

LETTERS TO THE EDITOR

Transfer of *Clostridium difficile* Spores by Nonsporicidal Wipes and Improperly Used Hypochlorite Wipes: Practice + Product = Perfection

To the Editor—Effective disinfection of contaminated surfaces is necessary to prevent transmission of *Clostridium difficile* spores. In addition to disinfection of rooms after discharge of patients with *C. difficile* infection (CDI), daily disinfection of surfaces may be useful as a measure to decrease healthcare personnel hand contamination by reducing the burden of contamination on frequently touched surfaces.^{1,2} Because *C. difficile* spores are resistant to killing by many disinfectants (eg, quaternary ammonium compounds), current guidelines recommend the use of sporicidal products such as sodium hypochlorite, particularly in outbreak or hyperendemic settings.^{3,4} In practice, it is not uncommon for healthcare facilities to use nonsporicidal products for some aspects of disinfection related to CDI (eg, daily cleaning of CDI rooms, equipment that may be damaged by exposure to hypochlorite). Rutala et al⁵ recently demonstrated that such use of nonsporicidal agents may be effective in reducing contamination on surfaces due to physical removal of spores (>2.9 log reduction). However, it is important for infection control practitioners to be aware that nonsporicidal wipes can transfer

spores from contaminated to clean surfaces,⁶ and improper use of hypochlorite wipes can also reduce effectiveness. Here, we examined the potential for transfer of *C. difficile* spores by quaternary ammonium-impregnated wipes and by hypochlorite wipes used for longer than the recommended duration.

Four wipes were tested: (1) Clorox premoistened germicidal wipes (Clorox), (2) used Clorox premoistened germicidal wipes (ie, a fresh wipe was used to wipe a clean surface area 25 ft long × 1 ft wide before testing, which resulted in drying within ~30 seconds after wiping a surface), (3) Kimtech Wet Task wipes (Kimberly-Clark) saturated with quaternary ammonium compound (VIREX II 256, Johnson-Diversey), and (4) Kimtech Wet Task wipes saturated with sterile water. The test organism was an epidemic North American pulsed-field gel electrophoresis type 1 isolate (VA 17). Spores were prepared as previously described.⁷

Transfer of spores was evaluated using a modification of the method of Williams et al.^{8,9} A clean bench top surface was inoculated with 5 log₁₀ colony-forming unit (CFU) aliquots of *C. difficile* spores suspended in 10 μL sterile water and allowed to air dry at room temperature for 30 minutes. The inoculation sites were manually wiped for 10 seconds with a wipe that was then sequentially wiped onto 4 clean sites for 10 seconds at each site. Each site was allowed 5 minutes of contact time before sampling with a sterile cotton-

