Prevention of \textit{Clostridium difficile} infection in rural hospitals

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\textbf{Background:} Prevention of \textit{Clostridium difficile} infection (CDI) remains challenging across the spectrum of health care. There are limited data on prevention practices for CDI in the rural health care setting.

\textbf{Methods:} An electronic survey was administered to 21 rural facilities in Wisconsin, part of the Rural Wisconsin Health Cooperative. Data were collected on hospital characteristics and practices to prevent endemic CDI.

\textbf{Results:} Fifteen facilities responded (71%). Nearly all respondent facilities reported regular use of dedicated patient care items, use of gown and gloves, private patient rooms, hand hygiene, and room cleaning. Facilities in which the infection preventionist thought the support of his/her leadership to be "Very good" or "Excellent" employed significantly more CDI practices (13.3 ± 2.4 [standard deviation]) compared with infection preventionists who thought there was less support from leadership (9.8 ± 3.0, \(P = .033\)). Surveillance for CDI was highly variable. The most frequent barriers to implementation of CDI prevention practices included lack of adequate resources, lack of a physician champion, and difficulty keeping up with new recommendations.

\textbf{Conclusion:} Although most rural facilities in our survey reported using evidence-based practices for prevention of CDI, surveillance practices were highly variable, and data regarding the impact of these practices on CDI rates were limited. Future efforts that correlate CDI prevention initiatives and CDI incidence will help develop evidence-based practices in these resource-limited settings.

\textit{Clostridium difficile} (\textit{C difficile}) is the most common bacterial cause of health care-associated diarrhea, accounting for 15% to 25% of antibiotic-associated diarrhea.\textsuperscript{3} Recent years have witnessed a rapid increase in the incidence of \textit{C difficile} infection (CDI) with recognition of a new highly virulent strain that has caused global outbreaks.\textsuperscript{2-6} Each year, CDI affects an estimated 500,000 persons, accounting for over $1 billion in costs and contributing to up to 20,000 deaths.\textsuperscript{7}

Prevention of CDI in health care institutions is essential. Whereas recent studies have examined CDI prevention practices,\textsuperscript{8-10} data on institutions other than acute care facilities are limited.\textsuperscript{11-13} As the spectrum of health care expands beyond traditional acute care settings, it is important to examine all types of health care settings regarding prevention of CDI because prevention efforts may need to be tailored to the type of health care setting.

Small rural hospitals are one such setting where data regarding the incidence of \textit{C difficile} and current infection control efforts are scarce. Aspects unique to small rural health care facilities such as patient census, interfacility movement, length of stay, and resources may impact the dynamics of \textit{C difficile} transmission and infection as well as application of infection control practices. To explore this, we undertook a survey to evaluate infection control practices relevant to CDI that are currently in use in rural acute care and critical access facilities in the state of Wisconsin and to evaluate the perceptions of lead infection preventionists (IPs) for potential
facilitators of and barriers to implementation of prevention practices for CDI.

METHODS

Data collection

The study was conducted in May 2012 as a collaborative effort between the University of Wisconsin and the Rural Wisconsin Health Cooperative (RWHC), a coalition of 35 rural Wisconsin health care facilities that provides services such as networking and advocacy for member facilities in many aspects of care including infection control. The study was submitted to the Institutional Review Board and deemed exempt. The survey instrument—adapted from prior research—was pilot tested by 4 IPs: 3 at the University of Wisconsin and 1 at RWHC and modified to incorporate feedback. The final version of the survey was administered electronically to lead IPs at the 21 health care facilities that are voluntary participants in the RWHC infection control roundtable. There are no appreciable differences between roundtable participant facilities and nonparticipant facilities. The final survey population included 4 acute care hospitals and 17 critical access hospitals. The primary respondent for the survey was an IP employed by the participating facility; however, consultation with physicians and other infection control staff was encouraged to ensure accurate responses. The survey was administered electronically using Select Survey software (Optimal Solutions Group LLC, College Park, MD). A cover letter with instructions and a uniform resource locator (URL, ie, Internet address) to access the survey was e-mailed to all facilities in the RWHC infection control roundtable.

