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ORIGINAL ARTICLE

A Multicenter Study of *Clostridium difficile* Infection–Related Colectomy, 2000–2006

Amelia M. Kasper, MD;[1] Humaa A. Nyazee, MPH;[1] Deborah S. Yokoe, MD;[2] Jeanmarie Mayer, MD;[3] Julie E. Mangino, MD;[4] Yosef M. Khan, MD;[4] Bala Hota, MD;[5] Victoria J. Fraser, MD;[1] Erik R. Dubberke, MD;[1] for the Centers for Disease Control and Prevention Epicenters Program

OBJECTIVE. To assess *Clostridium difficile* infection (CDI)–related colectomy rates by CDI surveillance definitions and over time at multiple healthcare facilities.

SETTING. Five university-affiliated acute care hospitals in the United States.

DESIGN AND METHODS. Cases of CDI and patients who underwent colectomy from July 2000 through June 2006 were identified from 5 US tertiary care centers. Monthly CDI-related colectomy rates were calculated as the number of CDI-related colectomies per 1,000 CDI cases, and cases were categorized according to recommended surveillance definitions. Logistic regression was performed to evaluate risk factors for CDI-related colectomy.

RESULTS. In total, 8,569 cases of CDI were identified, and 75 patients underwent CDI-related colectomy. The overall colectomy rate was 8.7 per 1,000 CDI cases. The CDI-related colectomy rate ranged from 0 to 23 per 1,000 CDI episodes across hospitals. The colectomy rate for healthcare-facility-onset CDI was 4.3 per 1,000 CDI cases, and that for community-onset CDI was 16.5 per 1,000 CDI cases ($P < .05$). There were significantly more CDI-related colectomies at hospitals B and C ($P < .05$).

CONCLUSIONS. The overall CDI-related colectomy rate was low, and there was no significant change in the CDI-related colectomy rate over time. Onset of disease outside the study hospital was an independent risk factor for colectomy.

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Clostridium difficile infection (CDI) is one of the most common healthcare-associated infections, causing significant morbidity and mortality, increased healthcare costs, and prolonged hospital lengths of stay.[1-3] Published reports indicate that the incidence and severity of CDI are increasing.[4-6] The emergence of a hypervirulent epidemic strain and community-acquired disease in patients who were previously considered to be at low risk will likely place an even greater burden on patients and the healthcare system.[7-9]

Subtotal colectomy with end ileostomy is the treatment of choice for patients with fulminant CDI refractory to medical therapy.[10-15] Studies have identified a variety of factors associated with improved survival after CDI-related colectomy, and colectomy performed earlier in the course of fulminant colitis, before the patient becomes critically ill, is generally associated with improved survival.[10,11,13,15-18] Studies have reported colectomy rates for CDI from less than 1% to 3% of CDI cases,[9,11,14-20] and the rate of colectomies for severe disease appears to be rising over time.[21] These studies have been limited to single centers or outbreak settings, so little is known about overall temporal trends in colectomy rates in nonoutbreak settings. Furthermore, the relationship between the location of CDI symptom onset and the risk of colectomy for CDI is unknown.

The objective of this study was to conduct a multicenter, multiyear analysis of the incidence of colectomies for severe CDI in a nonoutbreak setting. Colectomy cases were further classified by the location of CDI onset, on the basis of published recommended surveillance definitions.

METHODS

Setting and Population

Five geographically diverse academic hospitals participating in the Prevention Epicenters Program of the Centers for Disease Control and Prevention collected inpatient data from

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TABLE 1. Definitions of *Clostridium difficile* Infection (CDI) According to Exposures

