

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



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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



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



Source: iStockphoto.com



Clostridium difficile bacteria will thrive in a colon that has had the good bacteria destroyed by the action of antibiotics.

Source: colonhealth-tips.com



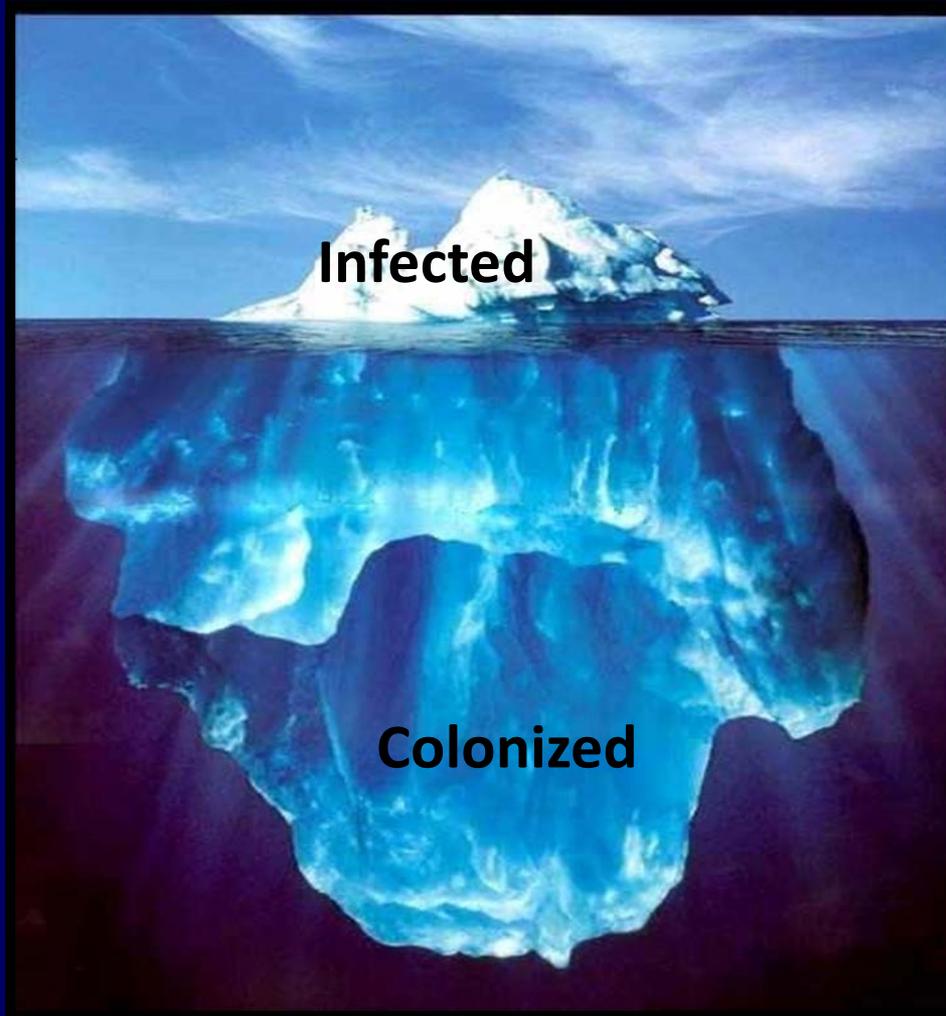
Source: abcnews.go.com



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



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

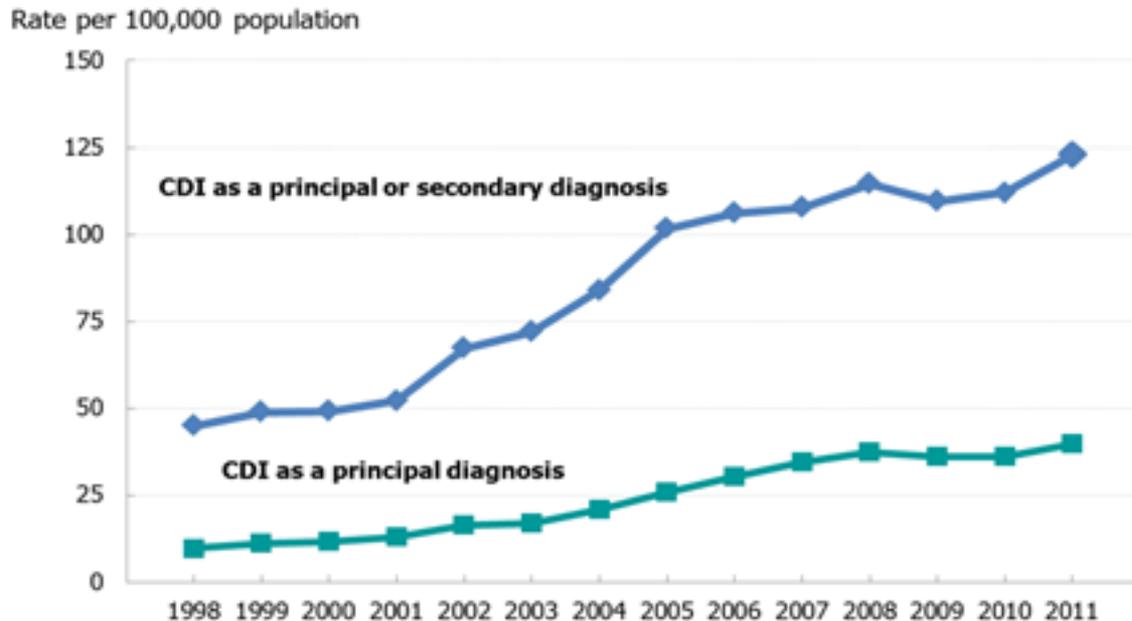
- Advanced age (>65 years)
- Use of nasogastric or gastrostomy feeding tubes
