

to these symptoms and those listed in the CTCAE for diarrhea, we added hypothermia.

The nature of our study population (ie, allogeneic hematopoietic stem cell transplant recipients) precludes the use of several of the other severity criteria mentioned by Jaber et al.¹ Many of the patients were neutropenic, making white blood cell counts frequently inapplicable. All of the subjects were immunosuppressed, and therefore immunosuppression is not a useful criterion for assessing the risk of poor outcomes due to CDAD in this patient population. Measurement of the lactate level is not routinely done, and it is unlikely that many of our patients would have had a sample for lactate measurement obtained within 48 hours of CDAD diagnosis. Patients with a significant increase in lactate level would likely be hypotensive as well, and hypotension is captured under the criteria for diarrhea, grades 2-4.

Our primary goal in creating a CDAD severity grading system was to develop a scale that could identify patients who are at high risk for poor outcomes, early in their clinical course. Previous CDAD severity grading systems, including those mentioned by Jaber et al.,¹ were not limited to symptoms present early in a patient's clinical course. Pepin et al.⁴ included death within 30 days of diagnosis in their definition of a complicated CDAD case. Dallal et al.⁵ developed their CDAD severity system based on outcomes, not presenting symptoms; the defining criteria for fulminant colitis were death or the requirement for emergency colectomy. Although the grading systems developed by Pepin et al.⁴ and Dallal et al.⁵ undeniably identify cases of severe CDAD, their ability to classify CDAD severity at the time of diagnosis has not been validated. The studies of Pepin et al.⁴ and Dallal et al.,⁵ as well as our own, were also limited by being retrospective. To the best of our knowledge, no studies exist that prospectively validate any CDAD severity grading system. We are currently conducting a prospective study of CDAD in allogeneic hematopoietic stem cell transplant recipients, and this study should provide additional data on the usefulness of our CDAD severity grading system in that patient population.

ACKNOWLEDGMENTS

Financial support. The research for the article discussed in this letter was supported by an EpiCenters grant (UR8/CCU715087-03) from the Centers for Disease Control and Prevention.

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article.

Erik R. Dubberke, MD; Justin Sadhu, MD;
Robert Gatti, BS; Kimberly A. Reske, MPH;
John F. DiPersio, MD, PhD; Steven M. Devine, MD;
Victoria J. Fraser, MD

From the Division of Infectious Diseases (E.R.D., J.S., K.A.R., V.J.F.) and the Division of Oncology (J.F.D., S.M.D.), Washington University School of Medicine, Saint Louis, and the University of Missouri-Kansas City School of Dentistry, Kansas City (R.G.), Missouri.

Address reprint requests to Erik R. Dubberke, MD, Division of Infectious Diseases, Washington University School of Medicine, Campus Box 8051, 660 S. Euclid Ave. Saint Louis, MO 63110 (edubberk@im.wustl.edu).

Infect Control Hosp Epidemiol 2007; 29:189-190

© 2007 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2008/2902-0019\$15.00. DOI: 10.1086/527273

REFERENCES

- Jaber MR, Reeves M, Couperus J. Is diarrhea enough to assess the severity of *Clostridium difficile*-associated disease? *Infect Control Hosp Epidemiol* 2008; 29:187-189 (in this issue)
- Dubberke ER, Sadhu J, Gatti R, et al. Severity of *Clostridium difficile*-associated disease (CDAD) in allogeneic stem cell transplant recipients: evaluation of a CDAD severity grading system. *Infect Control Hosp Epidemiol* 2007; 28:208-211.
- National Cancer Institute. Common Terminology Criteria for Adverse Events v3.0 (CTCAE). Available at: <http://ctep.cancer.gov/forms/CTCAEv3.pdf>. Accessed December 14, 2007.
- Pepin J, Valiquette L, Alary ME, et al. *Clostridium difficile*-associated diarrhea in a region of Quebec from 1991 to 2003: a changing pattern of disease severity. *CMAJ* 2004; 171:466-472.
- Dallal RM, Harbrecht BG, Boujoukas AJ, et al. Fulminant *Clostridium difficile*: an underappreciated and increasing cause of death and complications. *Ann Surg* 2002; 235:363-372.

Efficacy of Sodium Hypochlorite-Based Disinfectants Against *Clostridium difficile* Spores

TO THE EDITOR—In their recent article, Fawley et al.¹ presented data that indicated certain chlorine-based germicides were able to inactivate *C. difficile* spores, when used at recommended working concentrations. These results coincide with those of other studies on *C. difficile* spores that have been conducted using chlorine-based germicides at the recommended working strength and with recommendations by the Centers for Disease Control and Prevention.²⁻⁶ Studies such as these provide valuable information for infection control professionals in healthcare facilities, especially since the US Environmental Protection Agency does not currently recognize a test method for inactivation of *C. difficile* spores.