Type of CDI	Definition
HCF onset, HCF associated	Patient's stool sample tested positive >48 hours after admission to study hospital
Community onset, study-hospital associated	Patient's stool sample tested positive ≤48 hours after admission, provided that symptom onset was <4 weeks after the last discharge from a HCF and the most recent discharge was from an Epicenter
Community onset, non-study-hospital associated	Patient's stool sample tested positive ≤48 hours after admission, provided that symptom onset was <4 weeks after the last discharge from a HCF and the most recent discharge was from a HCF other than an Epicenter
Community onset, community associated	Patient's stool sample tested positive ≤48 hours after admission, provided that >12 weeks have elapsed since the last discharge from a HCF
Indeterminate	Patient's exposure setting does not fit any of the other criteria (eg, positive stool sample ≤48 hours after admission with HCF exposure 4–12 weeks prior to sample collection)
Recurrent	Patient's stool sample tested positive ≤8 weeks after a prior positive stool sample
Unknown	Patient's exposure setting could not be determined because of lack of available data

NOTE. HCF, healthcare facility.

July 1, 2000, through June 30, 2006. These hospitals were Barnes-Jewish Hospital (Saint Louis, MO), Brigham and Women's Hospital (Boston, MA), the Ohio State University Medical Center (Columbus, OH), Stroger Hospital of Cook County (Chicago, IL), and University of Utah Hospital (Salt Lake City, UT). Notably, a prior study found that the rates of CDI were significantly different between the hospitals, but there were no sustained outbreaks.[4] Inpatients 18 years old or greater were included in the study. Electronic medical records were queried to retrospectively collect dates of positive *C. difficile* toxin assay results; demographic information; comorbid conditions; *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) diagnosis codes; *ICD-9-CM* procedure codes for colectomy or hemicolectomy (45.73, 45.75, 45.76, 45.79, and 45.8); and admission and discharge dates. To provide a description of the overall population at the 5 hospitals, 4 patients not diagnosed with CDI were randomly selected among the patients discharged from the same study hospital during the same year for every case of CDI identified by toxin assay results or *ICD-9-CM* codes.

Definitions

The charts of all patients with a positive assay for *C. difficile* or the *ICD-9-CM* diagnosis code for CDI and an *ICD-9-CM* procedure code for colectomy were reviewed to determine if the colectomy was for CDI (CDI-related colectomy). For patients without a colectomy, a case of CDI was defined as a positive *C. difficile* stool toxin assay. For patients with CDI-related colectomy, a case of CDI was defined as the presence of a positive *C. difficile* toxin assay or the presence of the *ICD-9-CM* code for CDI and a CDI-related colectomy. The reason to have different definitions for a case of CDI based on whether there was a colectomy for CDI is 2-fold. All study hospitals are academic medical centers. Patients may be transferred for severe CDI and proceed to colectomy without repeating a toxin assay. In addition, patients with fulminant CDI may have an ileus or be taken to surgery prior to procurement of stool for *C. difficile* testing. Therefore, it was determined that the charts of patients assigned the *ICD-9-CM* code for CDI and a procedure code for colectomy would be reviewed. Conversely, most patients assigned the *ICD-9-CM* code for CDI without a positive toxin assay do not have CDI on the basis of further chart review.[22] Because of this, it was determined to be unnecessary to review the charts of the approximately 3,000 patients who were assigned the *ICD-9-CM* code for CDI but who did not have a positive toxin assay or a colectomy.

Cases of CDI were categorized on the basis of published surveillance definitions.[4,23-25] Charts of all patients with CDI onset 48 hours or less from admission were reviewed to determine recent healthcare exposures. Cases were categorized as healthcare facility (HCF) onset; community onset, study-hospital associated; community onset, non-study-hospital associated; indeterminate; and recurrent (Table 1). Recurrent cases were cases of CDI with a history of a positive toxin assay within the previous 8 weeks.

