Educational Module for Nurses in Long-term Care Facilities: Preventing and Managing *Clostridium difficile* Infections
Preventing and Managing *Clostridium difficile* Infections

Pre-test

1. List at least two characteristics of the *Clostridium difficile* bacterium.

2. Identify at least one important risk factor for the development of CDI in long-term care residents.
Preventing and Managing *Clostridium difficile* Infections

**Pre-test**

3. State the difference between colonization and infection with *C. difficile* bacteria.

4. Describe at least three strategies to prevent the transmission of *C. difficile* bacteria in long-term care facilities.
Learning objectives

- List characteristics of *Clostridium difficile* bacteria
- Define the term *C. difficile* infection (CDI)
- Describe one important risk factor associated with the development of CDI
Learning objectives

• State the difference between colonization and infection with *C. difficile* bacteria

• Describe at least three strategies to prevent the transmission of *C. difficile* bacteria in long-term care facilities (LTCF)
Introduction

Many pathogens can cause diarrheal illness in humans; of concern to healthcare facilities are:

- Norovirus
- *E. coli* O157:H7 and other Shiga toxin-producing *E. coli*
- Rotavirus
- *Clostridium difficile*
Introduction

- *C. difficile* bacteria can cause *C. difficile* infection (CDI)

- CDI is a major cause of antibiotic-associated and healthcare-associated diarrhea

- Elderly (>65 years) have increased risk of morbidity and mortality from CDI
Introduction

• *C. difficile* bacteria can cause a wide range of clinical symptoms

• Incidence and severity of CDI has increased recently
  – Possibly due to a new epidemic strain of *C. difficile* bacteria
C. difficile bacteria

- Anaerobic, spore-forming, Gram-positive bacilli
- C. difficile spores are difficult to remove from environmental surfaces (e.g., commode, door knob, bed rail, etc.)
- Can be part of the normal bowel flora
**C. difficile** bacteria

- *C. difficile* causes disease by toxin production
  - Toxin A = enterotoxin
  And/or
  - Toxin B = cytotoxin
- Not all strains of *C. difficile* produce toxins
  - A toxin-producing (toxigenic) strain must be present to cause disease
C. difficile bacteria

- Epidemic strain BI/NAP1/027 toxinotype III
  - Commonly known as “NAP1”
  - Epidemic in the U.S. since 2000
  - Increased resistance to fluoroquinolones (e.g., ciprofloxacin)
  - Increased production of toxins A and B
  - Presence of a third toxin (binary toxin)
Pathogenesis of CDI

- Antibiotics disrupt normal bowel flora, allowing *C. difficile* bacteria to overgrow

- CDI can occur if:
  - Disruption of normal bowel flora occurs (most commonly due to antibiotic use)
  - Exposure to spores or vegetative bacteria of a toxigenic *C. difficile* strain
  - Host factors or strain virulence are present
Pathogenesis of CDI

Toxigenic *C. difficile* bacteria invade a healthy colon, causing pseudomembranous colitis.
CDI signs and symptoms

- Symptoms begin during or shortly after a course of antibiotics – can be delayed as long as 8 to 12 weeks post-antibiotic exposure

- *C. difficile* can cause a spectrum of clinical manifestations, ranging from asymptomatic colonization to severe infection and death
Clostridium difficile bacteria will thrive in a colon that has had the good bacteria destroyed by the action of antibiotics.
CDI signs and symptoms

• Clinical symptoms
  – Watery diarrhea (most common symptom)
  – Fever
  – Abdominal cramps

• Severe disease
  – Pseudomembranous colitis
  – Toxic megacolon
  – Perforation of the colon
  – Sepsis
  – Elevated WBC count
  – Death
The Iceberg Effect

Infected

Colonized
Infection vs Colonization

- Colonization (“carrier”)
  - Presence of *C. difficile* bacteria in intestinal tract without signs or symptoms of illness

- Infection
  - Presence of toxigenic *C. diff* that results in symptoms of infection

*C. diff* can be transmitted if the person is colonized or infected
Risk factors for CDI

