Preventable Patient Harm: a Multidisciplinary, Bundled Approach to Reducing *Clostridium difficile* Infections While Using a Glutamate Dehydrogenase/Toxin Immunochromatographic Assay/Nucleic Acid Amplification Test Diagnostic Algorithm

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ABSTRACT Health care facility-onset *Clostridium difficile* infections (HO-CDI) are an important national problem, causing increased morbidity and mortality. HO-CDI is an important metric for the Center for Medicare and Medicaid Service's (CMS) performance measures. Hospitals that fall into the worst-performing quartile in preventing hospital-acquired infections, including HO-CDI, may lose millions of dollars in reimbursement. Under pressure to reduce CDI and without a clear optimal method for *C. difficile* detection, health care facilities are questioning how best to use highly sensitive nucleic acid amplification tests (NAATs) to aid in the diagnosis of CDI. Our institution has used a two-step glutamate dehydrogenase (GDH)/toxin immunochromatographic assay/NAAT algorithm since 2009. In 2016, our institution set an organizational goal to reduce our CDI rates by 10% by July 2017. We achieved a statistically significant reduction of 42.7% in our HO-CDI rate by forming a multidisciplinary group to implement and monitor eight key categories of infection prevention interventions over a period of 13 months. Notably, we achieved this reduction without modifying our laboratory algorithm. Significant reductions in CDI rates can be achieved without altering sensitive laboratory testing methods.

KEYWORDS *Clostridium difficile*, epidemiology, hospital infections, infection control

Clostridium difficile infections (CDI) result in a substantial burden of morbidity and mortality throughout the United States (1, 2). In 2011, *Clostridium difficile* was estimated to cause nearly half a million infections and 29,000 deaths in the United States, with older adults being especially vulnerable (2, 3). *C. difficile* is now the most common pathogen associated with infections in health care facilities (4). Complications related to CDI include disease recurrence, hospital readmissions, colectomies, death, and discharge to long-term-care facilities rather than to home (1). CDI are also associated with rising costs to acute-care facilities, with estimates upwards of $4 billion in 2008 (5).

Received 16 April 2018 **Returned for modification** 7 May 2018 **Accepted** 5 July 2018

Accepted manuscript posted online 11 July 2018

Citation Schultz K, Sickbert-Bennett E, Marx A, Weber DJ, DiBiase LM, Campbell-Bright S, Bode LE, Baker M, Belhorn T, Buchanan M, Goldbach S, Harden J, Hoke E, Huenniger B, Juliano JJ, Langston M, Ritchie H, Rutala WA, Smith J, Summerlin-Long S, Teal L, Gilligan P. 2018. Preventable patient harm: a multidisciplinary, bundled approach to reducing *Clostridium difficile* infections while using a glutamate dehydrogenase/toxin immunochromatographic assay/nucleic acid amplification test diagnostic algorithm. J Clin Microbiol 56:e00625-18. https://doi.org/10.1128/JCM.00625-18.

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There is a continuing debate in the clinical microbiology community concerning the optimal approach for the laboratory diagnosis of CDI (6). In the United States, the most widely used approach is to test a stool specimen, which takes the form of the cup (i.e., diarrheal stool), with an FDA-approved nucleic acid amplification test (NAAT), which detects genes involved in *C. difficile* toxin synthesis (6). An alternative approach is a two-step algorithm where an immunochromatographic screening test is done which detects a cell wall antigen of *C. difficile*, glutamate dehydrogenase (GDH), and *C. difficile* toxins. If the test is positive for both analytes, the patient's laboratory diagnosis is CDI; if negative for both, the patient is negative for CDI. In patients who are GDH positive/toxin negative (approximately 10 to 15%), an NAAT is performed, and the determination of CDI laboratory diagnosis is based on the NAAT result (7). A third approach is to use NAAT or GDH testing as the initial screen, and for those that are positive by that screen, use toxin enzyme immunoassay (EIA) as the confirmatory test; those who are toxin positive by the EIA are considered to be positive for CDI, while those who are negative are considered carriers of *C. difficile* (8). Outcome studies suggest this approach is the most specific for CDI diagnosis, although whether it is the most sensitive is debated (6). The most recently published clinical practice guidelines from the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA) recommend testing stools from patients who have unexplained new-onset diarrhea, defined as $\geq$3 stools in 24 hours, and who have not received laxatives in the prior 48 hours with the use of a NAAT alone or a stool toxin test as part of a multiple-step testing algorithm (i.e., GDH plus toxin, GDH plus toxin mediated by NAAT, or NAAT plus toxin) (9).