Data Analysis

Colectomy rates were calculated as the number of CDI-related colectomies per 1,000 toxin-positive cases. Data from hospital E were incomplete for the first 14 months; these months for hospital E were excluded from the analysis. Composite Charlson scores were calculated to assess comorbidity.[26] All tests were 2-tailed, and a P value of less than .05 was considered statistically significant, with Bonferroni adjustments for multiple comparisons when applicable. Data were compared with χ^2, χ^2 for trend, Fisher exact, and Mann-Whitney U tests. Univariate logistic regression was used to examine the contributions of age, sex, race, location of onset, Charlson score, and study center to the risk of colectomy. Variables associated with colectomy in unadjusted analysis ($P < .05$) were included in a multivariable regression logistic model to identify independent predictors of colectomy. Stepwise backward lo-

TABLE 2. Patient Characteristics

Hospital, characteristic	Patients without CDI	Patients with CDI[a]	Patients with colectomy for CDI
Hospital A (n = 28,215)			
No. of patients	24,232	3,955	28
Age, median (range), years	55.1 (18–103)	64.1 (18–105)	68.1 (23–87)
Female, no. (%)	13,727 (57)	2,015 (51)	15 (54)
Nonwhite, no. (%)	9,075 (37)	1,192 (30)	7 (25)
Charlson score, mean (range)	1.5 (0–16)	2.2 (0–15)	1.4 (0–7)
Mortality	2.8	12.7	53.6
Hospital B (n = 8,313)			
No. of patients	6,977	1,332	4
Age, median (range), years	47.1 (18–101)	56.2 (18–102)	42.2 (36–66)
Female, no. (%)	4,016 (58)	662 (50)	0 (0)
Nonwhite, no. (%)	1,315 (19)	168 (13)	0 (0)
Charlson score, mean (range)	1.1 (0–12)	2.2 (0–14)	1.3 (0–4)
Mortality, %	2.2	6.5	25.0
Hospital C (n = 10,692)			
No. of patients	9,641	1,026	25
Age, median (range), years	54.3 (18–106)	65.6 (18–97)	69.6 (42–87)
Female, no. (%)	5,612 (58)	535 (52)	11 (44)
Nonwhite, no. (%)	2,643 (27)	166 (16)	4 (16)
Charlson score, mean (range)	1.6 (0–15)	2.5 (0–14)	2.2 (0–11)
Mortality, %	3.3	8.4	28.0
Hospital D (n = 10,201)			
No. of patients	9,147	1,036	18
Age, median (range), years	53.9 (18–104)	63.4 (19–100)	70.1 (44–88)
Female, no. (%)	5,266 (58)	512 (49)	6 (33)
Nonwhite, no. (%)	3,153 (34)	231 (22)	2 (11)
Charlson score, mean (range)	1.3 (0–15)	1.4 (0–11)	0.6 (0–3)
Mortality, %	2.4	8.6	33.3
Hospital E (n = 4,165)			
No. of patients	3,530	635	0
Age, median (range), years	49.9 (18–100)	50.6 (18–99)	...
Female, no. (%)	1,691 (48)	237 (37)	...
Nonwhite, no. (%)	3,139 (89)	552 (87)	...
Charlson score, mean (range)	0.5 (0–10)	0.7 (0–11)	...
Mortality, %	2.4	7.7	...
Overall (n = 61,586)			
No. of patients	53,527	7,984	75
Age, median (range), years	53.4 (18–106)	61.5 (18–105)[b]	68.2 (23–88)[c]
Female, no. (%)	30,312 (57)	3,961 (50)	32 (43)
Nonwhite, no. (%)	19,325 (36)	2,309 (29)	13 (17)
Charlson score, mean (range)	1.4 (0–16)	2.0 (0–15)[d]	1.5 (0–11)[e]
Mortality, %	2.7	10.2	38.7

NOTE. CDI, *Clostridium difficile* infection.
[a] Cases of recurrent CDI are excluded.
[b] $P < .05$ comparing age of patients with and without CDI.
[c] $P = .03$ comparing age of patients with CDI with and without colectomy.
[d] $P < .05$ comparing Charlson score of patients with and without CDI.
[e] $P = .04$ comparing Charlson score of patients with CDI with and without colectomy.

gistic regression was used for multivariate analysis. Variables with significance levels of P less than .05 were retained in the final model. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated for each variable. Data were analyzed using Epi Info, version 3.4 (Centers for Disease Control and Prevention, Atlanta, GA), and SPSS for Windows, version 17.0 (SPSS, Chicago, IL). Approval was obtained from the institutional review boards of the Centers for Disease Control and Prevention and each of the participating centers.