- Antibiotic exposure!
  - >90% of all CDI occur during or after antibiotic therapy
- All antibiotics can increase risk, but broad-spectrum antibiotics are more likely to be associated with CDI
- A resident can be at risk for CDI up to 12 weeks post-exposure
  - It can take a long time for normal bowel flora to return!
Other risk factors for CDI

- Advanced age (>65 years)
- Use of nasogastric or gastrostomy feeding tubes
- Gastric acid suppression (due to antacids, proton pump inhibitors, or histamine-2 antagonists)
- Severe underlying medical, immunocompromising conditions
Incidence of CDI

- Rates of CDI are increasing in both acute care hospitals and LTCFs
- This increase may be due to:
  - Inadequate infection prevention and control practices in healthcare facilities
  - Overuse and misuse of antibiotics
  - More pathogenic strains of *C. difficile* bacteria (epidemic NAP1 strain)
Incidence of CDI

*Clostridium Difficile* Infection (CDI) Hospitalizations, 1998-2011

Rate per 100,000 population

CDI as a principal or secondary diagnosis

CDI as a principal diagnosis

NOTES: The CDI hospital stays include hospitalizations with a principal or secondary diagnosis of CDI.
SOURCE: National Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), AHRQ
Incidence of CDI

*Clostridium Difficile* Infection (CDI) Hospitalizations, 2011

Rate per 100,000 population

Age (years)

Total | Female | Male | <18 | 18-44 | 45-64 | 65-84 | 85+

NOTES: Rate of CDI stays per 100,000 population. The CDI hospital stays include hospitalizations with a principal or secondary diagnosis of CDI.

SOURCE: National Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), AHRQ
Diagnosis of CDI

• Clinical symptoms *and* lab test results

• When to test:
  – Resident with ≥3 unformed stools per 24 hours
  – Do not repeat testing during the same episode of diarrhea for a resident with confirmed CDI
  – Do not perform “test of cure” on any resident post-treatment
    • Resident may remain colonized with *C. diff* leading to a positive test result in the absence of symptoms
## Diagnosis of CDI

### Bristol Stool Chart

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Separate hard lumps, like nuts (hard to pass)</td>
</tr>
<tr>
<td>2</td>
<td>Sausage-shaped but lumpy</td>
</tr>
<tr>
<td>3</td>
<td>Like a sausage but with cracks on its surface</td>
</tr>
<tr>
<td>4</td>
<td>Like a sausage or snake, smooth and soft</td>
</tr>
<tr>
<td>5</td>
<td>Soft blobs with clear-cut edges (passed easily)</td>
</tr>
<tr>
<td>6</td>
<td>Fluffy pieces with ragged edges, a mushy stool</td>
</tr>
<tr>
<td>7</td>
<td>Watery, no solid pieces. <strong>Entirely Liquid</strong></td>
</tr>
</tbody>
</table>
Diagnosis of CDI

• Fresh, unformed stool for lab testing
  – Stool should take the form of the container

• Stool specimen must be refrigerated
  – *C. diff* toxin degrades rapidly at room temp
  – False-negative results can occur if not refrigerated

• Submit refrigerated specimen to the lab as soon as possible
## Diagnosis of CDI

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>Substance detected</th>
<th>Time required</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxin culture (gold standard)</td>
<td>Toxigenic <em>C. difficile</em></td>
<td>3-5 days</td>
<td>&gt;95%</td>
<td>80-90%</td>
</tr>
<tr>
<td>EIA toxin A or A/B</td>
<td>Toxin A or A/B</td>
<td>Hours</td>
<td>75-80%</td>
<td>97-98%</td>
</tr>
<tr>
<td>RT-PCR</td>
<td>Toxigenic <em>C. difficile</em></td>
<td>Hours</td>
<td>&gt;98%</td>
<td>80-99%</td>
</tr>
<tr>
<td>Cytotoxin</td>
<td>Toxin B</td>
<td>1-3 days</td>
<td>95%</td>
<td>90-95%</td>
</tr>
<tr>
<td>EIA GDH and toxin A/B</td>
<td><em>C. difficile</em> and <em>C. difficile</em> toxin</td>
<td>Hours</td>
<td>95 – 100%</td>
<td>97 – 98%</td>
</tr>
<tr>
<td>EIA GDH</td>
<td><em>C. difficile</em></td>
<td>Hours</td>
<td>95 – 100%</td>
<td>70 – 80%</td>
</tr>
</tbody>
</table>
Treatment of CDI