A major driver of this debate is the Center for Medicare and Medicaid Service's (CMS) hospital-acquired condition (HAC) reduction program (10). As a result of this program, institutions have focused intense efforts on reducing HACs, which include infections that occur in hospitals and were not present on admission. In October 2016, CMS began counting health care facility-onset (HO) CDI that were laboratory identified (LabID) as HACs. CDI LabID is defined by the National Healthcare Safety Network (NHSN) as any positive laboratory test result for *C. difficile* toxin A and/or B, or any detection of toxin-producing *C. difficile* organisms by culture or other laboratory means on an unformed stool specimen (11). For the purposes of the CMS HAC reduction program, HO-CDI LabID is defined as a positive laboratory test specimen collected greater than 3 days after admission to the facility. Hospitals that rank in the worst-performing quartile in preventing HACs, including HO-CDI LabID, experienced a 1% payment reduction beginning in fiscal year 2017 (FY17). For large medical centers, this payment reduction may put millions of dollars in reimbursement at risk. As a result, there has been an increased emphasis on reducing CDI rates within health care institutions (6, 12).

Since 2008, an increasing number of institutions have turned from enzyme immunoassays (EIA) to NAAT to perform *C. difficile* testing, due to the high sensitivity and relatively short turnaround time of NAAT. Despite risk adjustment from the NHSN on testing methodology (13), the resulting increase in *C. difficile*-positive results with NAAT may amplify the pressure on institutions to improve their infection rates (14). At our institution, the University of North Carolina Medical Center (UNCMC), a 933-bed academic hospital, we have used a two-step GDH/toxin immunochromatographic assay (*C. diff* Quik Chek Complete; TechLab, Blacksburg, VA) and NAAT (GeneXpert *C. difficile*; Cepheid, Sunnyvale, CA) algorithm since 2009 (7). Our HO-CDI LabID rate for FY16 was 11.0 infections per 10,000 patient days. CDI was consistently the most common cause of health care-associated infections in FY16 at UNCMC. Starting in April 2016, we sought to reduce our HO-CDI LabID rate by 10% by July 2017. We began by forming a multidisciplinary team to design and implement evidence-based interventions to prevent patient harm from *C. difficile*. In this paper, we describe the bundle of infection prevention approaches our team implemented to reduce CDI rates at UNCMC.

MATERIALS AND METHODS

Our multidisciplinary group met on a monthly basis to organize and coordinate our efforts. This group included representatives from Hospital Epidemiology, Performance Improvement and Patient Safety (PIPS), Clinical Microbiology, Antimicrobial Stewardship, Pharmacy, Infectious Disease, Environmental Services, Nursing, Patient Equipment, and Hospital Administration. The multidisciplinary group implemented multiple interventions and monitored the progress of each intervention with process measures. The interventions fell into eight discrete categories, as follows: diagnostic stewardship, electronic tools to enhance diagnostic stewardship, education, enhanced isolation precautions, hand hygiene, environmental cleaning and disinfection, antimicrobial stewardship, and pharmaceutical interventions (Table 1). The majority of the interventions were novel for our facility, but some (e.g., hand hygiene) focused on sustaining existing interventions that were already in place within our facility. The first new intervention began in March 2016, with implementation of the final intervention in May 2017 (Fig. 1).

Diagnostic stewardship. With the advent of highly sensitive NAATs, testing standards are necessary to ensure that the patient's clinical status warrants testing for CDI (14). Prior to convening the multidisciplinary group, the microbiology laboratory enforced *C. difficile* testing only for unformed, liquid stool and restricted testing for children less than 12 months of age without approval from a pediatric infectious disease physician. Starting in March 2016, the microbiology laboratory began enforcing other testing standards. Tests ordered on samples from patients with a positive *C. difficile* test in the previous 14 days were canceled, as this would not alter clinical management. Bolstered by evidence that repeat testing to detect CDI holds little value (9, 15), the microbiology laboratory also canceled tests ordered on patients with a negative *C. difficile* result in the previous 7 days. However, testing was considered on a case-by-case basis if the patient experienced new unexplained fever, abdominal pain, and leukocytosis in the 7 days after the first negative test.

Our laboratory standards discouraged testing of patients who received laxatives and/or stool softeners in the previous 48 h to reduce the risk of testing patients without clinically significant diarrhea, based on best practices documented in the literature (12, 16). Our standards also discouraged testing patients who had been continuously symptomatic since their last positive test, as well as asymptomatic patients who had completed antibiotic therapy (avoiding a "test of cure") (9). "Clinically significant" diarrhea was defined as "≥3 liquid stools in a 24-hour period, by history or observation" (9). The microbiology laboratory was able to enforce certain standards (i.e., no testing within 7 days of a previous negative result and no testing within 14 days of a previous positive result) by viewing results in the patient's electronic medical record and canceling orders. However, enforcing other standards (i.e., no testing within 48 h of a dose of laxative and/or stool softener, testing only clinically significant diarrhea) would have produced an unsustainable workload for the microbiology laboratory. Therefore, it was necessary for Hospital Epidemiology to improve diagnostic stewardship by using tools within our electronic medical record.