As valuable as the reported efficacy information is, however, the rest of the article by Fawley et al.¹ quickly loses relevance. The mean sporulation rates outlined in the abstract are especially misleading because the assumption is that all studies conducted were done with the recommended working strength of the germicides, which was not the case. The sporulation testing that was described actually involved deter-

mination of minimum inhibitory concentrations (MICs), which may prove useful when studying the effects of antibiotics in the human body but should not be extrapolated to environmental surface disinfection on the macroscopic level. To do so is misleading and erroneous. Fawley et al.¹ state that the mean *C. difficile* sporulation capacity was significantly increased by exposure to neutral detergent, to a combination of detergent and hypochlorite, and to hydrogen peroxide, but the sporulation assay that is described in the article *does not simulate actual facility cleaning and disinfection practices*. The method assumes 72 hours of contact with a highly diluted solution of each germicide tested. However, none of these germicides are intended or directed for use over an extended time period in an extremely diluted form. Thus, the 72 hour incubation period for a combination of the highly diluted germicide and *C. difficile* does not replicate actual practice. Since it is not clearly communicated to clinical readers that the sporulation observed with the tested germicides in this study does not come close to replicating actual clinical conditions, infection control professionals may overlook or stop utilizing products that would fight *C. difficile* safely and effectively.

The message that should be made very clear is that the chlorine-containing germicides, including the sodium hypochlorite-based disinfectant, were shown to inactivate *C. difficile* spores when used at recommended working strength, and these types of germicides should be employed in health-care facilities when *C. difficile* is a problem.

ACKNOWLEDGMENTS

Potential conflicts of interest. J.H. reports that she is an employee of Caltech Industries.

Joan Holschlag, BS

From Caltech Industries, Midland, Michigan.
Address reprint requests to Joan Holschlag, BS, 4520 E. Ashman Rd., Suite C, Midland, MI 48642 (jholschlag@caltechind.com).

Infect Control Hosp Epidemiol 2008; 29:190-191
© 2007 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2008/2902-0020\$15.00. DOI: 10.1086/524336

REFERENCES

1. Fawley WN, Underwood S, Freeman J, et al. Efficacy of hospital cleaning agents and germicides against epidemic *Clostridium difficile* strains. *Infect Control Hosp Epidemiol* 2007; 28:920-5.
2. Rutala WA. Environmental control to reduce hospital GI illness. In: Programs and abstracts of the 16th Annual Scientific Meeting of the Society for Healthcare Epidemiology of America (Chicago), 2006.
3. Apisarnthanarak A, Zack JE, Mayfield JL, et al. Effectiveness of environmental and infection control programs to reduce transmission of *Clostridium difficile*. *Clin Infect Dis* 2004; 39:601-2.
4. Kerr L, Johnson J. The effect of sodium hypochlorite disinfection of the environment on nosocomial acquisition of *Clostridium difficile*. *Am J Infect Control* 1994; 22:102.

5. Perez J, Springthorpe VS, Sattar SA. Activity of selected oxidizing microbicides against the spores of *Clostridium difficile*: relevance to environmental control. *Am J Infect Control* 2005; 33:320-5.
6. Centers for Disease Control and Prevention (CDC). Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR Morb Mortal Wkly Rep* 2003; 52(RR10):84-5.

Reply to Holschlag

TO THE EDITOR—Holschlag¹ has failed to understand the findings of our article² and appears to be suggesting that we were not clear in our experimental methods. This is incorrect. To evaluate the efficacy of germicides and/or cleaning agents against *Clostridium difficile*, we used 3 different measures: the capacity to inhibit vegetative cells, the capacity to prevent spore germination, and the potential to promote sporulation. We clearly stated the concentrations of germicides and cleaning agents that were used in these different experiments; the subinhibitory concentrations that were used in the sporulation experiments are made clear in the Methods section and are reinforced in both the legend to Figure 2 and the Discussion section.

Holschlag¹ questions the relevance of the results that we obtained in our sporulation experiments using subinhibitory concentrations. We addressed this point in the Discussion section, which highlights the potential of environmental stresses (including drying, exposure to air, and exposure to cleaning agents and/or germicides) to influence sporulation. Holschlag¹ failed to point out that our experimental design included the use of fecal emulsions, to test the effects of germicides and/or cleaning agents on *C. difficile* spores. In so doing, we attempted to test the effects of exposure to feces, dilution of the germicides and/or cleaning agents, and prolonged contact with spores, all of which are entirely plausible conditions that may occur in the clinical setting. In many instances in hospitals today, some environmental surfaces are cleaned infrequently or only “terminally.” Even if done frequently for a patient with diarrhea (who will have from several to 10 or more explosive voluminous bowel movements per day), it is likely that environmental cleaning solution will on occasion comprise a mixture of residual waning disinfectant and fecal material from cumulative explosive diarrheal episodes. Thus, our study was intended to at least represent what can occur in practice (eg, rehabilitation, long-term care, and acute care facilities, as well as in the use of physical therapy equipment and stretchers used to transport patients). The results of our study may explain, in part, the rise in rates of *C. difficile* infection over the last decade in North America and in several European countries. We would argue for (at least) daily cleaning and appropriate disinfection for all hor-