Safety and Nosocomial *Clostridioides difficile* Infections

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ABSTRACT

The rate of nosocomial *C. difficile* in the state of Rhode Island is among the highest in the country. Multiple factors impact the occurrence of nosocomial *C. difficile*. Improvement in a single factor may not lead to a decrease in the rate. We report the results of a multidisciplinary team that implemented multiple interventions, which led to a 42% reduction of nosocomial *C. difficile* at The Miriam Hospital.

KEYWORDS: *Clostridioides difficile*, multidisciplinary, safety, nosocomial

INTRODUCTION

*Clostridioides (*formerly *Clostridium) difficile* is the most common organism causing nosocomial infections.[1] In the United States, *C. difficile* is estimated to cause about 450,000 infections and approximately 29,000 deaths.[2] Previous studies have demonstrated that up to 15% of adults are colonized with toxigenic *C. difficile,* and almost 50% of elderly adults in long-term care facilities or nursing homes may be colonized with the bacteria .[3,4] Infections due to *C. difficile* can cause devastating complications such as acute renal failure, colectomy and death as well as leading to increased length of stay, excess morbidity and rising healthcare costs. The rate of nosocomial *C. difficile* in Rhode Island (RI) is among the highest in the country. In the period April 1, 2018 to March 31, 2019, Rhode Island ranked 49 out of 50.[5]

BACKGROUND

The Miriam Hospital is a 247-bed teaching hospital in Providence, RI. Despite reduction efforts during 2014–2015, the rate of nosocomial *C. difficile* remained above the national benchmark. During the second quarter of 2016, a multidisciplinary team was created that included Infection Control, Housekeeping, Nursing, Administration, Quality, Safety and Patient Care Equipment staff. Implementation of the recommendations of this group, based on literature review of best practices started during the third quarter of 2016. Consensus best practices include antimicrobial stewardship, surveillance, case isolation, use of personal protective equipment, effective cleaning within the hospital environment, and education.[2,6] The team took a multi-pronged approach to implementing in-hospital interventions.

METHODS/INTERVENTIONS

Ordering (correct ordering)

Appropriate and inappropriate stool testing was addressed. Education was provided to nurses and providers to send only loose stool specimens for *C. difficile* testing. An electronic order panel was created for ordering *C. difficile* testing and consisted of two questions, 1) has the patient had 3 or more loose stools (appropriate testing) within 24 hours and 2) has the patient had recent laxative use (inappropriate testing). It was discovered upon review of documentation in the electronic medical record that not all stools were recorded. Nurses documented whether a patient had a bowel movement, but nursing assistants did not. The electronic medical record was modified so that nursing assistants could document frequency and consistency of bowel movements. As part of the *C. difficile* electronic order panel, the number of bowel movements was displayed to the provider as an aid for appropriate testing. Hence, inappropriate testing could occur if a stool was collected from a patient who was given a laxative, developed loose stools and was colonized with *C. difficile* thus producing a false positive lab result.

Initiation of precautions

In order to initiate early precautions and reduce inappropriate testing, nurses were educated and feedback provided on a nurse driven protocol so that a stool for *C. difficile* could be obtained by a nurse and sent to the lab, provided the patients had 3 or more loose bowel movements in 24 hours and had not recently received a laxative. This would lead to earlier detection of *C. difficile* infection. Patients were placed on contact precautions while the *C. difficile* test was pending, leading to a potential reduction in transmission prior to a lab test to confirm the diagnosis.

Duration of contact precautions

Patients with *C. difficile* infection are maintained on Contact Precautions for the duration of their hospitalization. If the diarrhea resolves, the patient's room and the equipment in the room can still be contaminated with *C. difficile*.

Because the spores can persist in the environment for extended periods – months or years on inanimate surfaces – patients are not taken off contact precautions.[7]

Hand hygiene and Personal Protective Equipment (PPE)

Transmission via healthcare workers can be decreased using personal protective equipment (PPE), e.g. gowns and gloves, when taking care of patients who have *C. difficile* infection. Therefore, poor compliance with using gowns and gloves is one latent factor in the development of nosocomial *C. difficile*. Despite compliance, during the process of removing gowns and gloves, there may be inadvertent contamination of a healthcare worker's hands or clothing. All nurses received competency training on hand hygiene and use of PPE during 2017. The training included hands-on demonstration of competency.