RESULTS

During the study period, there were 8,569 episodes of toxin-positive CDI among 8,033 patients, including 540 (6.3%)

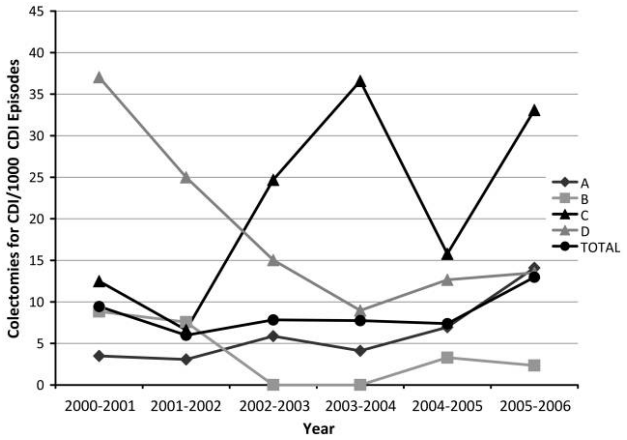

FIGURE 1. Colectomy rates by hospital over time. There was a significant increase in colectomies over time at hospital A ($P = .01$). CDI, *Clostridium difficile* infection.

cases of recurrent CDI. There were 252 patients who had a positive toxin assay or who were assigned the *ICD-9-CM* code for CDI and underwent a colectomy during the same hospitalization. Seventy-five (29.8%) of these patients had a CDI-related colectomy. Forty-nine patients (65%) with CDI-related colectomy had a documented positive toxin assay during the same admission. The colectomy incidence over the entire study period was 8.7 CDI-related colectomies per 1,000 CDI episodes. There was no significant overall trend in the annual incidence of CDI-related colectomy during the study period.

Demographic data are provided in Table 2. Overall, patients with CDI were older ($P < .05$) and had higher Charlson scores than patients without CDI ($P < .05$). The median age of patients who had a CDI-related colectomy was higher than that of patients with CDI who did not have a colectomy (68.2 vs 61.5 years; $P = .03$). White patients made up 71% of toxin-positive CDI cases but 83% of patients who had a CDI-related colectomy ($P = .03$). The proportion of colectomy patients who were female was 43%, compared with 50% of patients with a CDI-related colectomy ($P = .23$). The population of patients who underwent a CDI-related colectomy had lower Charlson scores than patients with CDI who did not undergo colectomy ($P = .04$).

Colectomy incidence at each hospital during the study period ranged from 0 to 23 per 1,000 CDI episodes. The only hospital with a significant linear trend in the annual colectomy rate over time was hospital A, which had an increase in CDI-related colectomy during the study period ($P = .01$; Figure 1). Though annual variations were evident, particularly at hospitals C and D, there were likely too few colectomies to find a significant linear trend. No colectomies for CDI were reported at hospital E during the study period. Comparisons by study center are presented in Table 2. Among patients without CDI, those at hospital A were the oldest, and those at hospital B were the youngest (55 vs 47 years; $P < .001$). Patients at hospital C had the highest Charlson comorbidity scores, and those at hospital E had the lowest (1.6 vs 0.5; $P < .001$). Among patients with CDI who did not undergo colectomy, those at hospital C were the oldest (66 years) and had the highest Charlson scores (2.5), whereas those at hospital E were the youngest (51 years) and had the lowest Charlson scores (0.7; both $P < .001$). Patients with CDI-related colectomy were the oldest (70 years) at hospital D and the youngest at hospital B (42 years; $P = .02$, not significant after Bonferroni correction). Those who had CDI-related colectomy at hospital D had the lowest Charlson scores, and those at hospital C had the highest scores (0.6 vs 2.2; $P = .01$).