Hospital Epidemiology and PIPS worked to modify our electronic record, Epic (Verona, WI), to create automated prompts based on the laboratory testing standards for clinicians ordering *C. difficile* testing (Fig. 2). The prompts were not hard stops; they were meant to remind health care personnel (HCP) of testing per hospital policy (e.g., only testing patients with clinically significant diarrhea and not testing patients who received laxatives in the previous 48 h). HCP were not prevented from ordering a test if they left the questions unanswered or answered them incompletely.

We also developed automated best practice advisories (BPAs) within Epic to inform HCP of appropriate testing based on the laboratory testing standards (Fig. 3). The BPAs act as an alert when HCP order *C. difficile* tests on patients with recent *C. difficile* results and/or documented laxative or stool softener use in the last 48 h based on medication administration records. Like the electronic prompts, the BPAs were meant to act as educational tools and reminders and were not hard stops, with the intent that the BPAs and ordering questions could become mandatory if auditing revealed a lack of improvement in diagnostic stewardship. The ordering questions were implemented in the medical record in October 2016, and the BPAs were implemented in March 2017. Compliance with testing standards was assessed by electronic audits of nursing documentation of laxative or stool softener administration in the 48 hours prior to testing and loose stools. Compliance with no prior testing within 7 days of a previous negative or 14 days of a previous positive was assessed by electronic audits of documented laboratory results in the patient's chart. The audits were performed monthly for all inpatients with *C. difficile* testing orders.

Education. In April 2016, an update on *C. difficile* testing per hospital policy was disseminated to physician leadership. Registered nurses were empowered to use a standing protocol based on laboratory testing standards to place an order for *C. difficile* testing for symptomatic patients. Education was presented at nursing staff meetings in April 2016 and disseminated to nursing leadership. The standing protocol was updated with the intent to expedite testing on symptomatic patients when appropriate in order to initiate isolation and treatment.

Enhanced isolation precautions. At our facility, patients with known or suspected (i.e., at the time of *C. difficile* testing order) CDI are placed on enteric precautions, an enhanced version of contact precautions. Enteric precautions require a private room, gloves when entering the room, a disposable gown and gloves for direct patient contact or whenever clothing may contact room surfaces, and hand hygiene with soap and water after removing gloves and/or exiting the room. Visitors are also required to wear a gown and gloves and perform hand hygiene with soap and water. Starting in April 2016, Hospital Epidemiology increased the duration of enteric precautions from cessation of antibiotic therapy to 30 days after the cessation of antibiotic therapy, based on evidence of persistent stool, skin, and environmental contamination after CDI (17). Hospital Epidemiology provided education to staff when

TABLE 1 UNCMC *C. difficile* reduction intervention bundle, March 2016 to May 2017[a]

Intervention	Implementation date	Process measure assessed?	Assessment method	Process measure outcome	*P* value
Diagnostic stewardship					
Testing only liquid stools	Prior to March 2016	Yes	Electronic compliance audit	1.8% increased compliance	0.63
No testing <12 mo of age	Prior to March 2016	No	NA	NA	NA
No testing within 7 days of a previous negative	March 2016	Yes	Electronic compliance audit	7.8% increased compliance	0.002
No testing within 14 days of a previous positive	March 2016	Yes	Electronic compliance audit	10.5% increased compliance	<0.001
No testing with 48 h of laxative	March 2016	Yes	Electronic compliance audit	7.9% increased compliance	0.02
Electronic testing prompts	October 2016	Indirectly assessed through overall testing compliance	NA	NA	
Electronic BPAs	March 2017	Indirectly assessed through overall testing compliance	NA	NA	
HCP education	April 2016	Indirectly assessed through overall ordering compliance	NA	NA	
Extended duration of enhanced isolation precautions	April 2016	Yes	Point prevalence surveys	13.9% decrease in HCP compliance with PPE	NA
Hand hygiene observations	Prior to March 2016	Yes	Ongoing peer audits	>90% compliance, not significantly changed	NA
Cleaning and disinfection					
Cleaning standardization	May 2016	Yes	Fluorescent dye audits of touchpoints	≥94% compliance, not significantly changed	NA
UV-C at discharge	Prior to March 2016	Yes	Retrospective, mo-long point prevalence electronic audits	43% compliance in August 2016 vs 100% compliance in October 2017	NA
Antimicrobial stewardship	July 2016	Yes	Electronic audits of days of therapy		
Cefepime				2.0% decrease	<0.05
Ceftazidime				12.2% decrease	<0.05
Levofloxacin				19.0% decrease	<0.05
Clindamycin				9.6% decrease	<0.05
Ceftriaxone				9.9% increase	<0.05
Proton pump inhibitor guidelines	May 2017	No	NA	NA	NA

[a]NA, not applicable.

