



CHICAGO JOURNALS



---

A Targeted Strategy to Wipe Out *Clostridium difficile*

Author(s): Robert Orenstein, Kimberly C. Aronhalt, James E. McManus, Leslie A. Fedraw

Reviewed work(s):

Source: *Infection Control and Hospital Epidemiology*, Vol. 32, No. 11 (November 2011), pp. 1137-1139

Published by: [The University of Chicago Press](#) on behalf of [The Society for Healthcare Epidemiology of America](#)

Stable URL: <http://www.jstor.org/stable/10.1086/662586>

Accessed: 28/11/2011 10:03

---

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at

<http://proofing.www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



*The University of Chicago Press* and *The Society for Healthcare Epidemiology of America* are collaborating with JSTOR to digitize, preserve and extend access to *Infection Control and Hospital Epidemiology*.

<http://proofing.www.jstor.org>

## CONCISE COMMUNICATION

## A Targeted Strategy to Wipe Out *Clostridium difficile*

Robert Orenstein, DO;<sup>1,2</sup> Kimberly C. Aronhalt, MA, RN;<sup>2</sup>  
James E. McManus, Jr;<sup>3</sup>  
Leslie A. Fedraw, PMP, MA, MT(ASCP)<sup>4</sup>

This study evaluated daily cleaning with germicidal bleach wipes on wards with a high incidence of hospital-acquired *Clostridium difficile* infection (CDI). The intervention reduced hospital-acquired CDI incidence by 85%, from 24.2 to 3.6 cases per 10,000 patient-days, and prolonged the median time between hospital-acquired CDI cases from 8 to 80 days.

*Infect Control Hosp Epidemiol* 2011;32(11):1137-1139

Strategies to combat the increased frequency of *Clostridium difficile* infection (CDI) transmission have focused on enhanced isolation practices, hand hygiene compliance, antimicrobial stewardship, and environmental control.<sup>1</sup> The goal of this project was to determine whether a targeted strategy using bleach-based wipes could reduce CDI incidence on 2 units where CDI was highly endemic.

### METHODS

We performed a before-and-after intervention that compared CDI incidence on 2 medical units from August 1, 2008, through July 31, 2010, at Saint Marys Hospital, a 1,249-bed hospital in Rochester, Minnesota. These units were selected because they were contiguous and had high endemic CDI incidence. Most patients were admitted to the hospital for a gastrointestinal or respiratory illness. The census, acuity, staffing, and categories of patients admitted to the wards were unchanged throughout the study period. Isolation compliance was measured before and during the study.

Cases of CDI were defined as present in patients with greater than 3 loose stools within a 24-hour period or toxic megacolon and a polymerase chain reaction positive for *C. difficile* toxin or with pseudomembranous colitis detected via endoscopic or histopathologic examination.

Asymptomatic patients with a toxin assay result positive for *C. difficile* or with diarrhea due to another cause and patients with cases of relapse attributed to another facility or unit were excluded from the study. Hospital-acquired CDI was defined by the onset of diarrhea and associated symptoms 72 hours or more after hospital admission or within 60 days of discharge from one of these units. Episodes were linked to the last hospital unit location.

Incident cases of CDI were defined as cases that occurred in an outpatient or cases that occurred less than 72 hours

after admission to the hospital in individuals with no previous hospitalization on these units within the previous 60 days. All cases were reviewed by an experienced surveillance team and validated by an infection control physician. CDI incidence was reported monthly for the years preceding and following the intervention. The time between hospital-acquired CDI cases was calculated. Isolation compliance was measured by standardized observational audit each month as the percentage of room entries for which there was full adherence. Healthcare workers used alcohol hand rub for hand hygiene regardless of the patient's CDI status.

