

CONCISE COMMUNICATION

Effectiveness of Routine Patient Bathing to Decrease the Burden of Spores on the Skin of Patients with *Clostridium difficile* Infection

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For 74 patients with *Clostridium difficile* infection, the quality and frequency of bathing was often limited because of such factors as the presence of devices, decreased mobility, and pain. Routine bathing practices had limited efficacy in decreasing the burden of spores on skin; however, showers were more effective than bed baths.

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Patients with *Clostridium difficile* infection (CDI) shed spores through fecal contamination, resulting in contamination of their skin, clothing, bedding, and environmental surfaces.^{1,2} We previously demonstrated that contamination of multiple skin sites, including the chest, abdomen, arm, and hand, was common among patients with CDI and could easily be transferred to gloved hands.³ In addition, skin contamination often persisted after resolution of diarrhea.^{3,4} These data suggest that the skin of CDI patients may be an important source of transmission.

Bathing with chlorhexidine gluconate has been shown to be effective in reducing the burden of such pathogens as vancomycin-resistant *Enterococcus* (VRE) and methicillin-resistant *Staphylococcus aureus* on skin.⁵⁻⁷ It is not known whether current hospital bathing practices are effective in decreasing levels of *C. difficile* spores on skin. Because antimicrobial soaps do not have activity against spores,⁸ the effect of bathing would have to be attributable to the mechanical effect of washing. In this study, we evaluated the efficacy of bathing for removal of *C. difficile* spores from CDI patients' skin and tested the hypothesis that showers are more effective than bed baths for removal of spores. In addition, we interviewed CDI patients to determine the frequency and type of bathing performed and identified factors that might limit their ability to bathe.

METHODS

We performed a 5-month prospective cohort study of patients with newly diagnosed CDI at Cleveland Veterans Affairs Medical Center in Cleveland, Ohio, including inpatients, outpatients, and residents of an associated long-term care facility. CDI was diagnosed on the basis of the presence of diarrhea (defined as 3 or more unformed bowel movements during a 24-hour period) and a polymerase chain reaction test positive

for *C. difficile* toxin B genes (*tcdB*) by a commercial assay (BD GeneOhm Cdiff assay). Information regarding patient characteristics was obtained by means of medical record review. The participants were interviewed using a standardized questionnaire to determine their bathing practices (ie, frequency and type of bathing, such as shower or bed bath) and to assess factors that might limit their ability to bathe. Mobility was assessed on the basis of patient interviews and the Braden Scale (ie, a routine nursing assessment that includes a mobility score).⁹ The hospital's institutional review board approved the study protocol.

For a subset of patients, we assessed the efficacy of bathing for removal of *C. difficile* spores from skin. All patients with an estimated length of stay of at least 2 days were assessed for willingness to provide culture samples before and after bathing. Within 3 days of the diagnosis of CDI, culture samples were obtained by simulating a physical examination of skin sites, including the abdomen, chest, forearm, hand, and groin, using a sterile glove premoistened with sterile water. Each skin site was contacted in 4 separate locations with a gloved hand that was then imprinted onto a prerduced *C. difficile* Brucella agar plate.¹⁰ In preliminary studies, we found that the hand-imprint culture method resulted in a greater yield of *C. difficile* colonies than did culture of swab samples (data not shown). The method used was identical to those used in previous studies by our group;^{3,4} however, in this study the sterile gloves were premoistened with sterile water prior to contact with the skin. Moistening of the gloves significantly increased the number of spores obtained after patient examinations in comparison with the use of dry gloves, and the number of nontoxicogenic *C. difficile* spores acquired on moist gloves after contacting artificially contaminated skin was equivalent to the number acquired on bare hands (data not shown). Specimens were obtained immediately before and 1 hour after the participant bathed.

The plates were transferred to an anaerobic chamber (Coy Laboratories) and incubated for 48–72 hours. Isolates were confirmed to be *C. difficile* on the basis of typical odor and appearance of colonies and a positive reaction using a *C. difficile* latex agglutination assay (Microgen Bioproducts). All isolates were tested for in vitro toxin production using *C. difficile* Tox A/B II (Wampole Laboratories); isolates that did not produce toxin were excluded from the analysis.

The Cochran Q test, a nonparametric repeated measures technique for analyzing dichotomous data, was used to compare the proportions of positive hand-imprint culture results before and after bathing. The Student paired *t* test was used to compare the mean number of colonies acquired on hands before and after bathing. A 2 × 2 repeated measures analysis of variance was also used to test differences in the number of colonies before and after bathing for each skin site cultured. Data were analyzed using SPSS statistical software, version 10.0 (SPSS).

RESULTS

Table 1 shows the characteristics of the 74 study patients with CDI. The mean age of the patients was 66 years, and 27 (36%) resided in a long-term care facility at the time of the survey. Fifty-eight patients (78%) used 1 or more medical devices, including intravenous catheters and supplemental oxygen. Thirty-seven patients (50%) had very limited mobility (Braden mobility score, 2), and 2 (3%) were bedbound (Braden mobility score, 1).

