6 Control of *Clostridium* (*Clostridioides*) *difficile* Infection in Long-Term Care Facilities/Nursing Homes

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In a healthcare setting, *Clostridium* (*Clostridioides*) *difficile* transmission most likely occurs as a result of person to person spread through the fecal-oral route or due to direct exposure to contaminated environment. The hands of healthcare personnel can become transiently contaminated with *C. difficile* spores and probably act as the main means by which the organism is spread in a healthcare setting [1]. Healthcare personnel can acquire the organism from patients with either active CDI or those who are asymptomatically colonized with *C. difficile* [2]. Patients with active *Clostridium difficile* infection (CDI) have large number of *C. difficile* spores in their stools, and healthcare personnel caring for these patients can unwittingly acquire the organism on their hands [3, 4]. As a result, most infection control interventions are directed against patients with active CDI. Although studies have shown that asymptomatically colonized patients with *C. difficile* contribute to CDI transmission, there is insufficient evidence to recommend screening for asymptomatic carriage and placing these patients in isolation in order to decrease CDI rates [2, 5]. Patients with recent CDI

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might continue to shed large amount of *C. difficile* spores even after resolution of their diarrhea, indicating a population of asymptomatic carriers who are more likely to transmit the organism [6].

In a CDI endemic setting, acquisition through the contaminated environment likely accounts for only a small proportion of CDI cases [2]. Those that are particularly at risk are those admitted to rooms previously occupied by a CDI patient [3]. Even admission to a room where the previous patient was administered antibiotics but did not have CDI is a risk factor for symptomatic CDI [7]. In addition, various fomites have been implicated in *C. difficile* transmission and CDI outbreaks such as blood pressure cuffs, oral and rectal electronic thermometers, and contaminated commodes and bedpans [3, 8–10].

Infection control interventions are one of the cornerstones for prevention and control of *C. difficile* in a healthcare setting. These interventions have also been successfully used to control outbreaks of CDI in various healthcare settings [11–13]. Frequently, a bundle of infection control interventions such as hand hygiene, isolation measures, and environmental disinfection have been used, making it difficult to determine which interventions were most effective to control *C. difficile*. Most of these studies related to efficacy of infection control interventions have been performed in acute care hospitals [5]. Until more data specific to long-term care facilities (LTCFs) become available, these studies should serve as the basis for management of CDI in LTCFs [14].

Control of CDI in LTCFs provides unique set of challenges which are not encountered in acute care hospitals. LTCFs might be limited in personnel, expertise, and resources to implement antimicrobial stewardship and various infection control measures to control *C. difficile*. LTCFs might not have a private room available to isolate a patient who develops CDI. A survey in six LTCFs showed that only three LTCFs placed CDI residents in private rooms [15]. LTCFs also might have common toilets, bathrooms, rehabilitation, and dining and recreation areas which might prove a hindrance in implementing CDI specific infection control measures [16]. Even if resources are available, prolonged length of stay of LTCF residents and the need to provide home-like envi-

ronment will limit implementation of some of the infection control measures [14, 16]. Many of the LTCF residents have dementia or other comorbid conditions which will limit their ability to adhere to basic standards of hygiene and contribute to organism spread. In addition, most LTCFs depend on off-site laboratories which might result in significant delays in CDI diagnosis.

LTCF staff also may have less collective knowledge and training regarding management of CDI. A 2005 survey in 248 Iowa LTCFs showed that 52% of LTCFs required both a negative *C. difficile* test and absence of diarrhea before discontinuing contact precautions [17]. Moreover, 77% of LTCFs tested for *C. difficile* only in the presence of complicated and severe diarrhea, therefore underestimating the true burden of infection [17]. Knowledge might be further reduced due to high staff turnover in these facilities especially if the new incoming staff are not educated and trained at recruitment [18].

In order to overcome these challenges, infection control measures recommended for acute care hospitals should be modified to suit the LTCF setting. In addition, LTCFs should collaborate with regional acute care hospitals in order to obtain the required expertise to manage CDI and obtain information on a patient's CDI status at the time of care transitions. All LTCFs should also have evidence-based written infection control policies specifically addressing *C. difficile* which should be updated at least on an annual basis.

The following discussion focuses on recommended control measures for *C. difficile* and the potential strategies to adapt them in an LTCF setting. The strength of recommendation and quality of evidence for various infection control measures are noted in Table 6.1.