- Gastric acid suppression (due to antacids, proton pump inhibitors, or histamine-2 antagonists)
- Severe underlying medical, immunocompromising conditions

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



NOTES: The CDI hospital stays include hospitalizations with a principal or secondary diagnosis of CDI.

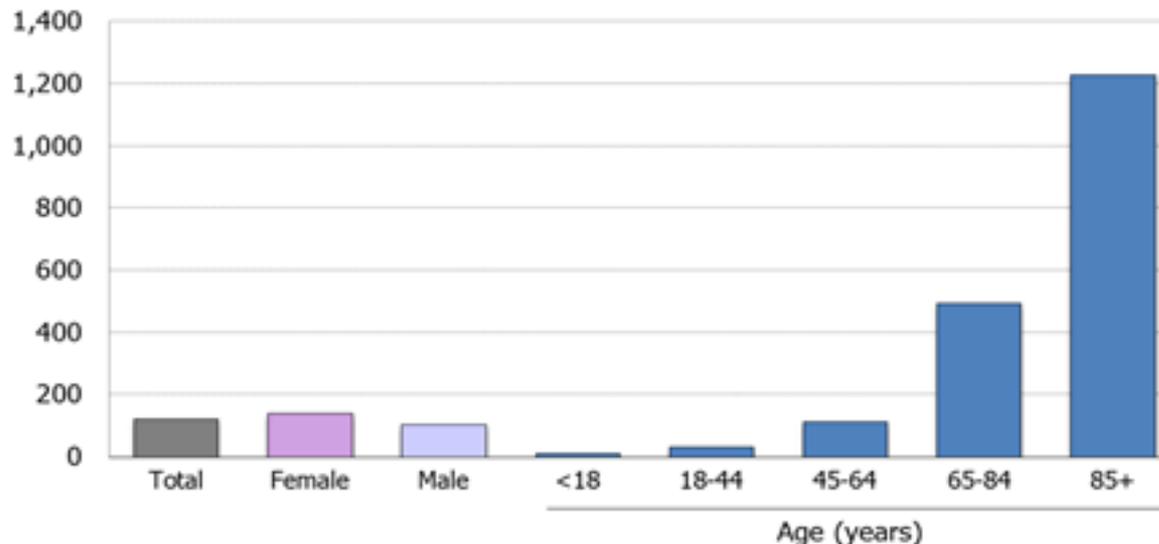
SOURCE: National Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), AHRQ

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Incidence of CDI

Clostridium Difficile Infection (CDI) Hospitalizations, 2011

Rate per 100,000 population



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

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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