From August 1, 2008, through August 1, 2009, all rooms were cleaned daily and at hospital discharge with a quaternary ammonium compound (HB-Quat). From August 2, 2009, through July 31, 2010, housekeepers replaced this product with Clorox brand germicidal bleach wipes with 0.55% active chlorine. Rooms and high-touch surfaces were cleaned in the same manner before and during the intervention. The bleach was allowed to dry to achieve the recommended 10-minute contact time to inactivate *C. difficile* spores. Room cleanliness was assessed by supervisors and with the use of adenosine triphosphate bioluminescence. Cleaning failures were documented if the relative light units were greater than 250.<sup>2</sup> Before the intervention, high-touch surfaces from a random sample of 5 rooms were tested. During the intervention, 5 rooms that were randomly selected on 3 occasions were sampled for 135 high-touch surface tests after terminal cleaning. Two random practice audits were performed by environmental services management before the intervention, and 4 were performed during the intervention period. Overall and hospital-acquired CDI incidence per 10,000 patient-days and the time between hospital-acquired cases were calculated monthly.

The incidences of hospital-acquired CDI on each unit and for both units combined were compared using Fisher's exact test to compare the incidence of infection before and after the intervention. Statistical significance was set at a *P* value less than .05.

### RESULTS

The baseline CDI incidence rates on these 2 units ranged from 61 to 106 cases per 10,000 patient-days before the intervention. This contrasted with the hospital's overall incidence rate of 24 cases per 10,000 patient-days. In the pre-intervention period, 16 hospital-acquired CDI cases (24.2 cases per 10,000 patient-days) occurred on unit A, and 15 hospital-acquired CDI cases (24.1 cases per 10,000 patient-days) occurred on unit B. During the year of intervention with the bleach wipes, the number of hospital-acquired cases decreased to 2 cases (3.5 cases per 10,000 patient-days) on unit A and 2 cases (3.7 cases per 10,000 patient-days) on unit

B. Together, the rate of hospital-acquired CDI decreased from 24.2 to 3.6 cases per 10,000 patient-days ( $P < .001$ ), an almost 7-fold decrease. The monthly incidence of both hospital-acquired and overall CDI for the 2 units is reported in Figure 1. The median time between hospital-acquired cases increased from 8 to 80 days. Monthly contact isolation compliance ranged from 63% in January 2010 to 100% in July 2009, with the median compliance being 86%. All tested rooms remained consistently well cleaned, with a 98% pass rate before and a 97% pass rate during the intervention. Twenty-seven cases of hospital-acquired CDI were prevented in this study. The incremental cost of a hospital-acquired CDI is estimated to be between \$5,000 and \$8,000. Thus, between \$135,000 and \$216,000 of excess costs may have been averted by these simple measures. During the study, 444 buckets of bleach wipes were used at an annualized cost of \$12,684.

## DISCUSSION

Daily and terminal cleaning of all rooms on these 2 units with 0.55% bleach wipes resulted in an 85% decrease in hospital-acquired CDI over a 12-month period and lengthened the median time between hospital-acquired CDI cases from 8 to 80 days. The unit with the highest CDI incidence in the entire hospital went 318 days without a hospital-acquired case. These reductions demonstrate that CDI incidence can be reduced with methods other than enhanced isolation practices.

This intervention had several unique aspects that led to its success. First, the intervention was focused on units with high endemic CDI incidence and used targeted surveillance data. These units already practiced enhanced isolation; all patients with diarrhea were isolated preemptively, and those with CDI remained in contact isolation for the duration of their hospital stay. These units had high rates of hand hygiene, contact

isolation compliance, and cleanliness. Second, we controlled many of the variables associated with CDI transmission before the intervention. Finally, all rooms were cleaned daily with bleach, regardless of whether the occupant had CDI. The process added little extra time to the housekeepers' daily routine, and rooms were able to be turned over quickly.

