar, C., Cohen, J. and Llewelyn, M. (2013). 'Influence of cohorting patients with Clostridium difficile infection on risk of symptomatic recurrence.' *Journal of Hospital Infection*, Vol. 85, Issue No. 1, pp. 17-21. [Online] Available from: https://www.sciencedirect.com/science/article/pii/S0195670113002272?via%3Dihub (Accessed: January 31, 2018).

McDonald IC, Gerding DN, Johnson S et al (2018). Clinical Practice Guidelines for Clostridium difficile Infection in Adults and Children: 2017 Update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA). *Clin Infect Dis* 2018;66:e1-e48, https://doi.org/10.1093/cid/cix1085 (Accessed: June 6, 2018).

Rodriguez Diaz, C., Seyboldt, C. and Rupnik, M. (2018). 'Non-human C. difficile Reservoirs and Sources: Animals, Food, Environment.' *Advances in Experimental Medicine and Biology*. AEMB, Vol. 1050.

Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee 2007. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings **HICPAC Guidelines**. [Online] Available from: https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html (Accessed: January 29, 2018).

United States Environmental Protection Agency EPA (2018). LIST K: EPA's Registered Antimicrobial Products Effective against Clostridium difficile Spores. [Online] Available from: https://www.epa.gov/pesticide-registration/list-k-epas-registered-antimicrobial-products-effective-against-clostridium (Accessed: January 31, 2018).

West Virginia Bureau for Public Health (2018). Guidelines for Clostridium difficile (C. diff) Outbreaks in Facilities. [Online} Available from:

https://dhhr.wv.gov/oeps/disease/AtoZ/Documents/CDiff%20Guidelines.pdf (Accessed: March 28, 2018).

✓ VERSION CONTROL

This is a new disease plan, and is not replacing a previous version.

✓ UT-NEDSS Minimum/Required Fields by Tab

N/A – electronically reportable only

✓ Electronic Laboratory Reporting Processing Rules

*C. diff** Rules for Entering Laboratory Test Results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-Specific Rules

Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.

Test Type	Test Result	Create a New Event	Update an Existing Event
Antigen by EIA/ELISA	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	No	Yes
Culture	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	Yes	Yes
PCR/amplification	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	No	Yes
Toxin assay	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	No	Yes

*A positive *C. diff* result will create a surveillance event. *C. diff* is only reportable electronically and does not participate in workflow.

Whitelist Rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.

***C. diff* Morbidity Whitelist Rule:** If the specimen collection date of the laboratory result is 14 days or less after the collection date of the last positive laboratory result, the laboratory result should be added to the morbidity event.

***C. diff* Contact Whitelist Rule:** None.

Graylist Rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

***C. diff* Graylist Rule:** If the specimen collection date of the laboratory result is 30 days before to seven days after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Other Electronic Laboratory Processing Rules

- If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.