

Clostridium Difficile Infections in Nursing Homes

ABSTRACT

Clostridium difficile infection (CDI) is rapidly becoming one of the most significant issues in healthcare. It remains the most common cause of diarrheal illness in institutionalized patients and residents, and healthcare workers are faced with many challenges relating to its identification, treatment, and transmission prevention. The Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project revealed that from 1993 to 2001 hospital discharges with CDI increased by 74%. This escalated from 2001 to 2005 to a 102% increase in discharges with CDI. CDI was a secondary diagnosis in most cases, particularly in the later years. While persons of any age are at risk for infection, the elderly are particularly susceptible and are at increased risk for adverse outcomes as a result of CDI. Mandatory reporting of healthcare-associated infections began in Pennsylvania nursing homes in June 2009. Preliminary data for the third quarter of 2009 showed that CDI accounted for almost 40% of overall gastrointestinal infections in nursing home patients statewide. Evidence-based risk reduction strategies are key to providing a safer healthcare facility environment when CDI is suspected or confirmed. These strategies include the infection prevention components of standard and contact precautions, environmental care, and judicious use of antibiotics. (Pa Patient Saf Advis 2010 Mar;7[Suppl 1]:10-5.)

Introduction

Clostridium difficile infection (CDI) caused by an anaerobic, gram-positive, spore-forming bacillus organism, is the most common cause of healthcare-associated infectious diarrhea in healthcare facilities and has the potential to cause outbreaks in hospitals and other settings. Exacerbated by the use of antimicrobial agents in the majority of cases, this disease has caused illness in all ages; however, the elderly (individuals 65 years of age or older) are at particular risk for this infection and of concern is the notable increase in morbidity and mortality in this population. This article discusses CDI with emphasis on the challenges of this disease and infection prevention measures in the nursing home setting. The term "nursing home" is defined by Webster's New World Medical Dictionary "as a residential facility for persons with chronic illness or disability, particularly older people who have mobility and eating problems." Nursing homes are also referred to as convalescent homes or long-term care (LTC) facilities. The terms nursing home and LTC facility are used interchangeably in this article.

Background of CDI

Incidence of CDI continues to rise exponentially. Data from the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project reveals that during the 8-year period from 1993 until 2001, the total number of nationwide hospital discharges with CDI increased from approximately 85,700 to 148,900 per year—a 74% increase. However, during the following 4-year period from 2001 to 2005, the rate of increase for CDI escalated, when the numbers of cases more than doubled to 301,200 (a 102% increase in 4 years). In most cases, CDI was a secondary diagnosis, particularly in the later years of the project.¹ A national point prevalence study of *C. difficile* (colonization and infection) in U.S. healthcare facility inpatients in 2008 was conducted by developing and distributing a survey to all Association for Professionals in Infection Control and Epidemiology members. Approximately 12.5% of all U.S. acute care facilities were represented. One thousand four hundred forty-three *C. difficile* patients among 110,550 inpatients were reported, revealing an overall prevalence rate of 13.1 per 1,000 inpatients. Of those 1,443 patients, 94.4% were reported to have CDI and 5.6% had colonization. Detailed data was provided on 73.6% percent of patients; of these, 69.2% were 60 years of age or older, 67.6% had comorbidities, and 79% had received antimicrobials within 30 days of the onset of symptoms.²

CDI in Pennsylvania

Hospitals

The Pennsylvania Health Care Cost Containment Council (PHC4) has tracked incidence of CDI in Pennsylvania. In a May 2007 research brief, which does not distinguish between community-acquired and healthcare-associated infections, PHC4 reports the following:³

- Pennsylvania hospitalizations as a result of CDI increased from 7,026 cases in 1995 to 20,941 cases in 2005.
- The hospitalization rate for CDI increased by 173% from 1995 to 2005.
- Patients with CDI were hospitalized two and a half times longer than patients without CDI, hospital charges were more than doubled, and patients with CDI were four times more likely to die than patients without CDI, not adjusted for other conditions.

In 2005, patients aged 65 years or older had the highest rate of CDI with 19.3 cases per 1,000 hospitalizations, and this variable has prevailed since 1995. Data on the elderly has been consistent with national reports on CDI hospitalization rates.^{4,5}

Nursing Homes

See the box "Mandatory Reporting of Confirmed *Clostridium difficile* Infections in Pennsylvania Nursing Homes" for preliminary CDI data.