Avoid Delays in CDI Diagnosis

LTCFs should empower physician assistants, nurse practitioners, and nurses to order *C. difficile* test if clinical criteria are met [19]. LTCFs should ensure timely collection and transport of stool samples to the laboratory. LTCFs frequently rely on off-site laborato-

Table 6.1 Rating the quality of evidence and strength of recommendation using GRADE (Grading of Recommendation, Assessment, Development and Evaluation) methodology [40] for various CDI infection control measures

Patient isolation	Strong recommendation, moderate quality of evidence
Glove use	Strong recommendation, high quality of evidence
Gown use	Strong recommendation, moderate quality of evidence
Hand hygiene, endemic setting	Strong recommendation, moderate quality of evidence
Hand hygiene, outbreak/ hyperendemic setting	Weak recommendation, low quality of evidence
Patient bathing	Good practice recommendation
Environmental cleaning	Weak recommendation, low quality of evidence
Evaluating cleaning efficacy	Good practice recommendation
Disposable and dedicated equipment	Strong recommendation, moderate quality of evidence

ries for *C. difficile* testing which might result in significant delays in CDI diagnosis causing delay in starting therapy and implementation of infection control measures [16]. This could contribute to *C. difficile* transmission in the LTCF. LTCFs should therefore create an alert system with off-site laboratories to notify positive *C. difficile* results or inquire laboratories on a daily basis [16]. If results cannot be obtained on the same day, then LTCFs should place patients with suspected CDI on isolation while the results of *C. difficile* testing are awaited [5]. Consideration should also be given to starting empiric treatment for *C. difficile* if significant delays in laboratory confirmation are anticipated [5].

Lower Threshold to Test for *C. difficile*

A significant percentage of CDI cases go undiagnosed [20]. LTCFs should therefore have a low threshold to test for *C. difficile*. Any resident with unexplained diarrhea especially during or immediately after completing a course of antibiotic therapy

should be suspected of having CDI [5, 19]. In a study involving acute care hospitals, LTCFs and outpatient clinics showed that facilities which were testing more frequently had lower prevalence of CDI compared to those facilities that infrequently tested for *C. difficile* [21]. Increased *C. difficile* testing likely leads to increased case detection and prompts institution of prevention measures and treatment limiting organism spread which eventually lead to decrease in CDI prevalence [21].

Education

Healthcare personnel in LTCFs should be educated about transmission, clinical features, diagnosis, management, and prevention of CDI [22]. LTCF personnel should be educated at least annually. If high staff turnover is anticipated, then more frequent education is needed to update new recruits [16].

Private Rooms or Cohorting for CDI Patients

Private rooms for CDI patients likely facilitate better infection control practices and result in decreased transmission to other residents [5]. Patients housed in double rooms have higher rates of CDI compared to those in single rooms, and roommates of CDI patients are more likely to acquire the organism [3]. Patients with CDI should be cared for in a private room with a dedicated toilet. If private rooms are limited, then CDI patients with fecal incontinence should be prioritized to placement in these rooms [5]. If private rooms are not available as the case may be in LTCFs, then CDI patients can be cohorted in the same room with dedicated commodes provided to each resident. When cohorting is done, colonization with other multidrug-resistant pathogens (methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus*) needs to be noted, and patients colonized with similar pathogens should be cohorted together [5]. If isolation in private rooms and cohorting cannot be done, then contact precautions can be maintained in multi-bed rooms with education of staff [16].

Contact Precautions (Use of Gloves and Gown)

During CDI patient care, hands of healthcare personnel are frequently contaminated by *C. difficile* spores which can later be transmitted to other patients in their care [1, 3]. Hand hygiene and glove use during patient contact will decrease the concentration of spores in the hands of healthcare personnel, thus reducing risk of CDI transmission. One study showed use of vinyl gloves in handling body substances reduced CDI incidence in the intervention wards but not in control wards where glove use was not implemented [23]. Another study in an LTCF showed that it was unlikely to find *C. difficile* in hands of healthcare personnel who regularly washed hands and used gloves [24]. Because of its proven efficacy, gloves should be used for caring all CDI patients, when entering their rooms or handling their body substances.

Healthcare workers' uniforms can be contaminated by *C. difficile* spores; however, it is unknown if such contamination contributes to the spread of CDI [25]. Efficacy of disposable gowns in reducing CDI transmission is unclear since this intervention has been implemented together with other infection control measures, making it difficult to assess its effectiveness. Despite the uncertain benefits, experts recommend using disposable gowns while caring for patients with CDI [5]. Gloves and gowns should be made readily available near CDI patient rooms and should include signage that illustrates their proper use [16].

As per the new guidelines, isolation measures (private rooms/cohorting and contact precautions) should be continued for at least 48 hours after diarrhea resolves [5]. The guidelines also recommend extending isolation precautions until discharge if CDI rates remain high despite adherence to standard infection control measures [5]. This might not be feasible in LTCFs due to prolonged length of stay of residents and need to provide home-like environment [16]. Therefore, extending isolation in LTCF residents should be made on an individual basis and should be considered if these residents are believed to be a significant source of *C. difficile* transmission.

Hand Hygiene

Hand hygiene is one of the most important measures to prevent transmission of *C. difficile* and other healthcare-associated infections. Hand hygiene with soap and water will aid in physically removing the *C. difficile* spores from the hands of healthcare personnel. Studies have shown that it is less likely to find *C. difficile* in hands of healthcare workers who perform regular hand washing [24]. Studies have also noted low rate of handwashing by healthcare personnel [26]. Alcohol-based hand rubs are increasingly being used to improve compliance with hand hygiene in healthcare facilities. Although there is a theoretical concern that use of alcohol-based products for hand hygiene might increase CDI rates (since alcohol is not sporicidal and will not eliminate *C. difficile* spores from the hands but simply displace them), studies have not shown use of such products will increase CDI incidence [27, 28].

