Preventing Health Care–Associated Infections Through Implementation of an Interprofessional Visual Management Safety Tracker

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ABSTRACT

Background: The management of health care associated infections (HAIs) challenges acute care facilities due to variability in practices. The purpose of this quality improvement project was to decrease central line–associated bloodstream infection, catheter-associated urinary tract infection, and *Clostridioides difficile* infection in a high acuity care environment using a visual management (VM) tool to address practice variations.

Local Problem: An acute care unit experienced increasing HAIs.

Methods: An interprofessional team used Lean methodology to implement a VM tool reflective of evidence-based HAI prevention practices that staff had frequently omitted.

Interventions: A VM tool called the Safety Tracker was created.

Results: In 12 months, HAIs decreased from 9 events to 1, with a corresponding reduction in indwelling urinary catheter utilization and central line utilization. More than $160 000 were avoided in health care costs.

Conclusions: Creating an interprofessional VM Safety Tracker could significantly reduce HAIs.

Keywords: health care–acquired infections, Lean methodology, quality improvement, visual management

More than 1 million patients are affected by health care–associated infections (HAIs) in the United States annually.[1,2] The Centers for Disease Control and Prevention states that in approximately 20 hospitalized patients, 1 patient will develop an HAI,[1,2] such as a central line–associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), or *Clostridioides difficile* (*C diff*) infection. HAIs lead to increased length of stay, potential complications, and increased costs. The estimated annual expense for HAIs is in the billions, with a single CAUTI costing an estimated $13 793, CLABSI $48 108, and *C diff* infection $17 260.[2,3] The financial losses affect patients as well as health care facilities, as patients and payers may decline to pay avoidable costs.[1,4]

One factor contributing to HAIs is variability in practices.[5,6] Variability naturally occurs when individuals from the health care team implement the same treatments using different procedures or vary the application of a single procedure. These variations can have subtle but cumulative negative effects on patient outcomes.[7,8] Time constraints and working in an intense clinical environment can lead to suboptimal outcomes, though standardizing care to limit variations may improve outcomes.[9]

LOCAL PROBLEM

Eliminating harm events is a hospital priority nationwide. However, avoiding patient harm can be challenging within inpatient units where acuity is high, resources are limited, and interprofessional teams use varied practices. In the first 2 quarters of 2018 at a Magnet-designated academic hospital in a statewide health care system, HAIs exceeded internal benchmarks on one

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25-bed acute care unit; CLABSI, CAUTI, and *C diff* infection significantly increased.

Our organization had adopted Lean management (LM) as a quality care model. LM is a philosophy that promotes value to the consumer through continuous quality improvement (QI) and respect for people.[10] Multiple published LM initiatives have demonstrated that teamwork, communication, and coordination within the team improve when LM is in place.[10,11] Layered within the LM approach is the Framework for Safe, Reliable, and Effective Care, guiding health care organizations in reaching safe and reliable outcomes with its 9 components: leadership, psychological safety, accountability, teamwork and communication, negotiation, transparency, reliability, improvement and measurement, and continuous learning.[1] The framework's foundation builds upon culture and learning systems, with the engagement of patients and families at the center.[1] Consequently, the framework paired nicely with the organization's nursing care delivery model, Relationship-based Care, which focused on 3 central tenets: relationship to self, colleagues, and patient and family.[12]

Using LM as a model of quality care, we created a visual management (VM) tool to address HAIs in the acute care unit. Classically, VM is considered a self-explaining, self-ordering, and self-improving system that enables staff to assess the status of an operation or process immediately, regardless of the person's knowledge of that process.[13,14] Within the LM system, VM has worked successfully, aligning with the communication component of the Framework for Safe, Reliable, and Effective Care.[1] VM provides the platform to orient staff about a singular improvement plan, an essential element for successful interprofessional team-based patient care. Although research is limited, one study found that VM contributes to harm reduction, with success arising from participants' involvement in promoting and cultivating an improvement atmosphere.[4]

The purpose of this QI project was to decrease HAIs in a high acuity care environment using a VM tool to address variability in practice. This report describes an interprofessional team's approach to designing, implementing, and evaluating a novel VM Safety Tracker tool to increase the performance of evidence-based infection prevention practices among high-risk patients. The initial target for HAI reduction included CLABSI, CAUTI, and *C diff* infection. Although the primary aim was to examine the effects of the VM on HAIs, we also examined the effects of the VM on cost avoidance.

METHODS

Context

With the adoption of LM, our organization shifted from one in which planning committees of leaders designed improvement initiatives to one that established processes and systems to support team members in solving problems and performing improvement in real time. The organizational culture empowered team members as experts and provided the staff with resources to act on ideas for improvement. In our culture, identifying issues was encouraged, rewarded, and supported.