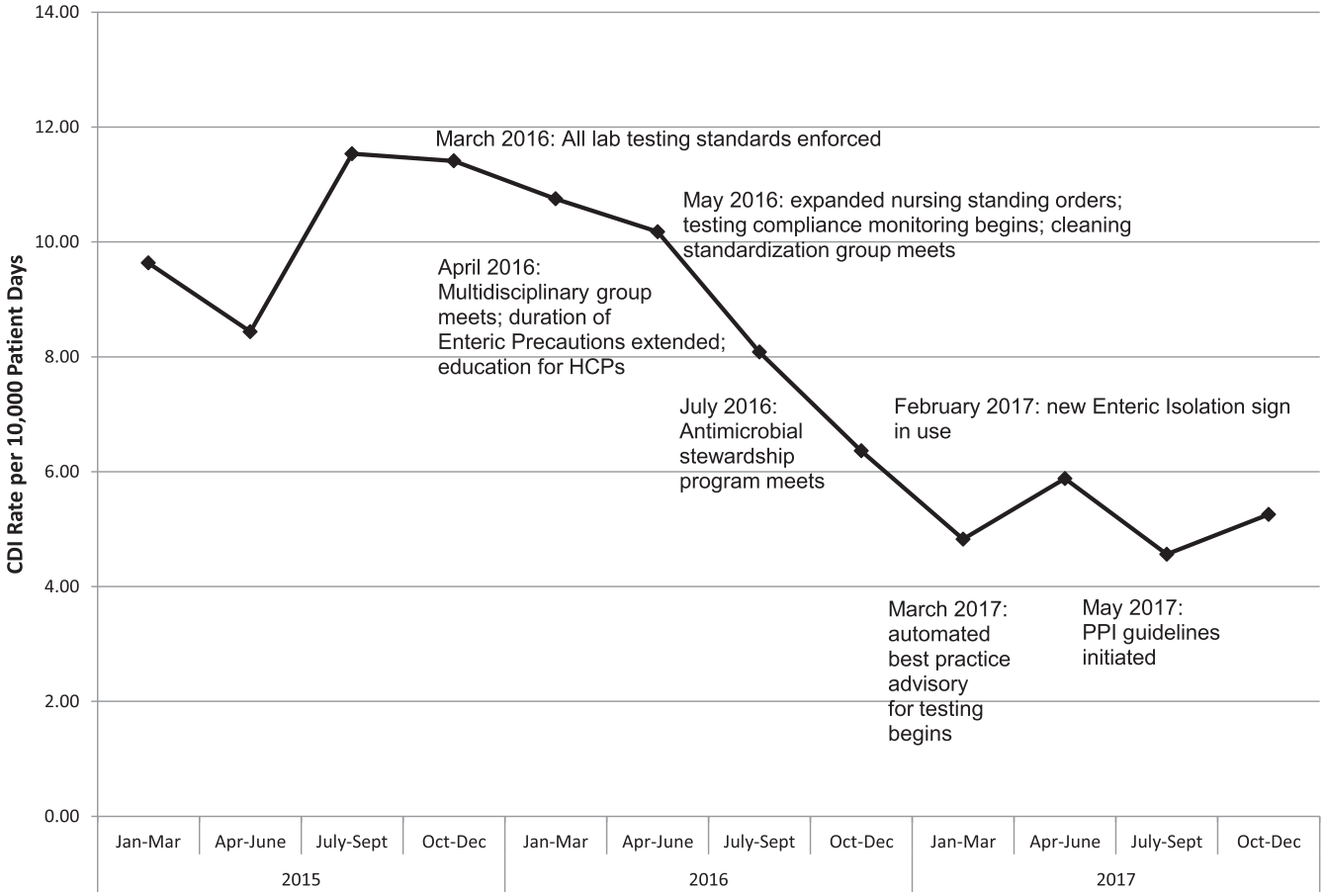

FIG 1 Health care facility-onset *C. difficile* LabID rates and novel interventions, 2015 to 2017.

this change was implemented and periodically monitored staff and visitor compliance with point prevalence surveys.

Since reducing CDI was an organizational goal for our facility, nurses working in the surgery service produced a novel intervention directed toward CDI prevention in February 2017. Nurses created a new enteric precautions sign that incorporated visual cues to prompt improved compliance with personal protective equipment (PPE) in isolation rooms.