Therefore, during CDI endemic settings, the guidelines recommend the use of either soap and water or alcohol-based hand hygiene product before and after caring for a CDI patient or after contact with the patient's environment [5]. During outbreak or hyperendemic settings, handwashing with soap and water is preferred to alcohol-based products as alcohol might not reliably remove/inhibit *C. difficile* spores [5]. Handwashing with soap and water is also preferred when hands are visibly soiled and when there is contact with feces or with area where fecal contamination is likely [5]. LTCFs should provide staff with accessible handwashing facilities and make alcohol-based hand hygiene products readily available. Although it can be time consuming and require resources, LTCFs should monitor compliance with hand hygiene and contact precautions and share results with staff (only a few assessments can be done on an intermittent basis) [16].

Resident Handwashing and Bathing

The hands of CDI patients can become contaminated with *C. difficile* [29]. These patients can in turn transmit spores to surfaces or could ingest spores. The latter could lead to CDI recurrence.

Other body surfaces of CDI patients could also become contaminated with *C. difficile* spores [6]. Compared to bed bathing, showering has been shown to reduce skin contamination with *C. difficile* [30]. Therefore, the guidelines encourage patients to wash hands with soap and water and shower to decrease the concentration of *C. difficile* spores on hands and other skin surfaces, respectively [5]. If LTCF residents with CDI can wash hands and shower, they should be encouraged to do so.

Environmental Disinfection

Patients who have CDI or colonized with *C. difficile* shed spores and contaminate the local environment [31]. *C. difficile* spores are more likely to be found in rooms of patients with CDI than in rooms of patients who are colonized with *C. difficile* or in rooms where patients neither have CDI nor are colonized [31]. Spores can be found on bed rails, bed sheets, floors, toilets, commodes, bedpans, sinks, and many other sites in rooms of patients [4, 31, 32]. Studies also show that degree of environmental contamination correlates with degree of healthcare personnel hand contamination with *C. difficile* spores [4]. Therefore, the room of CDI patients should be cleaned and disinfected in order to reduce spore burden and prevent transmission. However, *C. difficile* spores are resistant to commonly used disinfectants; only sporicidal agents (such as chlorine-based compounds) have been shown to reduce surface contamination with *C. difficile* [33]. Despite the efficacy of sporicidal agents in reducing *C. difficile* spore burden, this does not necessarily result in reduced CDI incidence in an endemic setting, likely because the degree of environmental contamination is not high enough to cause transmission [34]. The reduction in CDI incidence with the use of sporicidal agents has been noted, however, in the setting of CDI outbreaks or hyperendemic CDI rates when combined with other interventions to prevent CDI [35, 36]. Therefore, the guidelines only recommend the use of sporicidal agents in these scenarios or when there is evidence of repeated cases of CDI from the same room indicating extensive environmental contamination with *C. difficile spores* [5].

In the LTCF setting, resources and personnel might not permit daily disinfection of CDI patient rooms with sporicidal agents. As these agents are also of unproven efficacy in an endemic setting, these should only be considered as supplemental interventions in an LTCF. Standard facility cleaning protocol should be followed in CDI patient rooms as well and adequacy of cleaning monitored.

Evaluate Cleaning Efficacy

Several methods such as fluorescent markers and adenosine triphosphate bioluminescence have been used to assess cleaning efficacy [37, 38]. These methods correlate well with microbiologic methods of cleaning efficacy and are most effective when feedback is given in real time [38, 39]. However, these methods might be expensive and time consuming if implemented in LTCFs. LTCFs could consider inexpensive methods such as use of fluorescent markers and/or evaluate cleaning efficacy on an intermittent basis in only a few randomly selected rooms [16]. Educating environmental staff about proper cleaning methods and providing them with adequate cleaning supplies are also crucial.

Use Disposable and Dedicated Equipment

Blood pressure cuffs and oral and rectal electronic thermometers have been implicated in CDI outbreaks [8, 9]. Incidence of CDI has been reduced with the use of disposable thermometers in place of reusable electronic thermometers [9, 10]. These results support the use of disposable equipment when possible. Nondisposable equipment such as blood pressure cuffs and stethoscopes should be dedicated to the patient's room [5]. If equipment is to be reused after use in a CDI patient, then it must be cleaned and disinfected preferably with a sporicidal agent that is equipment compatible [5]. The facility's policy should clearly mention the personnel (environmental services vs nurses/nurses' aides) responsible for cleaning and disinfection of equipment. LTCF residents with CDI who have rehabilitation needs should be

encouraged to use rehabilitation equipment at the end of the day [16]. The equipment should then be thoroughly cleaned and disinfected before use by other residents the following day.

The implementation of the above-mentioned infection control measures in a specific LTCF would depend on the burden of CDI in that facility. Basic measures such as hand hygiene, glove use, environmental cleaning, and isolation/cohorting should be implemented in most LTCFs. Additional control measures can then be added if CDI rates fail to improve despite proper adherence with the measures that are already in place.

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