Of the 74 study patients, 36 (49%) bathed daily, 15 (20%) bathed 2–3 times per week, 19 (26%) bathed weekly or less often, and 4 (5%) reported bathing only on an as needed basis (ie, approximately once a month). In comparison with hospitalized patients, residents of the long-term care facility were less likely to bathe daily (34 [62%] of 55 vs 2 [11%] of 19; $P < .001$). In interviews, long-term care facility residents cited personal preference as the most common reason for not bathing daily (11 [58%] of 19 participants), but several residents also noted that they did not shower regularly in part because of lack of access to showers (ie, the facility has 8 showers for 165 long-term care residents). Hospitalized patients who did not bathe daily (21 [38%] of 55 hospitalized patients) typically cited multiple reasons, including personal preference, frequent diagnostic tests and procedures, weakness, and decreased mobility.

Sixty-four (86%) of the 74 CDI patients received bed baths rather than showering. In interviews, the most common reasons identified for receiving bed baths rather than showering were decreased mobility (45 [61%]), presence of devices (24 [32%]), pain (13 [18%]), and personal preference (8 [11%]). Many patients noted that these same factors limited their ability to bathe effectively.

Of the 74 CDI patients interviewed, 51 (69%) provided samples for culture so that skin contamination before and after bathing could be assessed. Fourteen (27%) of the 51 patients were excluded from the analysis, because all skin cultures of samples obtained before and after bathing had negative results. Compared with the 37 patients with positive skin culture results, the 14 patients with negative results were more likely to routinely bathe by showering (8 [57%] of 14 vs 9 [24%] of 37; $P = .045$) but not more likely to bathe daily (7 [50%] of 14 vs 14 [38%] of 37; $P = .53$). For the 37 CDI patients studied, there was a significant decrease in the proportion of positive hand culture results after showering (from 69% to 54% of 61 samples from 14 patients who showered; $P = .03$) but not after receiving a bed bath (from 54% to 47% of 99 samples from 23 patients who received bed baths; $P = .18$) (Figures 1A and 1B). Similarly, the mean number of spores acquired on hands decreased significantly after showers but not after bed baths (Figures 1C and 1D). For showering, the arm and chest skin sites had a significant decrease in the mean number of spores, but there was no significant decrease for the other skin sites. Five of the 14 patients for whom cultures were performed before and after

TABLE 1. Characteristics and Bathing Practices of 74 Hospitalized Patients with *Clostridium difficile* Infection (CDI)

Characteristic	Value
Age, years, mean (range)	66 (31–89)
Male sex	73 (99)
Hospital location	
Medical unit	30 (41)
Surgical unit	6 (8)
Intensive care unit	9 (12)
Spinal cord unit	10 (14)
Long-term care unit	19 (26)
Married	16 (22)
Nursing home resident	27 (36)
Mobility very limited	37 (50)
Wound present	22 (30)
Medical device present	58 (78)
Bathing frequency (any type)	
Daily	36 (49)
2–3 times per week	15 (20)
Once per week or less	19 (26)
As needed (approximately once per month)	4 (5)
Bathing type	
Shower	10 (14)
Bed bath	64 (86)
No. of bowel movements in past 24 hours, mean (range)	5 (2–13)
Fecal incontinence	26 (35)
Colostomy	3 (4)
Antimicrobial therapy for CDI	
Metronidazole	57 (77)
Vancomycin	17 (23)

NOTE. Data are no. (%) of patients, unless otherwise specified.

showering stated that they typically bathed by means of bed baths but did occasionally shower; these participants were asked to shower to provide additional data on the effectiveness of showering.

DISCUSSION

We found that the quality and frequency of bathing by patients with CDI in our institution is limited for a variety of reasons, including decreased mobility, the presence of devices, and pain. A majority of CDI patients received bed baths rather than showers, and only approximately one-half of patients reported bathing daily. Bed bathing did not significantly reduce the frequency of acquisition of spores on gloved hands after contact with skin sites, whereas showering was associated with a significant decrease in both the frequency and the mean number of spores acquired on hands. These findings suggest that encouraging CDI patients to shower could be a useful strategy to reduce the burden of spores on skin.