Environmental cleaning and disinfection. Environmental cleaning has been shown to be an integral part of CDI prevention (18, 19). Enhanced cleaning practices in enteric precautions rooms include the use of an EPA-registered cleaner with known sporicidal activity during daily cleans and at patient discharge. Since 2012, the environmental services staff also used UV light (UV-C) machines to terminally disinfect patient rooms after cleaning following patient discharge (Healthcare Optimum-UV Enlight or Tru-D SmartUVC). The thoroughness of cleaning was monitored on a regular basis with the application of fluorescent dye on surfaces as a surrogate measure for the removal of organic soil. Frontline staff received feedback on the results of the cleaning audits. Environmental services monitored enteric precautions rooms for terminal disinfection with UV-C machines at discharge. There was a lack of equipment cleaning standardization throughout the hospital, with units utilizing different departments to clean pieces of equipment (e.g., vital sign machines and intravenous [i.v.] pumps). Beginning in May 2016, PIPS led a second multidisciplinary group to create a standardized plan for cleaning both patient rooms and pieces of patient equipment throughout the hospital.

Antimicrobial stewardship and pharmacy interventions. As antimicrobial therapy can precipitate CDI, reducing the use of unnecessary antibiotics is crucial in preventing CDI (20). Our antimicrobial stewardship program, staffed by infectious disease physicians, infectious disease pharmacists, and a clinical microbiologist, began providing support through antimicrobial surveillance, prospective audits and feedback, and educational activities, including in-services to all pharmacists on CDI and laboratory testing standards in July 2016. Prior to that time, more limited surveillance of redundant antimicrobial regimens and bloodstream infections started in July 2014. Electronic alerts generated by the TheraDoc (Premier, Inc., Charlotte, NC) software module for antimicrobial stewardship included bug-drug mismatches, dual anaerobic coverage, dual antistaphylococcal coverage, and positive blood cultures. In 2016, the antimicrobial stewardship team specifically worked to reduce the use of third- and fourth-generation cephalosporins and fluoroquinolones, which have been associated with increased rates of CDI (21).

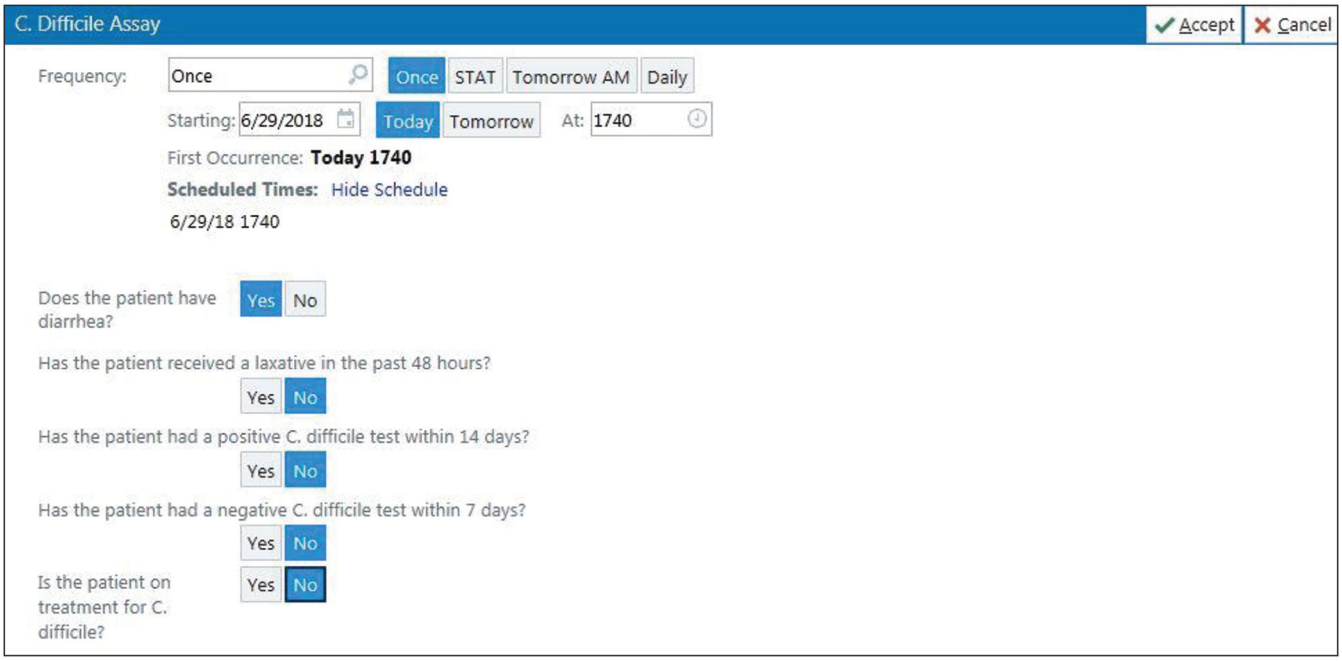

FIG 2 Electronic prompts for *C. difficile* testing.