Changing Epidemiology

Changing epidemiology reflects CDI occurring not only in healthcare facilities but also in peripartum women and other healthy people in the community, including children. These low-risk individuals have had no obvious antimicrobial or healthcare exposure that could potentially contribute to the disease.⁶ Toxin-producing strains of *C. difficile* produce a spectrum of disease ranging from mild or moderate diarrhea to its most advanced form known as pseudo-membranous colitis, which can lead to toxic dilation of the colon (megacolon), sepsis, and death.⁷ The epidemic strain has been named BI/NAP1/027 and produces two types of toxins: A and B. Binary toxin, another feature of this strain for which the role is not yet clearly defined, appears to be associated with a more severe form of disease and is far more deadly than previous strains.⁸

Asymptomatic Carriage

Asymptomatic fecal carriage of *C. difficile* is common in healthcare facilities, although in the past, transmission of CDI resulting from asymptomatic carriage has been questioned. A prospective study examining the prevalence of asymptomatic carriage of both epidemic and nonepidemic strains of *C. difficile*, conducted by the Cleveland Veterans Affairs Medical Center on LTC residents from July through September 2006, revealed 51% of 68 asymptomatic residents were carriers of toxigenic *C. difficile*. Asymptomatic carriers had higher percentages of skin (61% versus 19%) and environmental contamination (59% versus 24%) compared to noncarriers. Investigators' hands were easily contaminated with spores from the skin of asymptomatic residents. Findings of this study suggest that there is potential for significant disease transmission in LTC facilities as a result of asymptomatic carriage in residents.⁹

CDI in LTC Facilities

CDI remains the most common cause of acute diarrheal illness in a LTC setting, with units housing the sickest residents reporting the highest incidence of CDI. In addition, CDI places a substantial burden on healthcare facilities and may increase the risk of morbidity among the elderly with the potential for increased risk of mortality.¹⁰ The prevalence of infection varies and depends on the populations that are surveyed. Epidemiological studies must take into account that *C. difficile* produces a wide spectrum of disease, ranging from asymptomatic carriage to toxic megacolon.¹¹

A retrospective review from July 2001 through December 2003 to describe the incidence and prevalence of CDI in LTC was conducted in a 220-bed

LTC facility affiliated with an academic medical center in Maryland. Results revealed that the incidence of CDI ranged from 0 to 2.62 cases per 1,000 resident days.¹² Colonization rates in residents in the absence of a recognized outbreak have ranged from 4% to 20%. Asymptomatic carriage on admission to the LTC facility may be significant, and an additional 10% to 20% of residents may acquire the organism during their stay.¹³

A more recent study of CDI in Ohio hospitals and nursing homes during 2006 was conducted by the Ohio Department of Health in conjunction with Ohio State University to describe the epidemiology, disease burden, and mortality rate of healthcare onset CDI. Results revealed that during 2006, 11,200 nursing home cases (6,900 initial and 4,300 recurrent cases) of healthcare onset CDI occurred in nursing homes. The nursing home rate for initial cases was 1.7 to 2.9 cases/10,000 patient days. The rate of recurrent cases ranged from 0.8 to 2.4 cases/10,000 patient days.¹⁴

Risk Factors

Various factors are known to place LTC residents at particular risk for acquiring CDI, including the following:

- Antimicrobial usage is very common in LTC residents. According to a study conducted by Benoit et al., involving 4,780 residents in 73 nursing homes in 4 U.S. states from September 1, 2001, through February 28, 2002, 40% of residents received 1 or more courses of antibiotics. About 4.8 courses/1,000 resident days were prescribed for these patients with a mean facility range of 0.4 to 23.5. Use of any class of antibiotics has been documented as a cause of CDI; however, the infection is seen more commonly with the use of clindamycin, third-generation cephalosporins, and fluoroquinolones. Even the antibiotics used to treat CDI—vancomycin and metronidazole—have been associated with the disease; therefore, judicious use of antibiotics is essential to avoid the potential for significant morbidity and mortality.^{15,16} In a prospective study conducted by Thomas et al. in a 233-bed LTC facility using a denominator of 1,000 patient years to determine the rate of postantibiotic *C. difficile* colonization and risk factors for infection, results revealed an overall incidence rate of 1,600/1,000 patient years (based on 4 cases of diarrhea in 36 patients followed for 26 days). This study also noted no difference in early mortality rates, but 12-month mortality for the infected patients was higher (83% versus 50%, p = 0.05).¹¹
- Advanced age results in gradual deterioration in immune function. Underlying chronic conditions associated with aging render the elderly more susceptible to acquiring CDI. Of particular concern