HCF-onset CDI represented 4,897 episodes of CDI (58% of all toxin-positive episodes; Table 3). There were 21 CDI-related colectomies for HCF-onset CDI, accounting for 29% of all CDI-related colectomies. There were 794 episodes of community-onset, study-hospital-associated CDI (9% of all episodes) and 10 CDI-related colectomies (13% of CDI-related colectomy). The community-onset, non-study-hospital-associated category included 1,063 episodes of CDI (12% of all episodes) and 23 CDI-related colectomies (31% of CDI-related colectomies). There were 520 episodes of community-associated CDI (6% of all episodes) and 5 CDI-related colectomies (7% of CDI-related colectomies). Community-onset cases had higher colectomy rates than hospital-onset cases at all 4 hospitals that reported colectomies during the study period (Figure

TABLE 3. Comparison of *Clostridium difficile* Infection (CDI) Incidence and Deaths by Surveillance Definitions

	Patients with CDI, no colectomy		Patients with colectomy for CDI		
	No. (%) of patients	No. (%) of deaths	No. (%) of patients	No. (%) of deaths	Colectomies for CDI per 1,000 cases
Hospital onset	4,897 (57.5)	554 (11.3)	21 (28.8)	10 (47.6)	4.3
Community onset, study-hospital associated	794 (9.3)	70 (8.8)	10 (10.7)	4 (80)	12.4
Community onset, non-study-hospital associated	1,063 (12.5)	113 (10.6)	23 (30.7)	8 (80)	21.2
Indeterminate	365 (4.3)	20 (5.5)	8 (10.7)	3 (37.5)	21.4
Community associated	520 (6.1)	26 (5.0)	5 (6.7)	0 (0)	9.5
Recurrent	536 (6.3)	71 (13.2)	3 (4)	3 (100)	5.6
Unknown	345 (4.0)	19 (5.5)	5 (6.7)	1 (38.7)	14.3

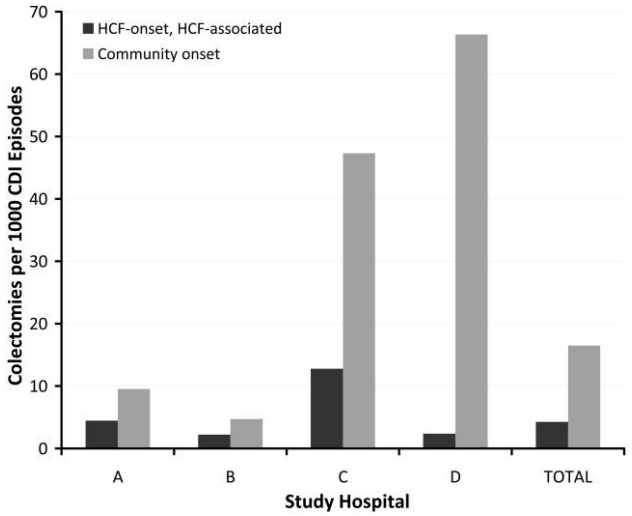

FIGURE 2. *Clostridium difficile* infection (CDI)–related colectomy rates by location of symptom onset. HCF, healthcare facility.

2). Six percent of cases and 4% of colectomies occurred among patients with recurrent CDI.

Risk factors for CDI-related colectomy are presented in Table 4. Advanced age (65 years and older) was associated with colectomy, with an OR of 1.9 ($P < .05$). White patients had a significantly higher OR for colectomy than nonwhite patients (OR, 2.0; $P = .02$). Admission to hospitals C and D was also associated with more CDI-related colectomies ($P < .05$). There were no differences in the risk of colectomy by patient gender, discharge year, or Charlson score. After multivariable adjustment, age of 65 years or older (OR, 1.6 [95% CI, 1.0–2.6]), admission to hospital C (OR, 4.0 [95% CI, 2.3–7.0]) or D (OR, 2.4 [95% CI, 1.3–4.5]), and community-onset CDI (OR, 3.4 [95% CI, 2.0–5.5]) remained significantly associated with CDI-related colectomy.