Proton pump inhibitors (PPI) are overused in hospitalized patients (22) and have been associated with an increased risk for CDI (23, 24, 25). Pharmacy representatives on the multidisciplinary team developed educational guidelines for PPI use at UNCMC. When PPI use was clinically indicated, the guidelines supported using the lowest dose possible for the shortest duration of time possible and avoiding dose escalation. The guidelines were presented to UNCMC pharmacists in March 2017 and to intensive care unit physician and nurse leaders in July 2017.

Hand hygiene. Meticulous hand hygiene remains a bedrock of CDI prevention (26, 27). Since 2014, UNCMC has measured hand hygiene compliance through "Clean In, Clean Out," a system of observations

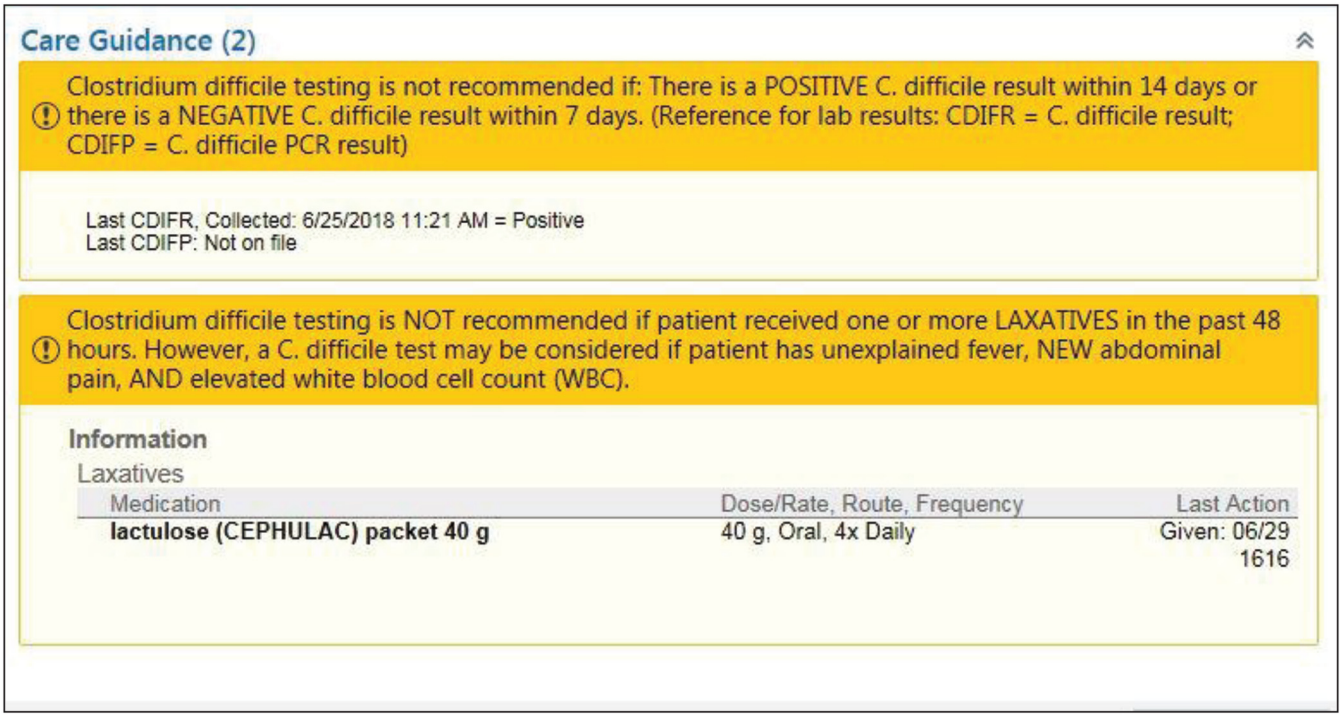

FIG 3 Electronic best practice advisories for *C. difficile* testing.

conducted by frontline personnel with immediate feedback. Prior to implementation of this program, hand hygiene rates were static and remained at less than 90%. Since implementation of the observation system, compliance rates have consistently been greater than 90%, with at least half of the thousands of inpatient observers offering immediate feedback. Our multidisciplinary group made a concerted effort to sustain hand hygiene compliance through education and special incentives.

Statistical analysis. A two-tailed Chi-square test was used to compare data for CDI rates before and after our bundle of interventions were implemented. A P value of <0.05 was considered statistically significant. Statistical analysis was performed using the SAS software (version 9.3; SAS Institute, Cary, NC, USA).