Our findings agree with those of earlier studies that demonstrate the potential for bleach products to reduce CDI. Bleach has effectively been used to terminate outbreaks of CDI.<sup>3</sup> Hospitals that use bleach solutions for discharge-only cleaning of the rooms of *C. difficile*-positive patients have shown reduced incidences of CDI.<sup>4</sup> Because a substantial reservoir of colonized patients or asymptomatic carriers may not be in isolation, we believe that daily cleaning may be more effective than discharge-only cleaning.<sup>5-7</sup> Cleaning of rooms at patient discharge from the hospital with 1 : 10 hypochlorite solution for patients with CDI on a bone marrow transplant unit led to a reduction in transmission on that unit but failed to demonstrate similar effectiveness in 2 other units, perhaps illustrating the importance of targeting areas of high incidence for maximum effect.<sup>8</sup> In that study, there was no measure of compliance with isolation or room cleanliness; room cleaning was performed only after patient discharge from the hospital, and the study preceded the NAP1 *C. difficile* epidemic in US hospitals.

A final aspect of our study is that we were able to demonstrate the aversion of significant costs that would have been incurred had CDI incidence remained elevated. The Center for Medicare Services has used elimination of hospital reimbursement for several healthcare-acquired infections and has targeted CDI as a potentially preventable infection for which similar measures may apply. By reducing the rate of hospital-acquired CDI 7-fold, we were able to avert between \$122,316 and \$203,316 in excess costs. It is estimated that

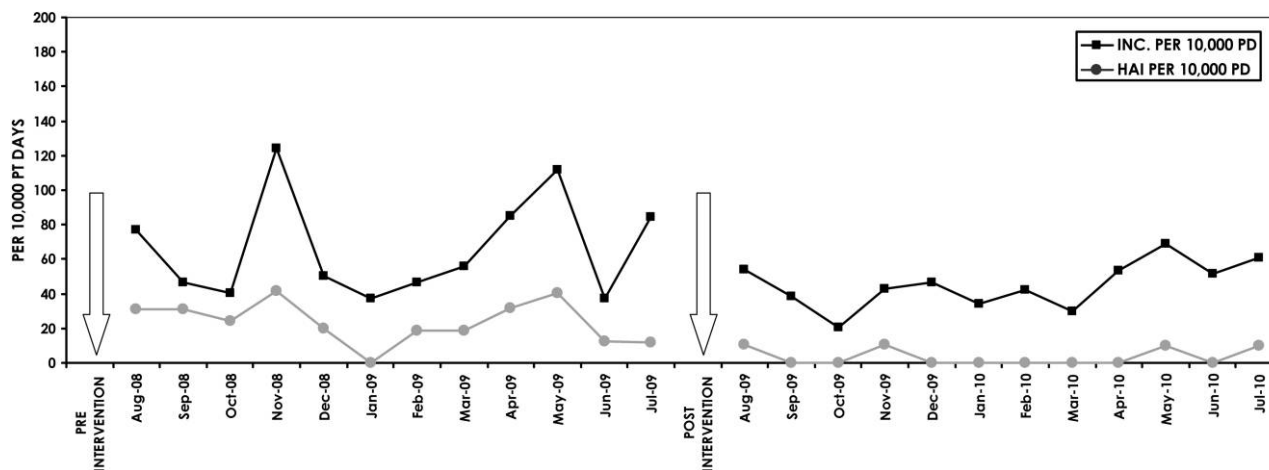


FIGURE 1. *Clostridium difficile* infection incidence for units A and B combined before the intervention (August 1, 2008–July 31, 2009) and after the intervention (August 1, 2009–July 31, 2010). HAI, hospital-acquired infection; INC, overall infection incidence; PD, patient days; PT, patient.

over 165,000 cases of hospital-acquired CDI occur annually in the United States. If other US hospitals could implement similar changes with only a 2-fold reduction in the incidence of hospital-acquired CDI, we could potentially avert between \$413 and \$660 million in costs and eliminate significant morbidity for hospitalized persons.

There are several limitations to our data. First, we attribute the effectiveness of this intervention to a targeted strategy. This was not a randomized trial but a before-and-after study design. Although we controlled for many confounders, many external factors impact the incidence of hospital-acquired infection and its reduction. Our study does not address whether bleach wipe cleaning of all rooms within a hospital will significantly impact the incidence of CDI or whether this intervention will be cost effective. Differing patient populations with longer lengths of stay or antimicrobial exposures could have differing outcomes. Our efforts were focused on areas where CDI was highly endemic but not epidemic. We did not compare discharge-only cleaning with daily cleaning, and it remains unclear whether cleaning only at hospital discharge could achieve similar results. Poorly tolerated products present a significant barrier to implementation. Another potential limitation to our data is whether they are generalizable. There may be important differences in the durability of the bleach wipe product depending upon ambient environmental conditions. The wet contact time was achievable with the wipes in our hospital, but the product may not provide the same contact time in low-humidity environments.

