

Environmental Control of Clostridium Difficile

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?

Over the past 2 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*?

Few studies have examined the use of chemical disinfectants for inactivation and/or removal of *C. difficile* spores and there are few well controlled studies investigating cleaning and disinfection methods. 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, some experts recommend 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}. 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 show persistent contamination by *C. difficile* in the patients room 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, handwashing, 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^{9,10}. These recommendations are summarized below. Whether to use bleach or not is controversial and more studies are necessary to determine "best practices". Each facility needs to consider the advantages and disadvantages of various cleaning strategies, 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 Guideline for Environmental Control of Infection in Healthcare Settings, 2003^{9,10}

1. Thoroughly clean and disinfect environmental and medical equipment surfaces on a regular basis using disinfectants according to manufacturer's recommendations. (Category IB)
2. Clean and disinfect high-touch surfaces (e.g. doorknobs, bed rails and bathrooms) more frequently than minimal touch surfaces. (Category II)
3. Advise families, visitors and patients about the importance of hand hygiene to minimize fecal contamination of surfaces. (Category II)
4. Because no EPA-registered products are specific for inactivating *C. difficile*, use hypochlorite-based solutions for disinfection of environmental surfaces, in accordance with guidance from the scientific literature, in patient care areas where surveillance indicates ongoing transmission of *C. difficile*. (Category II)
5. There is no recommendation regarding use of specific EPA-registered disinfectants to control *C. difficile*. (Unresolved Issue)

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.

Note: At present there are no EPA-registered products with specific claims for inactivating *C. difficile* spores, but there are a number of registered products that have claims against *C. difficile* in the vegetative state. 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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September 2006