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces. Entirely Liquid

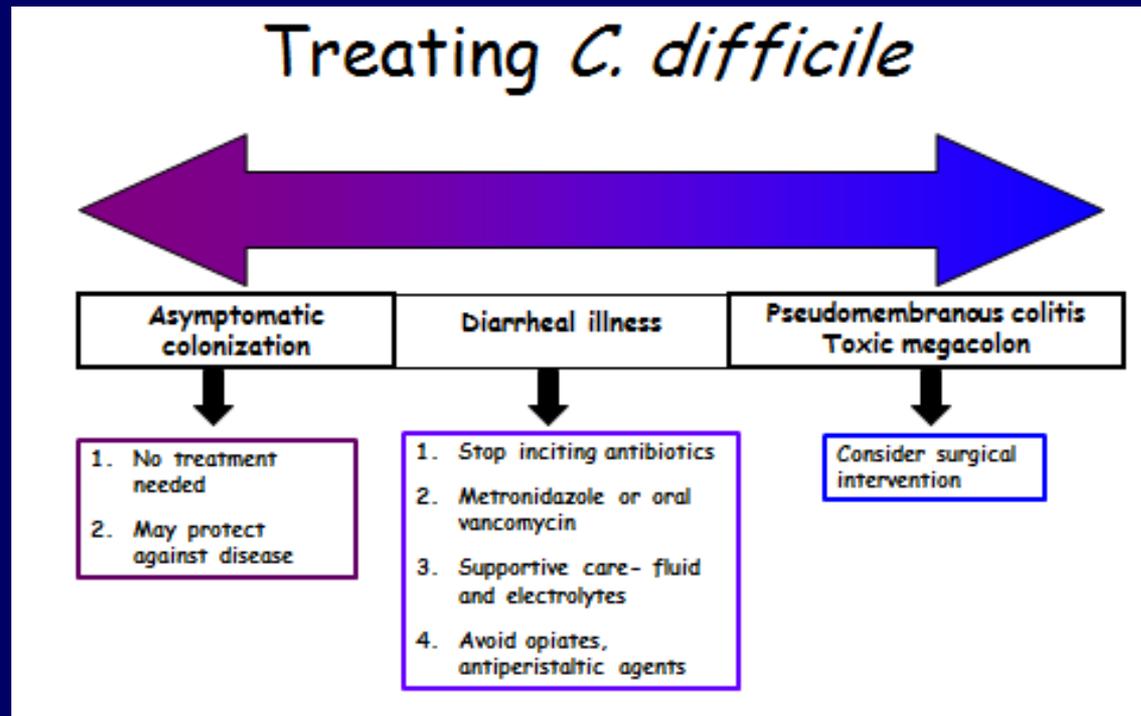
Diagnosis of CDI

- 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

Laboratory Test	Substance detected	Time required	Sensitivity	Specificity
Toxin culture (gold standard)	Toxigenic <i>C. difficile</i>	3-5 days	>95%	80-90%
EIA toxin A or A/B	Toxin A or A/B	Hours	75-80%	97-98%
RT-PCR	Toxigenic <i>C. difficile</i>	Hours	>98%	80-99%
Cytotoxin	Toxin B	1-3 days	95%	90-95%
EIA GDH and toxin A/B	<i>C. difficile</i> and <i>C. difficile</i> toxin	Hours	95 – 100%	97 – 98%
EIA GDH	<i>C. difficile</i>	Hours	95 – 100%	70 – 80%