Study measures

The survey assessed basic information of the facility including location, type of facility (acute care or critical access hospital), bed count, and average daily census. In addition, we asked respondents how frequently certain CDI prevention practices (as recommended by national guidelines) were employed in their facilities. Respondents were asked to estimate the frequency of practice on a Likert scale of 1 (never) to 5 (always). We defined responses of 4 (almost always) or 5 (always) as regular use of the respective prevention practice. The practices examined included the use of dedicated patient care items, use of gowns/gloves for contact precautions, placement of patients with CDI in private rooms, hand hygiene practices, education of staff and patients regarding CDI, avoidance of treatment of asymptomatic carriers, environmental services practices, and use of chlorine-based products during outbreaks. For each prevention practice, respondents were asked to indicate whether or not the facility has a written policy; however, consultation with physicians and other infection control staff was encouraged to ensure accurate responses. The survey was administered electronically using Select Survey software (Optimal Solutions Group LLC, College Park, MD). A cover letter with instructions and a uniform resource locator (URL, ie, Internet address) to access the survey was e-mailed to all facilities in the RWHC infection control roundtable.

Statistical analysis

Data were reviewed and analyzed for response frequency. For comparison of 2 binary variables, Fisher exact test was used, with significance defined as \( P < .05 \). Analysis of variance was used to compare means of continuous variables. Linear regression was used to examine correlation between 2 continuous variables. Because of the small sample size, multivariate analysis was not performed. All analyses were conducted using Epilinfo statistical software (Centers for Disease Control and Prevention, Atlanta, GA).

RESULTS

The survey response rate was 71% (15/21). Twelve of 17 critical access hospitals and 3 of 4 acute care hospitals responded. There were no appreciable differences between respondent and nonrespondent facilities with respect to facility characteristics. Respondents were clustered in West-Central, Southwest, and South-Central Wisconsin, with 1 respondent facility each in the Northwest and Northeast. General facility and infection control program characteristics are summarized in Table 1. Each critical associated infection that are monitored, and whether an antibiotic stewardship program is employed.
having a written policy in place.

over total responses (including both negative and uncertain responses). Percent of respondents is in parentheses. Monitored adherence of written policy is conditional on "
hospitals
access hospital had a capacity of 25 beds, whereas the acute care hospitals' capacities ranged from 36 to 73 beds. The average daily census for critical access hospitals was 7.1 (range, 3-14) and 15.7 (range, 14.5-18.3) for acute care hospitals. Aside from these variables, there were no other apparent differences between critical access and acute care hospital respondents in terms of facility census for critical access hospitals was 7.1 (range, 3-14) and 15.7

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Regarding their respective infection control programs, all respondents reported that they performed surveillance for CDI. Four of the 15 facilities had antibiotic stewardship programs of some type in place. CDI rates were provided for 8 hospitals, with an average of 2.7 cases per 10,000 patient-days and a range of 0 to 13.8. Given the low frequency of CDI rate reporting, statistical analysis for correlation of rates with particular aspects of infection control was not performed. Among facilities that reported their rate of CDI, the majority of respondents (6/8) did not know whether their facility's rate was increasing or decreasing. No facility identified outbreaks or clusters of CDI.

Table 2 shows the prevalence of specific CDI-related recommended infection control practices. Nearly all facilities reported regular use of dedicated patient care items, use of gown and gloves, placement of patients with CDI in private rooms, hand hygiene, use of chlorine-based solutions during outbreaks, and terminal cleaning with detergent and sporicidal agents.

When asked their level of agreement with a series of statements regarding implementation of CDI-related infection control practices, 60% of respondents thought that they receive a great deal of support from leaders in the hospital when they want to implement a change and 33% agreed with the statement that “financial constraints are a significant barrier that prevents implementing CDI prevention practices.” When asked to identify perceived barriers to the implementation of evidence-based practices from a list of potential barriers, several different challenges were identified (Table 3). The most frequent barriers identified included insufficient resources to adequately implement recommended practices, lack of a physician champion, and difficulty keeping up with new recommendations. Lack of supportive hospital leadership and cost-effectiveness were also cited by multiple respondents.

