



Environmental Control of *Clostridium difficile* Fact Sheet

February 2009 Version 3

What is *Clostridium difficile* (*C. difficile*)?

C. difficile is a spore forming bacterium that can produce toxins causing disease in humans. *C. difficile*-associated disease (CDAD) ranges from mild diarrhea to colitis and death. *C. difficile* is the most frequent cause of health-care associated diarrhea. Antimicrobial use is the primary risk factor for CDAD because it disrupts normal bowel flora and allows *C. difficile* overgrowth. Other risk factors include gastrointestinal surgery, long length of stay in healthcare settings, a serious underlying illness, advanced age and immunocompromising conditions e.g. cancer. Some patients have no clinical symptoms even though stool samples are positive for the *C. difficile* organism and/or its toxin while others develop CDAD.

How is *C. difficile*-associated disease changing?

In recent years, several states have reported increased rates of CDAD and numerous outbreaks have been reported, noting more severe disease and an increase in mortality¹. The increase in CDAD may be caused by changes in antibiotic use, changes in infection control practices or the emergence of a new strain of *C. difficile* with increased virulence, increased antimicrobial resistance or both^{1,2,3}. It is not clear at this time if the population at risk (those most susceptible to CDAD) is also changing⁴.

How is *C. difficile* transmitted?

C. difficile is present in feces and the major reservoirs of *C. difficile* are infected patients (both symptomatic and asymptomatic) and items or surfaces contaminated with feces⁵. *C. difficile* spores are transferred to patients primarily via the hands of healthcare personnel who have direct contact with infected patients or who have touched a contaminated surface or item. Documented cases of CDAD have been linked to a contaminated commode chair, a nursery baby bath and contaminated electronic rectal thermometer handles⁵.

What is the role of environmental surfaces in the spread of *C. difficile*?

Contamination of environmental surfaces with *C. difficile* in healthcare settings has been well documented. The ability of *C. difficile* to form spores allows the organism to survive in the environment for weeks or months⁶. These spores are highly resistant to cleaning and disinfection⁷. Contamination is most extensive in close proximity to symptomatic patients who soil their surroundings³.

Whether environmental contamination has a direct role in transmission is not clear, although transfer of the organism to hands could occur when contaminated surfaces are touched. Some studies suggest that there is a correlation between the frequency of *C. difficile* positive hand cultures and the amount of environmental contamination³.

What is the difference between *C. difficile* vegetative state and *C. difficile* spores?

The vegetative state is the active growth phase of the organism. A spore is a thick-walled resting cell produced by the organism to protect itself from unfavorable environmental conditions. When *C. difficile* in the vegetative state is challenged, but not killed, the bacterium forms a spore. *C. difficile* vegetative cells can survive up to 24 hours and spores up to 5 months in the environment⁷.

What environmental disinfectants are effective against *C. difficile*?

Quaternary ammonium compounds and phenols are not sporicidal and are only effective against *C. difficile* in the vegetative state⁸. Since some strains of *C. difficile* may display increased levels of spore production when exposed to non-chlorine-based cleaning agents and spores are more resistant than vegetative cells to surface disinfectants, the recommendation for cleaning environmental surfaces is the use of hypochlorite (bleach) for a) disinfection of rooms of patients with CDAD and b) for routine disinfection in units with high *C. difficile* rates^{9,10,13,14,15}. This recommendation is based on a study that showed a significant reduction in CDAD in the bone-marrow transplant unit when surfaces were cleaned with bleach (1:10 dilution) compared to cleaning with a quaternary ammonium compound¹¹. In the same study however, where the rate of CDAD (Neuro ICU and General Ward) was already low, disinfection with bleach did not result in a further decrease in the rate. Other studies have shown persistent contamination by *C. difficile* in patients' rooms despite "routine" cleaning and disinfection.

Undiagnosed and/or asymptomatic patients (those we don't know have the organism) may be an important source of *C. difficile* and person-to-person spread (via hands) is the main way this organism is spread between patients^{3,12}. Thus, hand washing, barrier precautions, and meticulous environmental cleaning[†] of fecally

contaminated surfaces (e.g. commodes, bathroom) for all patients are indicated to prevent spread of *C. difficile*¹².

† Low-level disinfectants do not kill spores however the cleaning process removes not only soil but microorganisms, thus reducing the number of microorganisms on the surface.

What are the CDC Recommendations to prevent transmission of *C. difficile*?

In 2003 the CDC published recommendations to prevent spread of *C. difficile* in health care settings and updated these recommendations in July, 2005 and Nov. 2008^{9,10,13}. Professional organizations such as Society for Hospital Epidemiologist of American (SHEA) along with Infectious Diseases Society of America (IDSA) and Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) have also issued guidelines specific to the control of *C. difficile*. The 2005 and 2008 CDC publication, as well as the SHEA/IDSA, recommendations are summarized below.