In conclusion, we found that daily room cleaning with 0.55% germicidal bleach wipes led to a sustained reduction in hospital-acquired CDI on units with high endemic incidence of CDI. Targeting the use of daily bleach wipe cleaning to units with an increased *C. difficile* colonization pressure is an effective method to wipe out healthcare-acquired CDI.

#### ACKNOWLEDGMENTS

*Financial support.* Clorox provided 214 buckets of donated product and a 30% price discount to the Mayo Clinic.

*Potential conflicts of interest.* J.E.M. has consulting relationships as a subject matter expert for environmental services education and training with 3M and Clorox. All other authors report no conflicts of interest relevant to this article.

Affiliations: 1. Division of Infectious Diseases, Mayo Clinic, Rochester, Minnesota; 2. Mayo Clinic Enterprise Infection Prevention and Control, Mayo Clinic, Rochester, Minnesota; 3. Environmental Services, Mayo Clinic, Rochester, Minnesota; 4. Quality Management Services, Mayo Clinic, Rochester, Minnesota.

Address correspondence to Robert Orenstein, DO, Associate Professor, Division of Infectious Diseases, Mayo Clinic, Phoenix Campus, 5777 East Mayo Boulevard, Phoenix, AZ 85054 (orenstein.robert@mayo.edu).

Presented in part: 3rd Decennial Society for Healthcare Epidemiology; 2010; Atlanta, Georgia (Abstract 142); and 21st Annual Scientific Meeting of the Society for Healthcare Epidemiology; 2011; Dallas, Texas (Abstract 156).

Received April 21, 2011; accepted July 14, 2011; electronically published October 6, 2011.

© 2011 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2011/3211-0016\$15.00. DOI: 10.1086/662586

#### REFERENCES

1. 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;31(5):431–455.
2. Lewis T, Griffith C, Gallo M, Weinbren M. A modified ATP benchmark for evaluating the cleaning of some hospital environmental surfaces. *J Hosp Infect* 2008;69(2):156–163.
3. Muto CA, Blank MK, Marsh JW, et al. Control of an outbreak of infection with the hypervirulent *Clostridium difficile* BI strain in a university hospital using a comprehensive “bundle” approach. *Clin Infect Dis* 2007;45(10):1266–1273.
4. Hacek DM, Ogle AM, Fisher A, Robicsek A, Peterson LR. Significant impact of terminal room cleaning with bleach on reducing nosocomial *Clostridium difficile*. *Am J Infect Control* 2010; 38(5):350–353.
5. Riggs MM, Sethi AK, Zabarsky TF, Eckstein EC, Jump RL, Donskey CJ. Asymptomatic carriers are a potential source for transmission of epidemic and non-epidemic *Clostridium difficile* strains in long-term care facility residents. *Clin Infect Dis* 2007; 45(8):992–998.
6. Bobulsky GS, Al-Nassir WN, Riggs MM, Sethi AK, Donskey CJ. *Clostridium difficile* skin contamination in patients with *Clostridium difficile*-associated disease. *Clin Infect Dis* 2008;46(3): 447–450.
7. Sethi AK, Al-Nassir WN, Nerandzic MM, Bobulsky GS, Donskey CJ. Persistence of skin contamination and environmental shedding of *Clostridium difficile* during and after treatment of *C. difficile* infection. *Infect Control Hosp Epidemiol* 2010;31(1):21–27.
8. Mayfield JL, Leet T, Miller J, Mundy LM. Environmental control to reduce transmission of *Clostridium difficile*. *Clin Infect Dis* 2000; 31(4):995–1000.