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Major article

Prevention of *Clostridium difficile* infection in rural hospitals

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Background: Prevention of *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.
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.
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.
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.

Clostridium difficile (*C difficile*) is the most common bacterial cause of health care-associated diarrhea, accounting for 15% to 25% of antibiotic-associated diarrhea.[1] Recent years have witnessed a rapid increase in the incidence of *C difficile* infection (CDI) with recognition of a new highly virulent strain that has caused global outbreaks.[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.[7]

Prevention of CDI in health care institutions is essential. Whereas recent studies have examined CDI prevention practices,[8-10] data on institutions other than acute care facilities are limited.[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 *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 *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

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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[14,15]—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[16,17] 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 and, if so, whether the written policy is monitored for adherence. Respondents were asked to rank the strength of evidence supporting these recommended practices on a Likert scale of 1 (no evidence) to 5 (extremely strong evidence). Respondents were also asked to identify the most important perceived barriers to implementing evidence-based practices by ranking from a preselected list of potential barriers and by indicating their agreement with a series of statements on a Likert scale of 1 (strongly agree) to 5 (strongly disagree). For analysis purposes, responses of 1 (strongly agree) or 2 (agree) were used to define agreement. Additional information obtained included rates of CDI and information regarding the structure of the current infection control program including whether the facility has an epidemiologist, whether IPs are certified in clinical infection control, the number of full-time equivalent IPs on staff, time invested in surveillance, types of health care-associated infection that are monitored, and whether an antibiotic stewardship program is employed.

Table 1
Characteristics of respondent facilities and infection control programs

General facility information	
Capacity (beds)	30; 25-73
Average daily census	8.9; 3-18.3
% Of private rooms	84; 20-100
Presence of house staff trainees	3/15 (20)
Use of electronic medical record	13/15 (87)
Infection control program	
Surveillance conducted for HAI?	
CDI	15/15 (100)
CLABSI	10/15 (67)
Surgical site infection	15/15 (100)
CAUTI	15/15 (100)
VAP	3/15 (20)
% Of time spent on surveillance	45; 10-90
Antibiotic stewardship program	4/15 (27)
Participation in HAI prevention collaboratives	11/15 (73)
Hospital epidemiologist employed	3/15 (20)
Number of IP full-time equivalents	0.6; 0-1.3
IP certified in infection control	2/14 (14)
Use of data-mining software	1/15 (7)
CDI-related information	
Duration of contact precautions	
48 Hours after asymptomatic	6/15 (40)
Duration of hospitalization	8/15 (53)
Method of environmental decontamination	
Use of chlorine solution during outbreaks	14/15 (93)
Use of detergent for surface cleaning	13/15 (87)
Use of sporicidal agent	13/15 (87)
Method of environmental monitoring	
Fluorescence marker	3/15 (20)
Bioluminescence assay	1/15 (7)
Observation	8/15 (53)
Report CDI to NHSN	1/15 (7)
Use of probiotic for prevention or treatment	2/13 (15)

CAUTI, catheter-associated urinary tract infection; *CDI*, *Clostridium difficile* infection; *CLABSI*, central line-associated bloodstream infection; *HAI*, health care-associated infection; *IP*, infection preventionist; *NHSN*, National Health Safety Network; *VAP*, ventilator-associated pneumonia.
NOTE. Data are combined responses for both acute care hospitals and critical access hospitals. Aside from hospital capacity and average daily census, there were no apparent differences in facility characteristics between acute care hospitals and critical access hospitals. Continuous variables are expressed as averages with range. Binary variables are expressed as number of positive responses over total responses (including both negative and uncertain responses) with percentages in parentheses.

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 EpiInfo 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