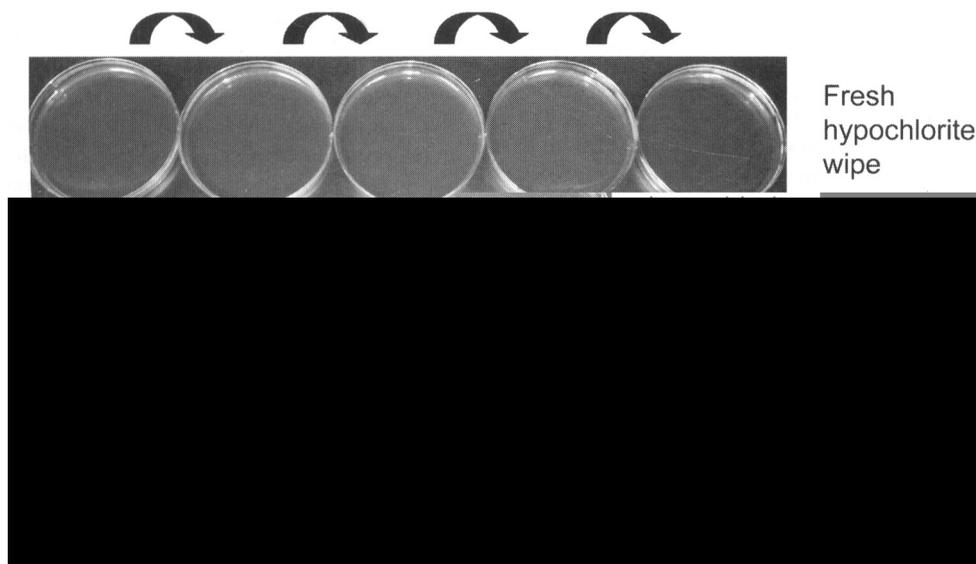


FIGURE 1. Illustration of transfer of *Clostridium difficile* spores by wipes. Ten-microliter aliquots containing ~5 log₁₀ colony-forming units of spores were spread to cover a 1-cm² area and allowed to air dry. The inoculation site was manually wiped for 10 seconds with a wipe that was then sequentially wiped onto 4 clean sites for 10 seconds at each site. After 5 minutes of wet contact time, sites were sampled using a sterile premoistened cotton-tipped swab neutralized with Dey-Engley neutralizer, and serial dilutions were plated onto pre-reduced *C. difficile* Brucella agar. Experiments were performed in triplicate. A color version of this figure is available in the online edition of the journal.

tipped swab (Fisher Scientific) premoistened in Dey-Engley neutralizer (Becton Dickinson). The swabs were vortexed for 45 seconds in 200 μ L of Dey-Engley neutralizer, plated onto prereduced *C. difficile* Brucella agar (CDBA), and cultured as previously described.⁷ For the fresh Clorox premoistened germicidal wipes only, an additional experiment was performed in which the inoculated site was wiped for 10 seconds and then sequentially imprinted onto 5 prereduced CDBA plates containing Dey-Engley neutralizer. All experiments were performed in triplicate.

Figure 1 provides an illustration of the findings. Use of fresh Clorox premoistened germicidal wipes with 5 minutes of contact time consistently reduced *C. difficile* spores to undetectable levels at the inoculum site, with no transfer of spores to clean sites. In contrast, large numbers of spores were transferred to all four sequential clean sites by wipes moistened with the quaternary ammonium product or water (mean number of spores recovered from the fourth transfer site, 3 and 2.1 log₁₀ CFUs, respectively). The used Clorox wipes transferred spores to all 4 sequential sites but in much lower quantities (mean, 0.4 log₁₀ CFUs recovered from the fourth transfer site). Finally, fresh Clorox premoistened germicidal wipes transferred large quantities of spores (CFU too numerous to count) to 5 successive CDBA plates containing Dey-Engley neutralizer (i.e., minimal contact time with hypochlorite allowed because of rapid exposure to neutralizer).

In summary, our results demonstrate efficient transfer of *C. difficile* spores from contaminated to clean surfaces by nonsporicidal wipes, as has previously been reported by Siani et al.⁶ Moreover, our findings illustrate the potential for transfer of spores by hypochlorite wipes that are used inappropriately. In our facility, observations of housekeepers demonstrated that many workers changed hypochlorite wipes infrequently while others used paper towels to dry surfaces shortly after application of hypochlorite. As illustrated here, such practices can result in insufficient wet contact time for killing of spores. Our findings demonstrate the need to provide clear instructions to housekeepers on how wipes should be used and provide support for the recommendation that sporicidal disinfectants are preferred for surfaces in CDI rooms when feasible.^{3,4} For effective disinfection of *C. difficile*, a sporicidal product plus correct practices are essential.

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Clostridium difficile Infection: It's a Family Affair

To the Editor—Infection control management of *Clostridium difficile* infection (CDI) in healthcare facilities has primarily focused on prevention of patient-to-patient transmission. We report on 6 cases of paired CDI identified over a 5-year period that occurred within the respective families, which highlights the potential for intrafamilial spread of CDI in both community and hospital settings. The original case-pairs were identified through root-cause analysis, which we perform on