Treatment of CDI



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

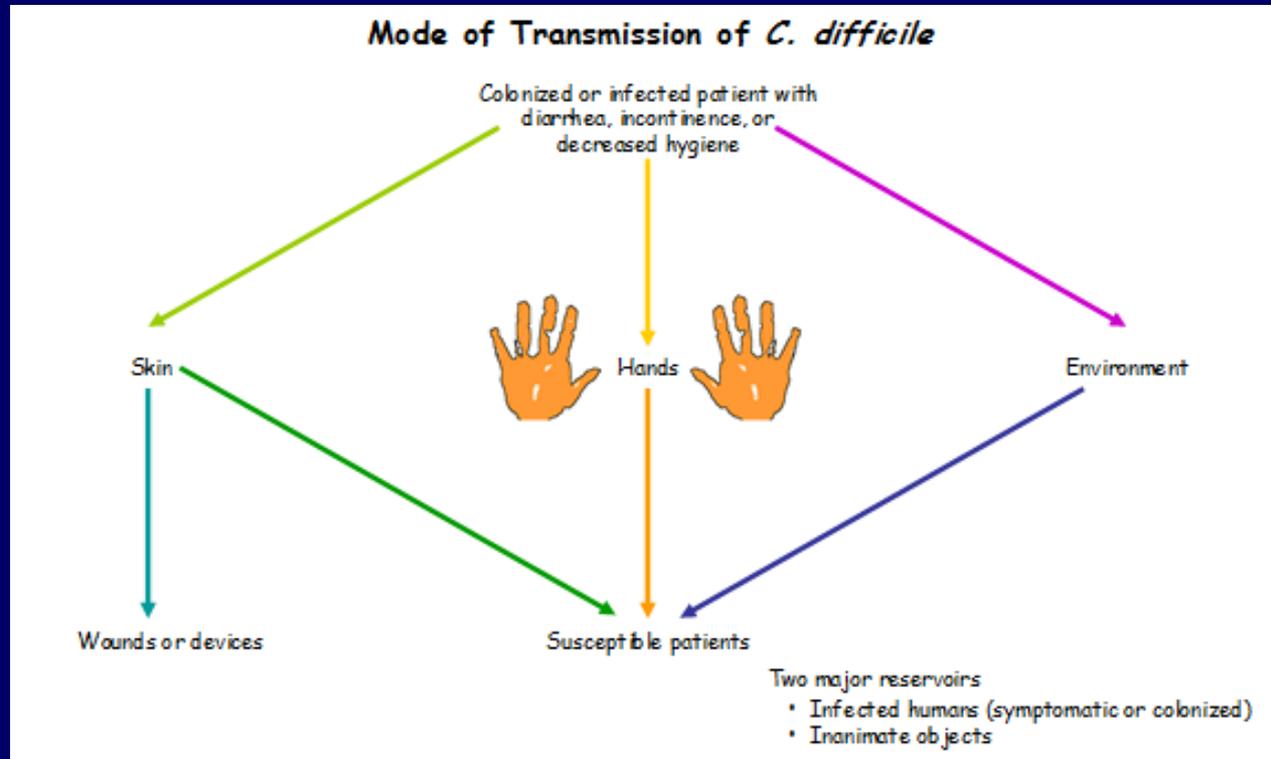
Treatment of CDI

- 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
 - Sporocidal 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

Glossary, part 1

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.

Pseudomembraneous 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*.

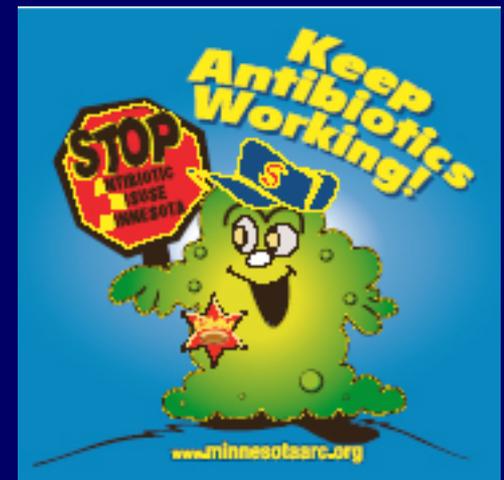
Toxic megacolon - An acute non-obstructive dilation of the colon, often seen in advanced ulcerative colitis or as a result of a *C. difficile* infection.

Toxigenic – Producing toxins

Virulence – The disease evoking power of a pathogen

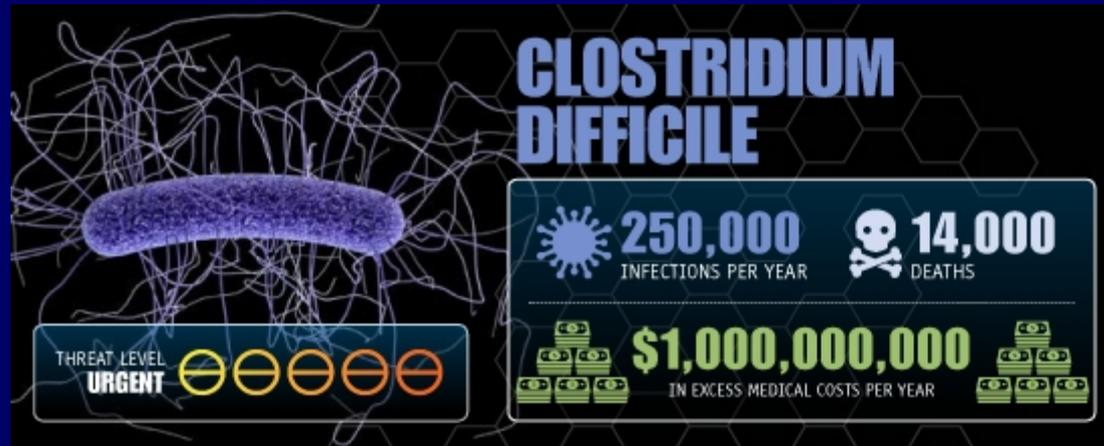
Antimicrobial Stewardship Resources

- <http://www.health.state.mn.us/divs/idepc/dtopics/antibioticresistance/>
- <http://www.cdc.gov/getsmart/healthcare/>
- <http://www.cdc.gov/longtermcare/>
- <http://www.minnesotaarc.org/>



C. difficile Resources

- <http://www.health.state.mn.us/divs/idepc/diseases/cdiff/>
- http://www.cdc.gov/HAI/organisms/cdiff/Cdiff_infect.html



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