RESULTS

In FY17, our HO-CDI LabID rate decreased to 6.30 infections per 10,000 patient days (95% confidence interval [CI] 5.30 to 7.40), representing a statistically significant ($P < 0.05$) decrease of 42.7% from the FY16 rate of 11.0 infections per 10,000 patient days (95% CI, 9.60 to 12.40) (Fig. 3). HO-CDI LabID rates from prior years also demonstrated a reduction in infection rates; in FY13, the rate was 7.60; in FY14, it was 9.00; and in FY15, it was 9.70. Our FY17 rate then represents a decrease of 17 to 35% from previous years. These decreases occurred during a time period when community-onset CDI rates actually increased, ranging from 4.7 infections in FY13 to 6.9 infections in FY17. Importantly, our decrease in HO-CDI has been sustained over time, with HO-CDI LabID rates of 4.60 and 5.30 in the first and second quarters of FY18, respectively.

A previous study using linear regression to estimate the cost of CDI found that acute-care-facility costs were at least $3,006 per case (includes community and hospital onset in 2008 dollars) (5). Using this estimate, our 100 fewer infections in FY17 potentially saved our facility approximately $300,600 in costs associated with CDI. Without further, more extensive analysis, this cost savings could not be considered an outright financial gain, but it is important to note that none of the interventions implemented in this bundle required an additional financial investment. All interventions were undertaken using existing resources and staff.

Provider compliance with testing per hospital policy was also significantly improved in the same time frame. Provider compliance with testing was measured by the following data that could be directly abstracted from the patient's electronic medical record: no previous positive test in the last 14 days, no previous negative test in the last 7 days, no laxatives or stool softeners administered in the 48 hours prior to testing, and loose stools documented. Eight months after the ordering prompts were instituted and 3 months after the BPAs, overall compliance with testing (i.e., all four measured components met hospital policy for each ordered *C. difficile* test) had improved from 65.6% in July 2016 to 77.6% in June 2017 ($P < 0.01$). In the same time period, compliance with each individual testing component improved as well. Electronic audits showed that loose stool documentation increased from 85.6% to 87.1%; no laxative administration within 48 hours prior to testing increased from 85.6% to 92.4%; no testing within 7 days of a previous negative increased from 90.5% to 97.6%; and no testing 14 days of a previous positive increased from 90.5% to 100% (Table 1). The overall number of *C. difficile* tests also decreased during the intervention period. In 2016, the average number of *C. difficile* tests ordered per month was 309. In 2017, the average number of tests ordered per month was 217.

Retrospective house-wide audits of electronic documentation in Epic showed increased compliance with the use of UV-C at discharge cleaning for enteric precautions rooms in a comparison of the month of August 2016 with October 2017 (Table 1). Environmental service audits of cleaning compliance with fluorescent dye on inpatient room touchpoints showed high monthly compliance that was not significantly changed from FY16 to FY17.

Point prevalence surveys performed by Hospital Epidemiology in June 2016 showed high HCP compliance (93%) with PPE in enteric precautions rooms. In December 2017, repeat point prevalence surveys showed decreased HCP compliance with PPE (80%) (Table 1).

Our hand hygiene compliance remained consistently high in the 11-month intervention implementation period. Our goal was to maintain $\geq$90% hand hygiene com-

pliance in ≥ 90% of participating areas, with immediate feedback on hand hygiene performance offered in ≥ 75% of observations. In FY17, all inpatient units consistently sustained more than 90% hand hygiene compliance (Table 1). Our monthly average feedback percentage on hand hygiene compliance was 54% across inpatient settings.

Our antimicrobial stewardship goal was to reduce the days of therapy per 1,000 patient days of third- and fourth-generation cephalosporins and fluoroquinolones associated with CDI. From FY16 to FY17, cefepime, ceftazidime, and levofloxacin use all decreased significantly (Table 1). Clindamycin days of therapy were also reduced. However, there was a statistically significant increase in ceftriaxone use in the same time period.

DISCUSSION

From FY16 to FY17, we were able to significantly reduce our HO-CDI LabID rate and sustain the reduction without altering our laboratory testing methodology. While other published approaches to CDI reduction have included multidisciplinary teams (28), automated electronic health record protocols (29), diagnostic stewardship (30), routine cleaning with sporicidal disinfectants (31) and UV light disinfection (32), and antimicrobial stewardship (21), our approach is the first published one, to our knowledge, to include multiple process measures demonstrating a reduction in CDI with evidence-based practices.

There was also an overall decrease in *C. difficile* testing from FY16 to FY17. This may, in part, indicate improved diagnostic stewardship on the part of ordering providers. Lending credence to this theory, provider ordering compliance to hospital policy significantly improved after the institution of electronic ordering prompts and BPAs.