All responding IPs thought that the strength of evidence is strong for the following practices: use of dedicated patient care equipment, use of gowns and gloves for care of patients with CDI, placement of patients with CDI in private rooms, meticulous hand hygiene, education of hospital personnel about CDI, decontamination of rooms of patients with CDI with chlorine-based products, education and training of environmental services staff, providing feedback for environmental services, and terminal room cleaning with a detergent. The remainder of recommendations had less perceived support, with 93% thinking there is strong evidence for education of the patient and their family about CDI and the use of a sporicidal agent for terminal cleaning, 86% for performing tests only on unformed stools, 75% for avoidance of the use of prophylactic antibiotics for CDI, 71% for avoidance of treatment or decolonization of asymptomatic carriers, and 36% for avoidance of electronic thermometers.

In comparing an IP’s perception of the strength of data in support of a particular practice compared with the self-reported prevalence of that practice in their facility, IPs in facilities where avoiding treatment of asymptomatic colonized patients is a regular practice were more likely to rate the evidence in favor of this practice as stronger (4.7 ± 0.5 [standard deviation] on a 5-point scale) compared with their counterparts in facilities where this was not a regular practice (3.3 ± 0.5, P value < .005). There was no such association for the remainder of practices studied.

Statistical analysis of the survey data found no significant correlation between many facility characteristics of interest (critical access vs acute care hospital, use of electronic medical record, employment of hospital epidemiologist, number of full-time

Table 2 Frequency of regular use, prevalence of specific written policies, and frequency of monitoring written policy for adherence for selected CDI-related infection control practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>Number of facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of dedicated patient care items and equipment</td>
<td>14/15 (93)</td>
</tr>
<tr>
<td>Use of gowns and gloves for contact with patients with CDI</td>
<td>14/15 (93)</td>
</tr>
<tr>
<td>Placement of patients with CDI in private rooms</td>
<td>15/15 (100)</td>
</tr>
<tr>
<td>Avoid the use of electronic thermometers</td>
<td>5/15 (33)</td>
</tr>
<tr>
<td>Perform meticulous hand hygiene based on CDC or WHO guidelines</td>
<td>13/15 (87)</td>
</tr>
<tr>
<td>Educate health care staff about CDI</td>
<td>11/15 (73)</td>
</tr>
<tr>
<td>Educate patients and family about CDI</td>
<td>8/15 (53)</td>
</tr>
<tr>
<td>Perform testing for C difficile only on unformed stools</td>
<td>12/15 (80)</td>
</tr>
<tr>
<td>Avoid use of prophylactic antimicrobial CDI therapy</td>
<td>6/14 (43)</td>
</tr>
<tr>
<td>Avoid treatment or decolonization of asymptomatic carriers</td>
<td>7/14 (50)</td>
</tr>
<tr>
<td>Use of chlorine-based products for environmental cleaning in outbreaks</td>
<td>14/15 (93)</td>
</tr>
<tr>
<td>Monitoring decontamination of rooms housing patients with CDI</td>
<td>7/15 (47)</td>
</tr>
<tr>
<td>Provide resources/training for environmental services employees</td>
<td>11/15 (73)</td>
</tr>
<tr>
<td>Provide performance feedback to environmental services staff</td>
<td>9/15 (60)</td>
</tr>
<tr>
<td>Perform terminal room cleaning with detergent-disinfectant</td>
<td>13/15 (87)</td>
</tr>
<tr>
<td>Perform terminal room cleaning with sporicidal disinfectant</td>
<td>13/15 (87)</td>
</tr>
</tbody>
</table>

CDI, Clostridium difficile infection; WHO, World Health Organization.

NOTE. “Regular use” is defined as a rating of 4 or 5 on a scale from 1 to 5 with 1 representing “Never” and 5 representing “Always.” Data are expressed as positive responses over total responses (including both negative and uncertain responses). Percent of respondents is in parentheses. Monitored adherence of written policy is conditional on having a written policy in place.

Table 3 Perceived barriers to implementation of evidence-based recommendations to reduce CDI, by number of respondents: n = 15

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Rated among 3 most important</th>
<th>Rated most important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not enough resources to implement recommended practices adequately</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Too difficult to keep up with all of the new recommendations</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Lack of a physician champion who will help advocate for change</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Hospital leadership is ineffective</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Most recommended practices are not cost-effective</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Local clinical culture distrusts outside recommendations</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Lots of committees but no communication</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

CDI, Clostridium difficile infection.
6-month surveillance study on nosocomial infections. Notably, comial infection. In the 1980s, RWHC hospitals participated in a Wisconsin, we noted a number of key statistical analysis of this variable.