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Mandatory Reporting of Confirmed *Clostridium difficile* Infections in Pennsylvania Nursing Homes

Mandatory reporting of healthcare-associated infections (HAIs) by nursing homes began in June 2009 in the Commonwealth of Pennsylvania. Act 52 of 2007, known as the Health Care-Associated Infection and Prevention Control Act, required the Pennsylvania Patient Safety Authority and the Pennsylvania Department of Health (DOH) to develop the reporting requirements for nursing homes, including a list of infections and criteria for determining those infections.¹ This task was accomplished with the use of the McGee Criteria (used by nursing homes since 1991) and modified Centers for Disease Control and Prevention criteria. The list of infections and criteria includes gastrointestinal (GI) infections and requires that a *Clostridium difficile* positive assay be reported if obtained from the resident. All HAIs from nursing homes are reported through the Authority's reporting system, known as the Pennsylvania Patient Safety Reporting System (PA-PSRS). PA-PSRS requires that nursing homes report their infections as per defined care areas. HAI reports include specific questions directed at best practices. The answers assist the Authority with the development of further educational programs for the promotion of best practices.

A review of GI infection reports from preliminary data for the period July 1 to September 30, 2009, revealed that *C. difficile* infection (CDI) accounted

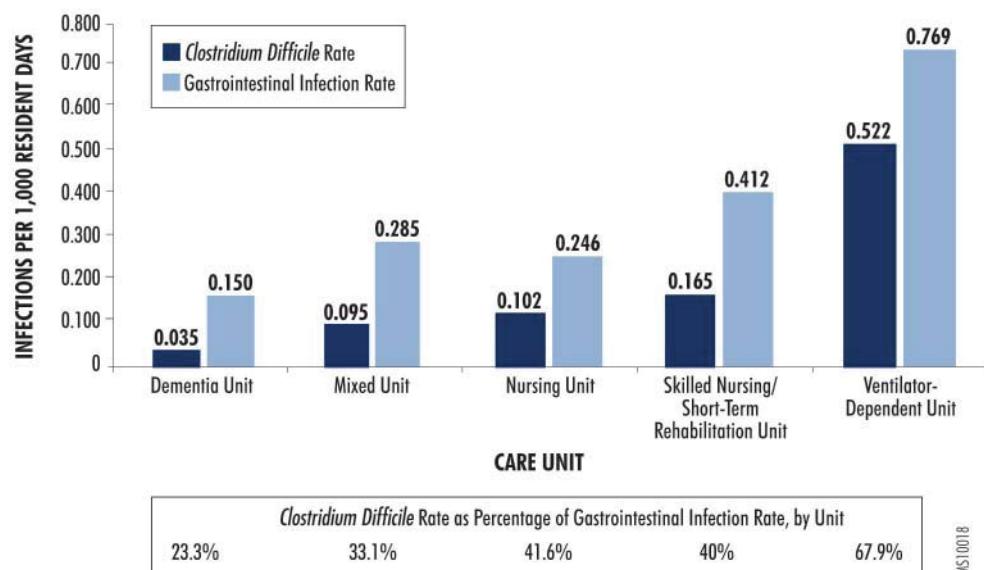
for 39% of all GI infections for the third quarter of 2009. The highest percentage of CDI cases occurred on the ventilator-dependent unit care area (67.9%), followed by the nursing unit care area (41.6%), skilled nursing/short-term rehabilitation unit care area (40%), mixed unit care area (33.1%), and dementia unit care area (23.3%). See the Figure for a chart of the nursing home GI infection overall rates and associated *C. difficile* rates by unit for the third quarter of 2009.

Nursing homes have access to their own data by means of reports generated in the Authority's reporting system. The individual nursing homes are able to read and print their reports. Reports include GI infection rates. The percentage of CDI cases are available to the individual facilities at the facility level as well as individual care areas. Facility-specific rates are not available to the public nor are they shared between facilities.

