

## 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.<sup>1,2</sup> 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.<sup>3,4</sup> 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 al<sup>5</sup> 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,<sup>6</sup> 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.<sup>7</sup>

Transfer of spores was evaluated using a modification of the method of Williams et al.<sup>8,9</sup> A clean bench top surface was inoculated with 5 log<sub>10</sub> 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-

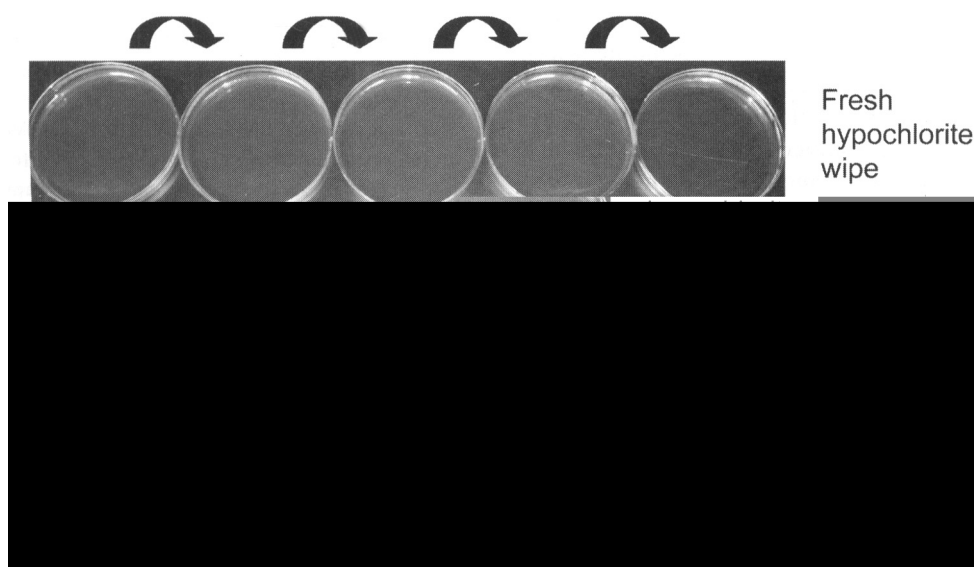


FIGURE 1. Illustration of transfer of *Clostridium difficile* spores by wipes. Ten-microliter aliquots containing ~5 log<sub>10</sub> colony-forming units of spores were spread to cover a 1-cm<sup>2</sup> area and allowed to air dry. The inoculation site was manually wiped for 10 seconds with a wipe 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  $\mu$ L of Dey-Engley neutralizer, plated onto prereduced *C. difficile* Brucella agar (CDBA), and cultured as previously described.<sup>7</sup> 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 log<sub>10</sub> CFUs, respectively). The used Clorox wipes transferred spores to all 4 sequential sites but in much lower quantities (mean, 0.4 log<sub>10</sub> 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.<sup>6</sup> 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.<sup>3,4</sup> For effective disinfection of *C. difficile*, a sporicidal product plus correct practices are essential.

#### ACKNOWLEDGMENTS

**Financial support.** Supported by a Merit Review grant from the Department of Veterans Affairs to C.J.D.

**Potential conflicts of interest.** C.J.D. reports that he has received research grants from STERIS and GOJO and is on an advisory board for 3M. All other authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

Jennifer L. Cadnum, BS;<sup>1</sup> Kelly N. Hurless, BS;<sup>2</sup> Sirisha Kundrapu, MD;<sup>1</sup> Curtis J. Donskey, MD<sup>1,3</sup>

**Affiliations:** 1. Division of Infectious Diseases, School of Medicine, Case Western Reserve University, Cleveland, Ohio; 2. Research Service, Louis Stokes Veterans Affairs Medical Center, Cleveland, Ohio; 3. Geriatric Research Education and Clinical Center, Cleveland Veterans Affairs Medical Center, Cleveland, Ohio.

Address correspondence to Curtis J. Donskey, MD, Geriatric Research Education and Clinical Center, Cleveland Veterans Affairs Medical Center, 10701 East Boulevard, Cleveland, OH 44106 (curtisd123@yahoo.com).

*Infect Control Hosp Epidemiol* 2013;34(4):441-442

© 2013 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2013/3404-0019\$15.00. DOI: 10.1086/669871

#### REFERENCES

- Kundrapu S, Sunkesula V, Jury LA, Sitzlar BM, Donskey CJ. Daily disinfection of high-touch surfaces in isolation rooms to reduce contamination of healthcare workers' hands. *Infect Control Hosp Epidemiol* 2012;33(10):1039-1042.
- Orenstein R, Aronhalt KC, McManus JE Jr, Fedraw LA. A targeted strategy to wipe out *Clostridium difficile*. *Infect Control Hosp Epidemiol* 2011;32(11):1137-1139.
- Dubberke ER, Gerding DN, Classen D, et al. Strategies to prevent *Clostridium difficile* infections in acute care hospitals. *Infect Control Hosp Epidemiol* 2008;29(suppl 1):S81-S92.
- Cohen SH, Gerding DN, Johnson S, et al. Clinical practice guidelines for *Clostridium difficile* infection in adults: 2010 update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). *Infect Control Hosp Epidemiol* 2010;35(5):431-455.
- Rutala WA, Gergen MF, Weber DJ. Efficacy of different cleaning and disinfection methods against *Clostridium difficile* spores: importance of physical removal versus sporicidal inactivation. *Infect Control Hosp Epidemiol* 2012; 33(12):1255-1258.
- Siani H, Cooper C, Maillard J-Y. Efficacy of "sporicidal" wipes against *Clostridium difficile*. *Am J Infect Control* 2011;39(3):212-218.
- Nerandzic MM, Donskey CJ. Effective and reduced-cost modified selective medium for isolation of *Clostridium difficile*. *J Clin Microbiol* 2009;47(2):397-400.
- Williams GJ, Denyer SP, Hosein IK, Hill DW, Maillard JY. The development of a new three-step protocol to determine the efficacy of disinfectant wipes on surfaces contaminated with *Staphylococcus aureus*. *J Hosp Infect* 2007;67(4):329-335.
- Williams GJ, Denyer SP, Hosein IK, Hill DW, Maillard J. Limitations of the efficacy of surface disinfection in the healthcare setting. *Infect Control Hosp Epidemiol* 2009;30(6):570-573.

### *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