DISCUSSION

This study examined CDI-related colectomy rates at multiple HCFs over a 6-year period. We also assessed risk factors associated with CDI-related colectomy. Prior studies of colectomy for CDI have been limited by being conducted at single centers, over relatively brief periods of time, or in response to CDI outbreaks. These studies have potentially biased the literature to more severe outbreaks of CDI. Our study minimizes these biases by including multiple HCFs over several years in the absence of any sudden increases in CDI incidence or clinically apparent increases in deaths due to CDI.[4]

CDI-related colectomy rates in the literature differ based on the clinical setting, drawing from a wide variety of patient populations and CDI rates. The overall CDI-related colectomy rate in this study was 8.7 per 1,000 CDI cases, consistent with previously published rates, which ranged from 2.7 to 32 colectomies per 1,000 CDI cases.[9,11,14-20] Kutty et al[9] recently published a report of a community-based CDI outbreak in 6 hospitals in North Carolina involving 109 patients with CDI; none required intensive care unit admission or a colectomy. It was hypothesized that the paucity of severe cases was due to the young age of the study population (median, 62 years). In contrast, Lamontagne et al[13] found that 23% of the 165 patients in 2 hospitals' intensive care units with fulminant colitis required a colectomy. The hospitalized population in our study includes low- and high-acuity patients, and the colectomy rate fell between those 2 extremes.

There are few published data describing colectomy rates according to CDI surveillance definitions. One single-center study during an outbreak at a community hospital reported a colectomy incidence for HCF-onset CDI of 2%.[19] The HCF-onset colectomy rate in our study was lower, at 0.43%. We found that patients who had community-onset CDI with recent HCF exposure had the highest colectomy rate (Table 3). To our knowledge, there are no prior studies of colectomy incidence among community-onset cases that can be used for comparison. The colectomy rate among patients with community-onset CDI in this study may be biased high. Four of the 5 study hospitals are academic referral centers. It is not uncommon for patients with severe CDI to be transferred for management of severe CDI and possible colectomy.

There are no standard guidelines for selecting patients with CDI for colectomy, and this may account for the differences in CDI-related colectomy rates across the study hospitals. Some patterns did emerge. Overall, patients who underwent CDI-related colectomy were significantly older than patients with CDI who did not have a colectomy. This age difference was present at all centers and likely reflects the higher likelihood of older patients developing severe CDI.[6,20,27] Patients who had a CDI-related colectomy had lower Charlson scores than patients with CDI who did not have a colectomy. This may reflect a greater willingness to proceed to colectomy among patients with fewer comorbidities, who are more likely to survive an emergent, high-risk procedure. Patients were more likely to have a colectomy for CDI at hospitals C and D. At these particular centers, there were no obvious associations between mortality of patients without CDI and either mortality of patients with CDI or CDI-related colectomy rates. Data on treatment for CDI was not collected. Therefore, it is not possible to determine whether differences in CDI-related colectomy rates translated to improved patient outcomes.

This study has some limitations. Different case definitions were used for the numerator and denominator to determine the rate of CDI-related colectomy. When conducting surveillance for a rare event, missing a few cases may result in large differences in the identified disease incidence. On the other hand, missing a few noncases has less of an impact on the identified disease incidence. These factors must be considered when balancing the accuracy of the method of surveillance with the resources necessary to conduct the surveillance. Use of *ICD-9-CM* codes to identify patients with CDI has been shown to overestimate the number of cases of

TABLE 4. Factors Associated with *Clostridium difficile* Infection (CDI)–Related Colectomy