Note

1. Reporting requirements for nursing homes under chapter 4 of the Medical Care Availability and Reduction of Error (MCARE) Act. PA Bulletin. 38 Pa.B. 5239 [online]. 2008 Sep 20 [cited 2009 Jul 28]. Available from Internet: <http://www.pabulletin.com/secure/data/vol38/38-38/1740.html>.

Pennsylvania Nursing Home Gastrointestinal Infection and Associated *Clostridium difficile* Rates by Unit, July 1 through September 30, 2009



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is the very high incidence and mortality associated with increasing age: the incidence among patients 90 years of age or older was 74.4 per 1,000 admissions and the mortality was 14%.¹⁷

- Extended lengths of stay in healthcare settings may contribute to development of colonization and/or infection.⁹
- Use of proton pump inhibitors (PPIs) has been associated with colonization of the gastrointestinal tract. PPI use is a possible risk factor due to suppression of gastric acid; however, the data are inconsistent. A study conducted by the Centers for Disease Control and Prevention found that PPIs should be selectively used in the presence of fluoroquinolones when controlling outbreaks of CDI.¹⁸ In contrast to this study, Pepin et al. did not find an association between PPI use and acquisition of *C. difficile*.¹⁹

For reasons that are unknown, it appears that the elderly who are receiving tube feedings have a higher incidence of acquisition as well as a higher mortality rate related to CDI.²⁰ The possibility of contamination of the tube feeding solution may cause an increase in the organism load, which may predispose the resident. Another theory is that while vegetative spores are easily destroyed by gastric acid, tubes such as a jejunostomy tube bypass the stomach, negating the action of the gastric acid.

Modes of Transmission

After episodes of diarrhea, a patient's *C. difficile* is shed in the stool and transmission occurs via the fecal-oral route on the hands of personnel and by contamination of the environment. Potential colonization of the intestinal tract occurs particularly when the normal flora is disrupted by antibiotic therapy. Hand carriage of the organism is the primary means of transmission. In addition, *C. difficile* also has the ability to heavily contaminate the environment and inanimate objects. In its spore state in particular, the organisms can persist for up to five months on healthcare environmental surfaces, rendering the organism highly transmissible.²¹

Contamination of the environment, persistence of spores for prolonged periods of time, resistance of spores to routinely used disinfectants and antiseptics, hand carriage by healthcare personnel, and exposure of residents to frequent courses of antimicrobial agents contribute to outbreaks in healthcare facilities.

Infection Prevention Measures

Due to the changing epidemiology of the organism with subsequent increasing incidence of resident morbidity, mortality, length of stay, and costs associated with CDI, control of this organism is critical. A multidisciplinary approach is warranted, using evidence-based practices.

A study at the University of Pittsburgh Medical Center (Pennsylvania) reported on an outbreak of an epidemic strain of *C. difficile* in its facility between 2000 and 2001 with severe outcomes. As a result of this emerging problem, a comprehensive CDI control bundle was implemented. This tiered approach required cooperation from the administrative team and included the formation of a *C. difficile* management team, staff education, enhanced case finding, and implementation of an antimicrobial stewardship program.²² This bundle has been used in other hospitals as a means to controlling CDI, and many components of the bundle are applicable to LTC prevention programs.

Residents residing in LTC facilities have a unique situation in that the facility is their home. Resident rights play a role in the design and development of infection prevention measures. Appropriate placement of residents with infections, particularly multidrug-resistant organisms and CDI, is critical for both the emotional well-being and prevention of transmission of organisms.

Infection prevention measures include the following:

Antibiotic restriction. Development of programs that encourage the proper use of antibiotics and prevention of misuse is essential in LTC facilities. Large numbers of residents are exposed to many courses of antibiotics during their nursing home stay. The strong association between antibiotic use and acquisition of CDI necessitates surveillance of utilization of these agents (particularly those groups of antibiotics known to place residents at higher risk than others).²³ Pennsylvania's Act 52 of 2007—The Health Care-Associated Infection and Prevention Control Act—requires all healthcare facilities, including nursing homes, to have a policy in place for appropriate use of antimicrobial agents.²⁴