Each facility needs to consider the advantages and disadvantages of various cleaning strategies, as well as review the guidelines and latest scientific publications. Regardless of the disinfectant used, successful environmental control of *C. difficile* requires a collaborative approach between housekeeping and nursing services. Surfaces likely to become contaminated with feces and high-hand contact surfaces need to be identified, the cleaning process defined (when and how), accountability for cleaning established (who) and compliance monitored.

CDC *C. difficile* Recommendations for Health Care Providers, July 2005¹⁰

1. Ensure adequate cleaning and disinfection of environmental surfaces and reusable devices, especially items likely to be contaminated with feces and surfaces that are touched frequently.
2. Use an EPA-registered hypochlorite-based disinfectant for environmental surface disinfection after cleaning. Household bleach appropriately diluted may also be used.
3. Place patients with known or suspected CDAD in Contact Precautions which includes private room, gloves, gowns (if soiling likely) and dedicated patient care equipment.
4. Perform hand hygiene using either an alcohol hand rub or soap and water. If facility experiences an outbreak, consider using only soap and water for HH for patients with CDAD; alcohol-based hand rubs may not be as effective against spores.

The CDC goes on to say:

Surfaces should be kept clean and body substance spills should be promptly cleaned up as outlined in the Guideline for Environmental Infection Control. Hospital cleaning products can be used for routine cleaning. Hypochlorite-based disinfectants have been used with some success for

surface disinfection in those patient-care areas where surveillance indicates ongoing transmission of *C. difficile*⁹.

CDC Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008¹³

- 1) In units with high rates of endemic *Clostridium difficile* infection or in an outbreak setting, use dilute solutions of 5.25%–6.15% sodium hypochlorite (e.g., 1:10 dilution of household bleach) for routine environmental disinfection. Currently, no products are EPA-registered specifically for inactivating *C. difficile* spores. Category II.
- 2) If chlorine solution is not prepared fresh daily, it can be stored at room temperature for up to 30 days in a capped, opaque plastic bottle with a 50% reduction in chlorine concentration after 30 days of storage (e.g., 1000 ppm chlorine [approximately a 1:50 dilution] at day 0 decreases to 500 ppm chlorine by day 30). Category IB.
- 3) An EPA-registered sodium hypochlorite product is preferred, but if such products are not available, generic versions of sodium hypochlorite solutions (e.g., household chlorine bleach) can be used. Category II.

SHEA/IDSA Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals¹⁵

Ensure cleaning and disinfection of equipment and the environment (B-III for equipment and B-II for the environment).

- 1) *C. difficile* spores contaminate the environment in which patients are housed and the equipment used to care for them. This includes the following:
 - a) Furnishings in the room, including over-bed tables, bed rails, furniture, sinks, floors, commodes, and toilets
 - b) Patient care equipment that directly touches patients, such as thermometers, stethoscopes, and blood pressure cuffs
 - c) “High-touch” (i.e., frequently touched) surfaces, such as door knobs and intravenous fluid pumps
- 2) *C. difficile* appears to contaminate very few surfaces outside patient rooms
- 3) Contaminated surfaces and equipment are potential reservoirs for transmission of *C. difficile*.
 - a) Recent guidelines have outlined environmental disinfection protocols. There are no US Environmental Protection Agency-registered products specific for inactivating *C. difficile* spores. Data are conflicting as to whether inactivation of spores is necessary to prevent *C. difficile* transmission, especially in a setting of endemicity.
 - b) Facilities should consider using a 1 : 10 dilution of sodium hypochlorite (household bleach) for environmental disinfection in outbreak settings and settings of hyperendemicity in conjunction with other infection prevention and control measures (see below: II. Special Approaches for

the Prevention of CDI). The bleach solution should have a contact time of at least 10 minutes.

- 4) Develop and implement protocols for disinfection of equipment and the environment.
 - a) On a routine basis, assess adherence to protocols and the adequacy of cleaning.
 - b) Assess the adequacy of cleaning before changing to a new cleaning product (eg, bleach). If cleaning is not adequate, address this before changing products.
 - c) Because of the high turnover of housekeeping personnel, educate personnel on proper cleaning technique frequently. Ensure that education is provided in the personnel's native language.
- 5) Dedicate noncritical patient care items, such as blood pressure cuffs, stethoscopes, and thermometers, to a single patient with CDI.
 - a) When this is not possible, ensure adequate cleaning and disinfection of shared items between patient encounters. Ensure that the manufacturers' recommendations for contact time of disinfectants are followed.

Note: At present there are no EPA-registered products with specific claims for inactivating *C. difficile* spores. The EPA has directed that any disinfectant with a *C. difficile* vegetative claim, remove that claim from the label. The vegetative cells are killed by low level disinfectants. There are a number of registered products that contain hypochlorite. If an EPA-registered hypochlorite product is used, consult the label instructions for use conditions.

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Important:

The information provided in this report is believed to be reliable; however, due to the wide variety of intervening factors, 3M does not warrant that the results will necessarily be obtained.



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March 2009