Environment (room)

Reducing environmental contamination includes cleaning of patients' rooms daily and upon discharge from the hospital. Patient rooms should be thoroughly cleaned prior to receiving the next patient. Optimum cleaning of the room includes sufficient dedicated time, equipment and appropriate cleaning agents. Environmental cleaning practices including the use of cleaning agents (hydrogen peroxide and sodium troclosene) and disposable mop heads and cloths were implemented. A stainless-steel cleaning cart was purchased to hold the cleaning agents and supplies used for rooms that housed patients with *C. difficile* and other micro-organisms that required special cleaning. Discharge cleaning was performed with two housekeeping staff. Ultraviolet light surface decontamination has been successfully used in infection control and was used in rooms after a patient is discharged and the room cleaned.[8] As part of the *C. difficile* improvement process, the use of ultraviolet light surface decontamination was prioritized to those rooms that had housed a patient with *C. difficile*.

Environment (equipment)

C. difficile can contaminate shared equipment that is used in patients' rooms. Thorough cleaning of the equipment is needed to prevent transmission to other patients. Patient-care equipment was cleaned with bleach wipes after each use.

Cleaning: "Scrub Club"

Contaminated equipment and surfaces are potential environmental reservoirs. When a patient with nosocomial *C. difficile* was identified on a ward, high touch areas in all patient rooms, nurse's station and shared equipment that was on the ward was cleaned with a bleach-based product. The cleaning program was named "Scrub Club," (comprehensive cleaning using a sporicidal agent). Departments involved in "Scrub Club" included Housekeeping, Nursing and Patient Care Equipment staff. The purpose was to enhance cleaning on the ward in case there was inadvertent environmental contamination.

Bedpans and commode liners/blood pressure cuffs

Bedpans and commodes, particularly those used by patients with diarrhea, can lead to splashing and contamination of the environment. Bedpan/commode liners were purchased, and their use was encouraged for all patients with loose stools. These liners absorbed the liquid to eliminate splashing. Additionally, disposable blood pressure cuffs were purchased and used in all in-patient rooms, replacing the need to clean the blood pressure cuff when a patient was discharged.

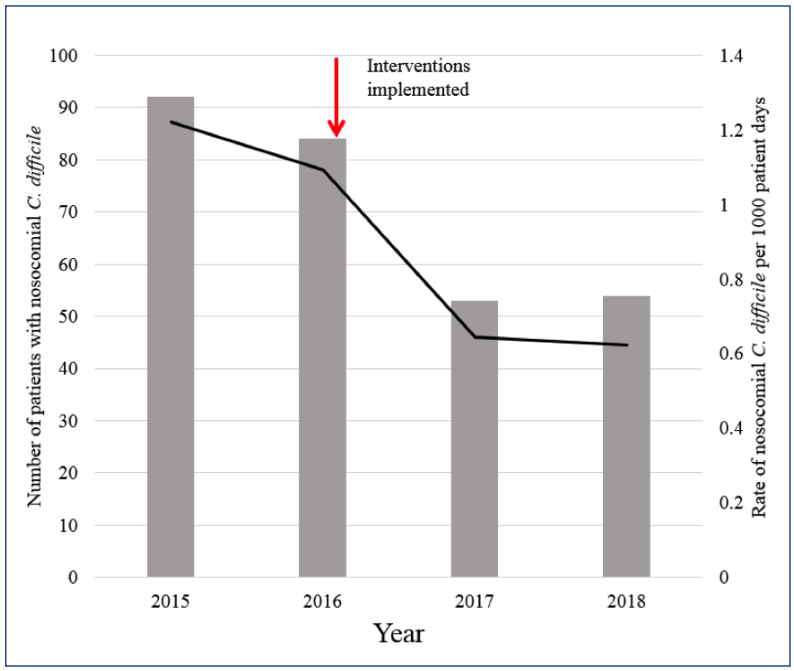
Antibiotics

Another factor associated with *C. difficile* infection is exposure to antibiotics. Unnecessary exposure to antibiotics could be decreased or eliminated to decrease the rate of *C. difficile* infections. During 2014 a formal Antimicrobial Stewardship program was started; its activities and interventions increased over time.

RESULTS

The number of patients with nosocomial *C. difficile* decreased from 92 in 2015 to 84 in 2016 to 53 in 2017 and 54 in 2018. There was a 42% reduction in the number of cases when comparing 2017 to 2015. (**Figure 1**)

Figure 1. Number of patients with nosocomial *C. difficile* and rate of nosocomial *C. difficile* per 1,000 patient days by year.