Treating *C. difficile*

- **Asymptomatic colonization**
  - 1. No treatment needed
  - 2. May protect against disease

- **Diarrheal illness**
  - 1. Stop inciting antibiotics
  - 2. Metronidazole or oral vancomycin
  - 3. Supportive care—fluid and electrolytes
  - 4. Avoid opiates, antiperistaltic agents

- **Pseudomembranous colitis**
  - Consider surgical intervention

- **Toxic megacolon**
Treatment of CDI

• Stop any non-critical antibiotic therapy!
  – 15-20% of CDI cases resolve after discontinuing the “offending” antibiotic

• Consider CDI antibiotic therapy
  – Metronidazole – mild to moderate CDI
  – Vancomycin – severe CDI
  – Fidaxomicin – new drug

• Consider Infectious Disease physician consult
Treatment of CDI

- Rehydration
  - Provide water, broth, and electrolyte-rich liquids etc. if not contraindicated
- Avoid anti-diarrheals (anti-peristaltics)
- Probiotics
  - *Lactobacillus, Bifidobacterium*, etc.
  - No conclusive evidence of effectiveness
Treatment of CDI

• Recurrent CDI
  – Occurs in 6-35% of patients
  – Risk increases with each subsequent recurrence

• Fecal Microbiota Transplantation (FMT)
  – Treatment to restore normal bowel flora
  – Stool from healthy donor transplanted via enema, colonoscopy, or nasogastric route
  – Good option for those with multiple recurrences of CDI
Treatment of CDI

- CDI can result in serious intestinal conditions such as bowel obstruction
  - Cramping abdominal pain that comes and goes
  - Abdominal distention
  - Dramatic decrease in bowel movements
  - Diminished or absent bowel sounds
- Notify resident’s care provider immediately if these signs/symptoms develop
Transmission of C. difficile

• *C. diff* is spread via the fecal-oral route

• *C. diff* spores remain on surfaces and inanimate objects for long periods of time

• *C. diff* bacteria can be spread to other residents, even if they have not had antibiotic exposure
Transmission of *C. difficile*
Infection Prevention and Control

• Prevent acquisition of *C. difficile* bacteria
  – Always use good infection prevention and control practices, including good hand hygiene

• Prevent development of CDI
  – Antimicrobial stewardship
Infection Prevention and Control

- Hand hygiene
  - Clean hands with soap and warm water for 15-20 seconds
  - Before and after entering rooms of, and caring for residents with CDI
  - Before and after wearing gloves and/or gowns
  - Alcohol-based hand rubs do not kill the spores of *C. diff* bacteria
Infection Prevention and Control

- Standard Precautions – for all residents, all of the time

- Contact Precautions – for residents with CDI symptoms
  - Gloves and gown for resident care
  - Dedicated equipment (e.g., commodes, blood pressure cuffs, and stethoscopes)
  - Clean and disinfect shared equipment immediately after use by a resident with CDI and before use by any other resident
Infection Prevention and Control

• Isolation Precautions
  – Private room, if possible or cohort CDI positive residents together
  – If incontinent of stool or unable to perform appropriate hand hygiene, resident may be excluded from common areas, social activities

• Continue Contact and Isolation Precautions until diarrhea is resolved for 48-72 hours
  – Isolation Precautions may be discontinued before resolution of diarrhea if stool can be contained, resident can follow instructions, and can perform appropriate hand hygiene
Environmental Cleaning and Disinfecting

- Cleaning must be done before disinfecting
  - Cleaning removes food, dirt, organic matter
  - Disinfection kills bacteria and their spores
- Use EPA-registered, hospital-grade products
  - Sporicidal disinfectant or bleach solution
  - Follow manufacturer recommendations for use
Environmental Cleaning and Disinfecting

• Daily cleaning and disinfection of at least:
  – Bedrails, furniture, bedside commodes
  – Bathroom sink, floor, tub/shower, toilet
  – Frequently touched surfaces (light switches, door knobs, call bells, TV remotes, etc.)