Our findings are consistent with those of previous studies that demonstrated that bed baths using nonantimicrobial soap have limited efficacy in removal of pathogenic bacteria from skin.^{5,6} Daily bed baths with chlorhexidine-impregnated

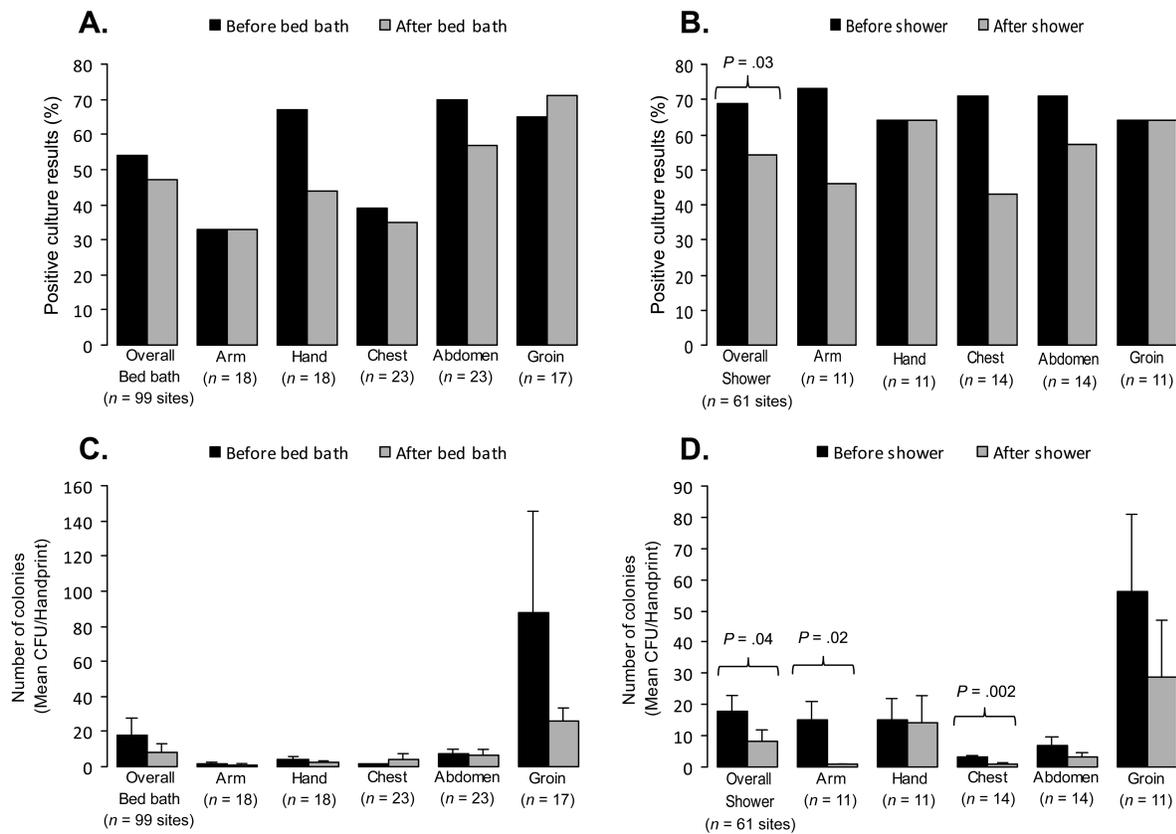


FIGURE 1. Proportion of positive hand culture results (A and B) and mean (\pm standard error) number of spores acquired on gloved hands (C and D) from examination of 37 patients with *Clostridium difficile* infection before and after bathing by bed bath ($n = 23$ patients) or shower ($n = 14$ patients). Skin sites examined included the groin, chest, abdomen, arm, and hand.

cloths were effective in decreasing levels of chlorhexidine-susceptible pathogens, such as VRE, on skin and in decreasing the incidence of VRE infection, but use of these cloths had no effect on the incidence of CDI.⁵ Hand washing with soap and water has also been shown to be significantly more effective in decreasing levels of *C. difficile* spores on hands than use of antiseptic hand wipes or alcohol-based hand rubs.^{8,11} It is likely that hand washing and showering are more effective than use of hand rub or bed bathing because of increased physical removal of spores with these procedures.

Although showering was more effective than bed bathing, it is notable that spores were acquired on investigators' hands about one-half the time even after patients had showered. This finding could be attributable in part to lack of thorough showering; many patients stated that such factors as decreased mobility, the presence of devices, and pain limited their ability to bathe effectively. Alternatively, it is possible that unknown factors keep washing from easily removing *C. difficile* spores from skin.¹¹ Edmonds et al¹² reported that hand-washing products removed only about 90% of *C. difficile* spores from hands, with equivalent results for several products.

Our study has several limitations. We studied a relatively small number of patients who were predominantly male and

elderly. Additional studies are needed to assess bathing practices among CDI patients at other institutions. Only a minority of the study participants were in the intensive care unit, so additional studies are needed to determine optimal bathing practices to be used in intensive care units. We examined the efficacy of single episodes of bathing by shower or bed bath. It is possible that multiple bed baths or showers over a period of days could have a cumulative effect in decreasing the burden of spores on skin.

In summary, the quality and frequency of bathing by CDI patients was often limited because of such factors as the presence of devices, decreased mobility, and pain. Showering was more effective than bed bathing in decreasing the acquisition of spores on investigators' hands. However, both methods of bathing had limited efficacy in decreasing the burden of spores on skin. There is a need to develop more effective strategies to remove *C. difficile* spores from skin.

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