2423. Cost-effectiveness of core and emerging infection control interventions to reduce hospital-onset Clostridioides difficile infection: An agent-based simulation modeling approach

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Background. Multiple infection control interventions have been recommended to reduce hospital-onset Clostridioides difficile infection (*C. difficile*; HO-CDI), including contact isolation, environmental disinfection, and hand hygiene. These interventions have differential effects on reducing HO-CDI that change for each hospital setting. In the context of today's constrained resources, with trade-offs a necessary part of any prevention plan, infection control personnel need information regarding intervention cost-effectiveness that is tailored to their unique hospital setting.

Methods. We evaluated the cost-effectiveness of nine infection control interventions and eight multiple-intervention bundles using our group's agent-based model of *C. difficile* transmission. This previously developed model represents a general 200-bed acute-care adult hospital. Effectiveness was measured from the hospital perspective in terms of both quality-adjusted life years (QALYs) and HO-CDIs.

Results. Six interventions reduced cost while increasing QALYs and averting HO-CDI, compared with baseline standard hospital practices: daily cleaning (saved an average of $407,854 and 36.8 QALYs annually in a 200-bed hospital), HCW hand hygiene ($181,767; 17.7 QALYs), patient hand hygiene ($25,700; 6.3 QALYs), terminal cleaning ($64,986; 12.8 QALYs), screening at admission ($9,083; 18.5 QALYs), and reducing patient transfers ($27,514; 3.1 QALYs). Adding patient hand hygiene to the HCW hand hygiene intervention was cost saving. When screening, HCW hand hygiene, and patient hand hygiene interventions were sequentially added to daily cleaning to form two, three, and four-pronged bundles, the incremental cost-effectiveness ratios for these additions were $26,588, $44,173, and $123,379 per QALY, respectively.

Conclusion. Using cost-effectiveness data, institutions may consider streamlining their infection control initiatives and prioritizing a smaller number of highly effective interventions. Our model could be used to evaluate the cost-effectiveness of existing core and emerging infection control interventions for specific hospital settings.

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2424. Shedding of Viable Clostridiodes difficile in Patients Admitted to a Medical Intensive Care Unit

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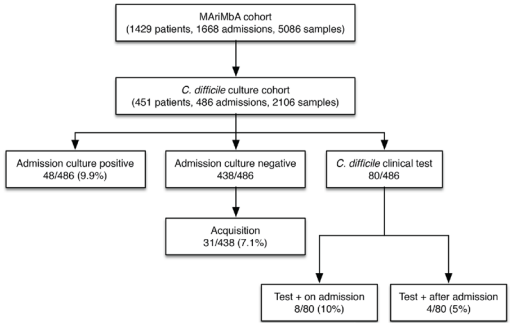
Background. Hospitalized patients are at risk of colonization with a range of healthcare-associated bacterial pathogens, including *C. difficile*. In patients admitted to intensive care units (ICUs), in whom *C. difficile* infection (CDI) is associated with increased morbidity and mortality. To understand the risk for acquisition of *C. difficile* and development of CDI, we monitored ICU patients daily for shedding of *C. difficile* by culture.

Methods. We conducted a secondary analysis of daily rectal/fecal swab samples collected from medical ICU patients of a 720-bed academic medical center in Chicago, IL. Selective culture for *C. difficile* was performed on swab samples from patients who had 2 or more samples obtained using selective media. Confirmation of putative *C. difficile* isolates was done by specific PCR assays for the 16S rRNA-encoding gene and the toxin genes tcdA, tcdB, cdtA and cdtB. Clinical testing for CDI was performed using the Xpert® *C. difficile* PCR assay (Cepheid). Clinical and demographic metadata were collected at bedside and by electronic medical record review.

Results. Culture was attempted on 2106 swab samples from 451 patients (486 ICU admissions) (Figure 1). A mean of 4.33 samples was obtained from each patient. *C. difficile* was isolated from 211 (10%) samples from 79 patients (Table 1). The first sample was positive by culture for 48 (9.9%) of patient admissions to the ICU. 31 (6.4%) patients who were initially negative by culture had a subsequent sample from which *C. difficile* was isolated. Persistence of culture-positivity varied from patient to patient (Figure 2). Of 80 patients who were tested for CDI based on physician suspicion, 12 patients had a positive Cepheid PCR test; 9 had diarrhea and were treated for CDI.

Conclusion. Surveillance for shedding of *C. difficile* by daily culture reveals that patients admitted to the ICU can shed the pathogen intermittently without attributable disease. This can be in the form patients who are admitted carrying the organism as well as those who appear to acquire the organism during their stay. It is unclear whether patient or microbiome factors underlie the differences seen in patterns of shedding. Furthermore, intermittent shedding may reflect multiple episodes of exposure to *C. difficile* spores and asymptomatic shedding without stable colonization.



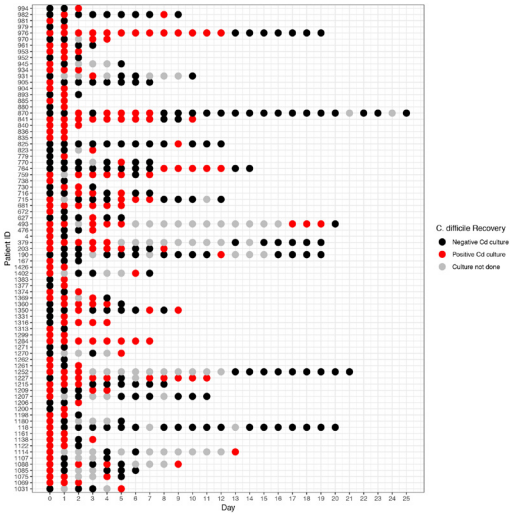


Table 1 Characteristics of Study Population (N = 486 admissions)