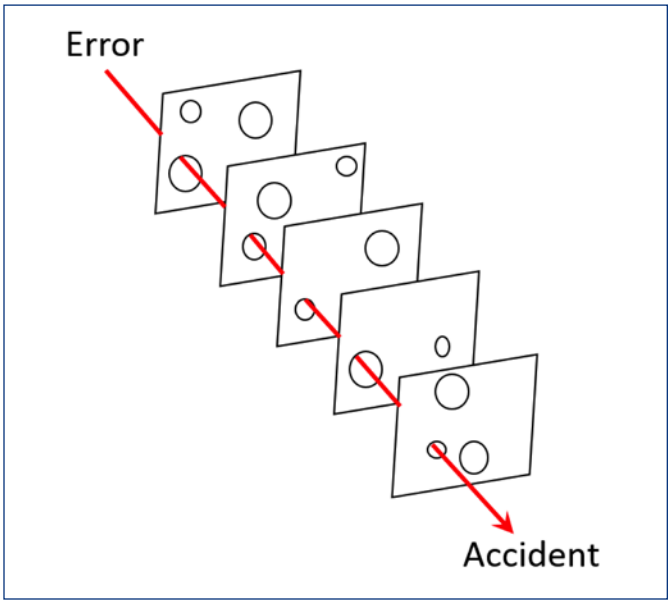
DISCUSSION

Transmission of *C. difficile* may occur in a healthcare setting when the organism is transferred from patient-to-patient via the hands of healthcare workers or from a contaminated environment. The development of nosocomial *C. difficile* in various patient populations on different wards throughout the hospital was not necessarily due to an individual safety error, but suggested potential systemic, hospital-wide deficiencies in infection control. Previous efforts to eliminate specific sources of infection were unsuccessful in reducing nosocomial *C. difficile* infections. Instead, a collaborative, interdisciplinary approach involving multiple intervention points and several departments resulted in a reduction in nosocomial *C. difficile* infections.

There may have been unrecognized improvements in other processes due to the Hawthorne effect. Other unmeasured processes may have also contributed to the reduction such as increased thoroughness of cleaning by Housekeeping.

Cases of nosocomial *C. difficile* can be explained by the Swiss cheese model of accident causation (**Figure 2**).[9] For an accident to take place, alignment of the holes in the Swiss cheese must occur such that an error will flow through all the holes emerging from the other end producing an accident. This model shows the defenses as pieces of Swiss cheese which have holes or flaws (latent defects) in them. Some examples of latent factors include equipment design, equipment choice, equipment maintenance, procedures, policies, training, communication, resources, staffing, workload, physical environment, noise, interruptions, roles, responsibilities and supervision. In order to reduce *C. difficile* on the wards, some of these factors were addressed. Appropriate testing, early identification of infected patients, initiation of contact precautions, bleach cleaning of patient rooms, shared equipment and the nursing ward, use of bedpan liners, as well as other improved compliance may have protected against the development of nosocomial *C. difficile*. The numerous interventions involving multiple hospital departments resulted in the reduction in the rate of nosocomial *C. difficile*. The goal will be to not only sustain these improvements but to further reduce the rate of nosocomial *C. difficile*.

Figure 2. The Swiss cheese model of accident causation illustrates that there are many layers between an error and an accident. Holes, in each slice, represent flaws (latent failures) that if aligned can allow the accident to occur.



References

1. Magill SS, O'Leary E, Janelle SJ, Thompson DL, et al. for the Emerging Infections Program Hospital Prevalence Survey Team. Changes in Prevalence of Health Care-Associated Infections in U.S. Hospitals. N Engl J Med. 2018; 379: 1732-1744.
2. Schultz K, Sickbert-Bennett E, Marx A, Weber DJ, et al. 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. Journal of Clinical Micribiology. 2018; 56(9). DOI: 10.1128/JCM.00625-18.
3. Schaffler H, Breitruck A. Clostridium Difficile—From Colonization to Infection. Frontiers in Microbiology. 2018; 9: 6461.
4. Furuya-Kanbamori L, Marquess J. Asymptomatic Clostridium difficile colonization: epidemiology and clinical implications. BMC Infectious Diseases. 2016; 15: 516.
5. Centers for Medicare & Medicaid Services. Hospital Compare Database. https://data.medicare.gov/Hospital-Compare/Healthcare-Associated-Infections-State/k2ze-bqvw/data (accessed February 3, 2020 at 1:07 P.M. EST)
6. Balsells E, Filipescu T, Kyaw MH, Wiuff C, et al. Infection prevention and control of Clostridium difficile: a global review of guidelines, strategies, and recommendations. J Glob Health. 2016; 6: 020410.
7. Claro T, Daniels S, Humphreys H. Detecting Clostridium difficile spores from Inanimate Surfaces of the Hospital Environment: Which Method is Best? J Clin Microbiol. 2014; 52: 3426-3428.
8. Pegues DA, Han J, Gilmar C, McDonnell B. Impact of Ultraviolet Germicidal Irradiation for No-Touch Terminal Room Disinfection on Clostridium difficile Infection Incidence Among Hematology-Oncology Patients. Infection Control and Hospital Epidemiology. 2017; 38: 39-44.
9. Human Error. James Reason, Chapter 7 (Latent errors and systems disasters), Cambridge University Press, Cambridge. 1990.

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