Our multidisciplinary CDI prevention group was a key strength of our approach. The coordinated use of multiple disciplines to address CDI is recommended as a method to control CDI, due to the inherent complexity of preventing this type of infection (24). Our facility's leadership supported the creation of this working group and the implementation of our intervention bundle. Consensus from all the stakeholders in the multidisciplinary group ensured that our interventions were well-thought through and evidence based. In addition, leveraging existing resources in the hospital for these efforts was cost-effective and efficient, considering that the mean cost of CDI is $3,006 per case. While an estimated savings of greater than $300,000 may be an overestimate, as it does not take into account other factors, it provides evidence that reduced infections can result in significant cost savings to facilities beyond simply reducing CMS penalties. No additional staff members were hired to implement any intervention, and we leveraged existing resources (e.g., our current medical record and our current UV-C machines) to achieve our goal. Our two-step testing algorithm had been in place since 2009 and represented no additional cost.

Importantly, laboratory testing methods were not altered during this study, so changes in CDI rates cannot be attributed to using a different testing strategy in which NAAT or GDH screening is first done and then followed by a confirmatory test with a relatively less-sensitive testing method.

Because multiple interventions were implemented during the same time period and because some efforts were focused on sustaining existing interventions (e.g., hand hygiene), it is difficult, if not impossible, to assign the reduction in CDI to any single intervention.

While there has been no evidence of worsened clinical outcomes due to enhanced testing standards, we did not specifically conduct surveillance to assess for potential missed diagnoses, nor did we have a baseline of CDI-related adverse outcomes. It is possible that there were patients who might have had delays in being diagnosed with CDI because they had received laxatives in the 48 h prior to testing or had a negative *C. difficile* assay result in the 7 days prior to testing. However, we felt reasonably confident that adverse patient outcomes would have been reported if they had truly occurred because our facility has a robust patient safety reporting system, and prac-

ticing adult and pediatric infectious disease physicians and infectious disease pharmacists were part of our multidisciplinary group.

Alert fatigue was a concern when we implemented our electronic ordering prompts and BPAs. It is possible that rather than acknowledging the messages in the electronic ordering prompts and BPAs, HCP became inured to the alerts and simply stopped paying attention to them. However, our overall success in reducing our HO-CDI LabID rates and increased compliance with testing per hospital policy even without making these alerts and BPAs hard stops lead us to believe that the prompts and BPAs succeeded in reaching a significant number of ordering clinicians. Because neither the prompts nor the BPAs contained hard stops, provider compliance with testing per policy must be monitored closely to ensure that the intervention continues to be sustained.

There were mixed results from our other process measures. Our institution had success in overall reductions in the use of antibiotics that commonly precipitate CDI, in sustaining hand hygiene compliance rates, and in improving the use of UV-C at terminal cleaning for enteric precautions rooms. However, HCP compliance with appropriate gowning and gloving in enteric precautions rooms actually decreased over the same time period. The exact reasons behind this are unclear. It may be that compliance with enteric precautions is more susceptible to individual error and that an annual point prevalence survey is not frequent enough to remind HCP about the importance of following enteric precautions, while more frequent audits and in-person reminders from other HCP helped sustain or improve the other process measures. Also, as our point prevalence survey occurred on a single day, it may not accurately represent PPE compliance in our facility.

There was a slight decrease in CDI LabID rates from October 2015 to April 2016, prior to organization of the multidisciplinary group and implementation of the majority of the interventions (Fig. 1). However, the most significant decline in the number of LabID CDI events occurred from April 2016 through March 2017, the time period when the majority of our interventions were implemented. While the initial decline in CDI cases may be due to natural fluctuation or other factors, such as a consistently high rate of hand hygiene, it is unlikely that our most significant rate reductions and continued sustainment were due to chance or other factors. One limitation of this bundle of interventions is the potential need for continued monitoring of rates. With the exception of the testing prompts and the BPAs, our interventions are not automated and require effort to sustain them through auditing, education, and communication to frontline HCP.

In conclusion, through use of a multidisciplinary group and implementation and monitoring of multiple interventions, our facility was able to effectively reduce our HO-CDI LabID rate while still using a highly sensitive laboratory testing method. We demonstrated that engaging a wide group of stakeholders and implementing a variety of evidence-based interventions was an effective way to significantly lower our HO-CDI LabID rates without altering our laboratory algorithm.

ACKNOWLEDGMENTS

We acknowledge the work of all the group members of the CDI Infection Prevention Workgroup, the UNCMC Clinical Microbiology Laboratory staff, the UNCMC Hospital Epidemiology Department, the UNCMC surgery service Kaizen Team, particularly Angela Overman, Maureen Heck, Crystal Norton, and Tracey Farmer; the UNCMC Performance Improvement & Patient Safety Department, particularly Erin Burgess and Megan Miller; Thomas Ivester; and Lucille Purser.

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