Characteristic	Colectomies for CDI per 1,000 patients	OR (95% CI)	*P*	Multivariable OR (95% CI)	Multivariable *P*
Age					
18–64 years	6.2	1.0 (reference)		1.0 (reference)	
≥65 years	12.1	**1.9 (1.2–3.2)**	**<.05**	**1.6 (1.0–2.6)**	**.05**
Sex					
Female	7.6	1.0 (reference)		1.0 (reference)	
Male	10.0	1.3 (0.8–2.1)	.2	1.4 (0.9–2.3)	.15
Race					
Nonwhite	5.3	1.0 (reference)		1.0 (reference)	
White	10.3	2.0 (1.1–3.8)	.02	1.6 (0.8–2.9)	.16
Charlson score					
0–1	10.4	1.0 (reference)		...	
2–3	8.8	0.9 (0.5–1.4)	.5	...	
4–5	2.2	0.2 (0–2.9)	.1	...	
≥6	4.3	0.4 (0.2–1.2)	.1	...	
Surveillance definition					
HCF onset	4.3	1.0 (reference)		1.0 (reference)	
Community onset	16.5	**3.9 (2.3–6.8)**	**<.05**	**3.4 (2.0–5.5)**	**<.05**
Discharge year					
2000–2001	9.4	1.0 (reference)		...	
2001–2002	6.0	0.6 (0.2–1.9)	.4	...	
2002–2003	7.8	0.8 (0.3–2.2)	.7	...	
2003–2004	7.7	0.8 (0.3–2.2)	.7	...	
2004–2005	7.4	0.8 (0.3–2.0)	.6	...	
2005–2006	12.8	1.4 (0.6–3.2)	.4	...	
Study hospital[a]					
A	6.4	1.0 (reference)		1.0 (reference)	
B	3.0	0.5 (0.1–1.4)	.1	0.6 (0.2–1.6)	.27
C	23.1	**3.6 (2.0–6.4)**	**<.05**	**4.0 (2.3–7.0)**	**<.05**
D	16.2	**2.5 (1.3–4.7)**	**<.05**	**2.4 (1.3–4.5)**	**<.05**

NOTE. Boldface type indicates statistical significance. CI, confidence interval; HCF, healthcare facility; OR, odds ratio.
[a] Hospital E was not included in this analysis because there were no colectomies for CDI reported during the study period.

CDI, and most patients with the *ICD-9-CM* code for CDI but without a corresponding positive toxin assay do not have CDI. Although *ICD-9-CM* codes are specific for CDI, the positive predictive value is only approximately 75% because of the relatively low prevalence of CDI.[22] Therefore, it was decided to limit the CDI-without-colectomy group to CDI cases with positive toxin assays only. Conversely, there was concern that some patients with CDI diagnosed at a referring HCF would be transferred for severe CDI and proceed to colectomy without repeating a toxin assay at the study hospital or that patients with fulminant CDI may be taken to surgery prior to procurement of a stool specimen for toxin testing. Although these cases represent a minority of all CDI cases, they may represent a large proportion of patients who undergo a CDI-related colectomy. These patients were included in the definition of CDI-related colectomy to avoid missing these cases. Consequently, colectomy rates may be overestimated, particularly for community-onset, non-study-hospital-associated cases. This is notable considering the overall low incidence of colectomy identified in this study.

As reported previously,[4] hospital B experienced a CDI pseudo-outbreak from July 1, 2004, to June 30, 2006, related to improper stool sample collection and transport. We chose to include data from hospital B during the pseudo-outbreak for this particular study, since 2 of the 4 colectomies performed during the study period at hospital B were performed during the pseudo-outbreak. The true colectomy incidence during these periods is therefore likely biased low. Another limitation of the data is that different toxin assays were used among the hospitals over the study period. It is unclear how or to what extent these different assays may have influenced CDI incidence. Additionally, data on infecting *C. difficile* strains are not available. It is possible that the hospitals involved in this study have a low proportion of CDI cases due to highly virulent epidemic strains, thus accounting for the low colectomy incidence. The epidemic BI/NAP1/027 strain has been identified at hospital A.

This study reports that no significant change in overall colectomy rates occurred from 2000 to 2006 but that CDI-related colectomy is associated with community-onset CDI, there are differences in colectomy incidence across HCFs without an obvious impact on outcome, and CDI-related colectomy is associated with high mortality. Because of the difficulties in establishing optimal criteria on when to take a patient with CDI to surgery, our study supports the need for prospective surveillance studies to track CDI-related colec-

tomy trends in stable sentinel populations while using standardized case definitions. Studies such as these will allow for comparisons between HCFs to identify trends in CDI-related colectomies and factors associated with improved patient outcomes, which can be used to improve patient selection for CDI-related colectomy.

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