• Terminal cleaning and disinfection
  – Regardless of how long ago diarrhea occurred
  – Include bed frame, mattress, pillows, curtains
Antimicrobial Stewardship

- Using antibiotics only if clinically indicated is an important key to preventing CDI

- Antibiotic use is high in LTCFs
  - 40% of all systemic medications prescribed
  - 25-70% of LTCF residents receive at least one systemic antibiotic each year
    - Up to 75% of those are unnecessarily prescribed
Antimicrobial Stewardship

• Reasons for unnecessary antibiotic prescriptions include:
  – Inability of LTCF residents to communicate symptoms to healthcare personnel
  – Treating colonization, not just infection
  – Pressuring prescribers for antibiotics

• Accurate nursing assessment is essential to assist providers in prescribing appropriately
Antimicrobial Stewardship

• Stewardship definition: “the careful and responsible management of something entrusted to one's care” – Merriam-Webster Dictionary

• Antimicrobial stewardship: strategies for the responsible use of antimicrobials
  – In order to be effective, must include all levels of healthcare workers
Antimicrobial Stewardship

- Antimicrobial stewardship prevents misuse, enabling the benefits of antimicrobials to outweigh the risks

- Ingredients for successful stewardship include:
  - Education for nurses and providers
    - Evidence-based guidelines for clinical assessment, testing for and treating infections
  - Accurate assessment of resident changes in condition
  - Accurate, timely communication and documentation of resident signs/symptoms and laboratory results
  - Participation of all care providers within the LTCF
Cytotoxicity - The quality of being toxic to cells. Examples of toxic agents are chemical substances or an immune cell.

Diarrhea – At least six watery stools over 36 hours, three unformed stools in 24 hours for 2 days, or eight unformed stools over 48 hours.

Enterotoxin – A toxin produced by enterobacteria that acts on the intestinal mucosa to cause diarrhea.

Fecal incontinence – Inability to prevent the discharge of feces.

Ileus – Mechanical, dynamic, or adynamic obstruction of the bowel; may be accompanied by severe colicky pain, abdominal distention, vomiting, absence of passage of stool, and often fever and dehydration.
Glossary, part 2

Normal bowel flora – A population of organisms that inhabit the bowel that under normal conditions do not cause infection.

Probiotics – Dietary supplements containing potentially beneficial bacteria or yeast that are intended to assist the body’s naturally occurring flora within the digestive tract. Common probiotics include Lactobacillus, Sacchayromyces, or Bifidobacterium.

Pseudomembranous colitis (PMC) – A form of gastroenteritis caused by the body’s inflammatory response to the C. difficile toxins. It causes yellowish plaques, called pseudomembranes, to form on the inner lining of the colon. These plaques prevent the regular absorption of nutrients through the intestine and cause watery diarrhea. This inflammation of the intestine can be very painful.
Glossary, part 3

Sepsis – The presence of various pus-forming and other pathogenic organisms or their toxins in the blood or tissues.

Spores – In biology, a spore is a reproductive structure that is adapted for dispersion and surviving for extended periods of time in unfavorable conditions. Spores form part of the life cycles of many plants, algae, fungi and some protozoans. The term spore may also refer to the dormant stage of some bacteria, like Clostridium difficile.

Toxic megacolon - An acute non-obstructive dilation of the colon, often seen in advanced ulcerative colitis or as a result of a C. difficile infection.

Toxigenic – Producing toxins

Virulence – The disease evoking power of a pathogen
Antimicrobial Stewardship Resources

- http://www.health.state.mn.us/divs/idepc/dtopics/antibioticresistance/
- http://www.cdc.gov/getsport.healthcare/
- http://www.cdc.gov/longtermcare/
- http://www.minnesotaarc.org/
C. difficile Resources

- http://www.health.state.mn.us/divs/idepc/diseases/cdiff/
References, part 1


References, part 2


13. Rutala WA. “Best” practices for disinfection of non-critical surfaces and equipment. Talk presented at: Association for Professionals in Infection Control and Epidemiology conference; May 2, 2014; Peewaukee, WI.