DISCUSSION

In our survey of a subset of rural health care facilities in Wisconsin, we noted a number of key findings. First, whereas most rural facilities reported that adoption of infection control practices for prevention of CDI was common, a number of challenges persisted, hampering prevention and surveillance activities. Second, leadership support was an important organizational factor, the lack of which hindered progress in infection control practices for CDI prevention. Third, lack of resources was a major barrier to implementation of prevention practices for CDI. Fourth, respondents also cited difficulty with keeping up with new, and often extensive, guideline recommendations. Finally, we noted that very few facilities had antibiotic stewardship programs, and the ones that did exist were highly variable in the extent of stewardship and the resources devoted to the program.

There are a number of reasons why small rural facilities may differ from nonrural acute care facilities with regards to CDI prevention. Smaller facilities may have a lower disease burden and overall decreased incidence. However, rural facilities may face unique barriers to implementing infection control practices. For example, with lower census, the anticipated benefit of systematic infection control reforms may be perceived to be low. Differences in the use of antibiotics or in the degree or type of antibiotic stewardship programs may also impact transmission. Lack of specialist input may be a barrier for the development of antibiotic stewardship programs. Critical access hospitals, of which a considerable portion are rural, are not required to report health care-associated infection data to Centers for Medicare and Medicaid Services, which also may affect the resources dedicated to infection control and prevention practices. Laboratory facilities are highly variable, and increased turnaround time for send-out tests may delay the diagnosis of CDI. Given the short patient stay prior to discharge or transfer, patients with CDI may not be symptomatic until leaving the facility, making the true burden of disease invisible to that facility.

Many of the previous studies of infection control in rural hospitals predate the rise of C difficile as an important cause of nosocomial infection. In the 1980s, RWHC hospitals participated in a 6-month surveillance study on nosocomial infections. Notably, in that study, C difficile or pseudomembranous colitis was not even listed by name in the 11 categories of infection undergoing surveillance. There were 2 reported isolates of Clostridium from sources other than urine, sputum, or surgical sites, but species and location were not reported. A more recent study also analyzed infection control practices in small rural hospitals in the western United States. They found that the majority of these facilities were working to enact recommended infection control practices. This survey advances on this work by focusing specifically on CDI and examining perceptions of IPs working in those facilities.

Our findings have implications for IPs, clinicians, facility executive leadership, and patients. Given the relatively small sizes of rural facilities in our study population, whether critical access or acute care, dedicated resources for infection control may be difficult to obtain. This is not a challenge unique to rural hospitals. However, because patient movement across rural and urban facilities is widespread, efforts on infection control must be focused on preventing transmission across settings. This is particularly relevant for CDI where many cases may arise after discharge. Mechanisms to ensure effective interfacility communication regarding movement of patients infected or colonized with multidrug-resistant bacteria must be a priority. Another important area of intervention is in the development of antibiotic stewardship programs for rural health care facilities. In case studies of antibiotic stewardship programs, Ohl and Luther noted that, in some rural facilities, the lack of specialist input in the development of a stewardship program may a significant barrier to the implementation of such a program. Taking advantage of mechanisms such as e-consults or telecommunication with other facilities may be one possibility to surmount such obstacles and promote judicious antibiotic use.

Our study has a number of limitations. First, because the response rate was less than 100%, our results have some susceptibility to nonresponse bias. Second, our survey was limited only to rural facilities within RWHC that were part of an infection control roundtable. Although we did not find major differences between facilities that were or were not part of the infection control roundtable, data on facilities that did not participate in our survey are very limited. It is certainly possible that facilities already part of an infection control roundtable may be more likely to examine infection control literature and implement prevention initiatives for CDI as early adopters. Third, most facilities did not provide CDI rates, which prevented us from analyzing the relationship between prevention practices and CDI rates.

These limitations notwithstanding, our study provides a baseline for CDI prevention practices in rural facilities in Wisconsin. Our findings serve as a call to action to the health care system to systematically collect incidence and surveillance data on CDI. This will allow institutions to more effectively devise interventions for prevention and to examine the impact of prevention practices on the incidence of CDI in the rural health care setting.

Acknowledgments

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References