	Negative (n = 407)	*C. difficile* Colonized (n = 79)	OR [95% CI]	p -value
Age in years*, μ ± SD	63 ± 16	57 ± 18	0.98 [0.96, 0.99]	0.002
Female, n (%)	211 (52)	39 (49)	1.10 [0.68, 1.79]	0.687
Race, n (%)				0.0729
African American	183 (45)	25 (32)	0.61 [0.35, 1.06]	0.0746
Asian/Other/Unknown	69 (17)	19 (24)	1.22 [0.65, 2.28]	0.5343
Caucasian	155 (38)	35 (44)	*Referent*	
Functional status before admission, n (%)				0.055
Completely dependent with ADLs*	95 (26)	28 (39)	2.02 [1.13, 3.60]	0.0159
Required some assistance with ADLs	74 (21)	15 (21)	1.39 [0.70, 2.75]	0.3426
Completely independent for ADLs	192 (53)	28 (39)	*Referent*	
Braden Scale, M ± IQR	14 ± 6	14 ± 6	0.95 [0.88, 1.03]	0.2352
Charlson Comorbidity Index, M ± IQR	5 ± 6	5 ± 6	1.03 [0.97, 1.10]	0.7533
Elixhauser Comorbidity Index, n (%)				
Congestive heart failure*	115 (28)	32 (41)	1.73 [1.05, 2.85]	0.0301
Valvular disease	36 (9)	10 (13)	1.49 [0.71, 3.15]	0.2894
Pulmonary circulation disorders	36 (9)	7 (9)	1.00 [0.43, 2.34]	0.9964
Peripheral vascular disease	47 (12)	13 (16)	1.51 [0.77, 2.94]	0.2249
Hypertension	286 (70)	51 (65)	0.77 [0.46, 1.28]	0.3135
Paralysis	50 (12)	12 (15)	1.28 [0.65, 2.53]	0.4788
Other neurological disorders	149 (37)	29 (37)	1.00 [0.61, 1.66]	0.9866
Chronic pulmonary disease	103 (25)	23 (29)	1.21 [0.71, 2.07]	0.4798
Diabetes without chronic complications	32 (8)	5 (6)	0.79 [0.30, 2.10]	0.8175
Diabetes with chronic complications	130 (32)	28 (35)	1.17 [0.71, 1.94]	0.5431
Hypothyroidism	64 (16)	10 (13)	0.78 [0.38, 1.59]	0.4875
Renal failure	156 (38)	35 (44)	1.28 [0.79, 2.08]	0.3198
Liver disease	57 (14)	9 (11)	0.79 [0.37, 1.67]	0.5351
Chronic peptic ulcer disease	25 (6)	5 (6)	1.03 [0.38, 2.78]	1
HIV and AIDS	6 (1)	1 (1)	0.86 [0.10, 7.22]	0.8869
Lymphoma	19 (5)	1 (1)	0.26 [0.03, 1.98]	0.2231
Metastatic cancer	38 (9)	8 (10)	1.10 [0.49, 2.44]	0.8263
Solid tumor without metastasis	27 (7)	4 (5)	0.75 [0.26, 2.21]	0.8022
Rheumatoid arthritis/collagen vascular diseases	20 (5)	7 (9)	1.88 [0.77, 4.61]	0.1611
Coagulation deficiency	129 (32)	27 (34)	1.12 [0.67, 1.86]	0.6654
Obesity	148 (36)	22 (28)	0.68 [0.40, 1.15]	0.1464
Weight loss	192 (47)	46 (58)	1.56 [0.96, 2.54]	0.0721
Fluid and electrolyte disorders	272 (67)	55 (70)	1.14 [0.67, 1.92]	0.6286
Blood loss anemia	39 (10)	6 (8)	0.78 [0.32, 1.90]	0.5771
Deficiency anemias	224 (55)	46 (58)	1.14 [0.70, 1.86]	0.6014
Alcohol abuse	43 (11)	6 (8)	0.70 [0.29, 1.69]	0.4223
Drug abuse	21 (5)	4 (5)	0.98 [0.33, 2.94]	0.9717
Psychoses	31 (8)	5 (6)	0.82 [0.31, 2.18]	0.6892
Depression	84 (21)	21 (27)	1.39 [0.80, 2.42]	0.2401
Medical Devices on Admission, n (%)				
Central venous catheter	127 (31)	25 (32)	1.03 [0.61, 1.74]	0.9039
Gastrostomy tube*	31 (8)	12 (15)	2.17 [1.06, 4.44]	0.0301
Urinary bladder catheter	65 (16)	8 (10)	0.59 [0.27, 1.29]	0.1858
Tracheostomy	23 (6)	9 (12)	2.16 [0.96, 4.85]	0.0585
Mechanical ventilation during admission*, n (%)	181 (44)	47 (59)	1.83 [1.12, 2.99]	0.0144
Positive for Cepheid assay during MICU admission*, n (%)	5 (1)	7 (9)	7.82 [2.41, 25.30]	0.0009
Positive for CDI by clinical criteria*, n (%)	3 (1)	6 (8)	11.07 [2.71, 45.25]	0.0009
Antimicrobial receipt after MICU admission and before first rectal swab collection, n (%)	280 (69)	62 (78)	1.65 [0.93, 2.94]	0.0845
Vasopressor or inotropic support during MICU admission*, n (%)	88 (22)	29 (37)	2.10 [1.26, 3.52]	0.0041
Total length of MICU stay in days*, M ± IQR	4 ± 4	5 ± 7	1.05 [1.01, 1.09]	0.0089

* $p < 0.05$

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