Resident placement. Place any resident with CDI and fecal incontinence in a private room until diarrhea has resolved. However, as private rooms are not always available in the LTC setting, cohorting residents with similar organisms is the next best approach for spatial separation. If cohorting and separation are not options, strict infection control precautions are indicated, including dedication of a bathroom to one resident and a commode to the other. The frequency of environmental cleaning may have to be increased (including the commode and bathroom) if residents share a room. In addition, if a resident with CDI needs to be in a room with an uninfected resident, assess the uninfected resident for risk of acquiring infection, because high-risk conditions (e.g., immunosuppression, postsurgery, antibiotic recipients, and underlying chronic conditions) will place the uninfected resident at increased risk.²⁵

Standard precautions. Measures begin with standard precautions for all residents, including those who have diarrhea with known or unknown etiology.²⁶

Components of standard precautions include the following:

- Hand hygiene in the form of handwashing with regular soap or antimicrobial soap and water is the most effective means for ridding the hands of the vegetative bacteria and spores. Alcohol hand rubs are *not* sporicidal and should *not* be used when caring for residents with CDI. (For more information, see the article "Hand Hygiene Practices and the Use of Alcohol-Based Sanitizers" in the September 2008 issue of the *Pennsylvania Patient Safety Advisory*.²⁷)
- Wear gloves at all times while delivering direct care and when in contact with the resident's immediate environment.
- Wear gowns at all times while delivering direct care and when contact with the resident's environment is anticipated.
- Use of personal protective equipment such as masks, eye protection, and face shields if the healthcare worker feels that there is a risk of facial contamination.
- Clean and maintain medical equipment and instruments/devices according to the manufacturers' instructions to prevent patient-to-patient transmission of infectious agents.

Contact precautions. These precautions are to be used for residents with uncontrollable diarrhea who are unable to share a room with another person until the diarrhea subsides.²⁶

Components of contact precautions include the following:

- Place resident in a private room with a bathroom that is used solely for that resident.
- Wash hands with regular soap or antimicrobial soap and water as the preferable method for hand hygiene. Alcohol handrubs are *not* sporicidal and therefore may be suboptimal for use when handling residents with CDI.²⁷
- Don gloves before entering the room, and wear at all times when in contact with the resident and the resident's environment
- Don gowns before entering the room, and wear at all times when in contact with the resident and the resident's environment
- Dedicate resident care equipment and items for single patient use. If this is not possible, clean and disinfect equipment and items between residents.

Care of the environment. *C. difficile* plays a significant role in causing spread of infection. Because *C. difficile* is shed in the feces, the environment becomes easily contaminated as spores persist and are highly resistant to cleaning and disinfection measures.²⁸ A six-month prospective study by Samore et al. was conducted to define the frequency of nosocomial *C. difficile* patient-to-patient transmission in an urban tertiary referral hospital. Results revealed

environmental contamination at greater than or equal to one site in 58% of rooms.²⁹ Commonly used disinfectants in healthcare are not sporicidal but will kill the vegetative organism. A 14-month study conducted by Mayfield et al. at a tertiary care facility found that unbuffered 1:10 hypochlorite solution is effective in decreasing patients' risk of developing CDI in areas where CDI is highly endemic.³⁰

Common disinfection procedures include the following:

- Daily cleaning and disinfection of rooms using a 5.25% sodium hypochlorite (household bleach product) and water in a 1:10 dilution.²⁶ Repeat the procedure upon discharge of resident or termination of contact precautions.
- Adherence to special precautions for use of sodium hypochlorite by personnel preparing and using the products.
- Enforcement of appropriate cleaning procedures and monitoring of practices.

Conclusion

C. difficile has emerged in recent years as a serious threat in the United States and countries worldwide. Epidemic strains caused by the rapidly spreading, hyper virulent BI/NAP1/027 strain have been responsible for many outbreaks. Antibiotic usage plays a large role in acquisition of the organism, particularly third-generation cephalosporins, fluoroquinolones, and clindamycin. However, all antibiotics have the potential to cause some type of CDI. The elderly are at particular risk, and a significant increase in morbidity and mortality is noted in the LTC environment. Infection prevention measures can be a challenge in LTC due to the unique living environment. Asymptomatic carriage may contribute significantly to disease transmission in LTC facilities. The environment plays a large role in the risk of transmission. Infection prevention measures are multidisciplinary, and vigilant practices are essential to the prevention of transmission and subsequent acquisition of this potentially deadly organism.

Notes

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