As an organization embracing LM, the interprofessional team highly valued integrating tools such as VM to support the improvement of care processes in a high acuity environment. One type of VM tool that had been integrated locally was a visual board labeled Managing for Daily Improvement (MDI). During the previous year, the clinical unit for this quality initiative integrated MDI within the unit's standard work and instituted twice-daily team huddles to review the MDI board when the shifts changed.

At the end of the second quarter of 2018, as the number of HAIs on the target unit trended upward, hospital leaders and unit team members identified an urgent need for change. When reviewing the unit's current state, the team decided to use the existing unit-based MDI board and incorporate a new element for prompting the staff to prioritize HAI prevention activities within the patient's daily routine. The challenge was to create an HAI-related visual tool, clear and identifiable for all team members, including providers, patient care technicians, therapy staff, and nurses.

Intervention

A team was assembled consisting of registered nurses, patient care technicians, a unit secretary, leaders proficient in LM, a clinical operations manager (COM), clinical nurse specialists, and a nurse executive to investigate the root cause of HAIs within the high acuity environment. The team used LM tools, such as *5 Whys* and gap analysis, in the root cause investigation, and several themes emerged, including the lack of HAI

awareness, inconsistent use and varying expectations for bundle compliance depending on the role, and failure to understand the highest priorities in preventing harm. Given these findings, the unit council, in collaboration with the clinical nurse specialists, conducted a literature review to identify the evidence base for best practices in preventing HAIs.

Best practices were evaluated through published evidence, examining local data, and consulting local and organizational experts. The interprofessional team agreed that certain practices were essential and identified the practices collectively as the CAUTI bundle, CLABSI bundle, and *C diff* bundle.[15,16] The unit council met to assess gaps and barriers and identify the most frequently missed practices in each bundle. Then, the unit council gathered ideas about key activities that would address unit gaps to prevent harm. Finally, the conversation led the interprofessional team to create a VM tool called the Safety Tracker.

The purpose of the Safety Tracker was to prompt staff to focus on activities to prevent HAIs. A vital feature of the Safety Tracker was its simplicity. The staff insisted that the tool had to be easy to use, not a burden. Therefore, we used several strategies to make the Safety Tracker easy to use. The charge nurse each shift printed the simple 8.5 × 11″ Safety Tracker on a sheet of paper, identifying the 25 patient rooms on the target unit (see Supplemental Digital Content, Figure, available at: http://links.lww.com/JNCQ/A948). Not every activity within a bundle was placed on the Safety Tracker. If the unit team determined an activity within the bundle was critical to reducing harm and staff omitted it from patient care frequently, the activity was written on one line of the Safety Tracker. Second, the staff suggested using a bubble chart template as the backbone of the Safety Tracker, as the team was familiar with bubble charts from previous LM rapid improvement events. Third, each line item had an associated visual image that correlated with the written text. The bubble would be left blank to mark as incomplete or filled in to mark as complete once an activity was verified as documented. When scoring the Safety Tracker, the staff agreed that there would be no partial credit listed on the tool for activities that were started but not completed.

Once the Safety Tracker was created, the staff identified the need for additional, dedicated time to focus on the Safety Tracker activities and agreed to initiate a daily safety huddle. The safety huddle was a time when a review of the Safety Tracker occurred quickly, gaps in care were identified, and accountability was put in place to ensure the completion of preventive activities. The staff recommended that the safety huddle be led by team members, with the charge nurse conducting the Safety Tracker review. Safety huddles were scheduled twice per day, once for each shift at 11 AM and 11 PM.

Over the course of a 10-day trial period, the staff shared several key suggestions during the safety huddles. First, to create a more visually effective tool, the staff notated the patient's room number with the HAI for which the patient was at risk (eg, central line infection). This addition increased visual awareness for ease of tracking. Second, for patients with a central line or urinary catheter, the team discussed the continued need for the catheter or if escalation for removing a device was required to reduce overall line utilization. Third, if a *C diff* test was ordered, the team discussed whether the test was necessary. Fourth, the staff validated the preventive actions were completed. If not, a team member was assigned and written on the tracker to complete the actions by the end of the shift. Fifth, the team identified any individual heavy workloads and collectively ensured that barriers would be addressed, and team assistance provided to facilitate the completion of assigned tasks. Finally, inspired by the COM, the staff suggested to end each safety huddle by speaking aloud a mantra, which was also printed on the Safety Tracker as a reminder: "Remember, you are consciously making a decision to potentially harm a patient if you do not follow standard work, and that is not okay."

Two roles were instrumental in implementing and monitoring the use of the Safety Tracker: the charge nurse and the COM. The charge nurse ensured the team huddles occurred at the appointed time and facilitated the conversation. During the 3 to 4 minutes needed to conduct the safety huddle, the charge nurse prompted problem identification and problem solving. The charge nurse initiated the Safety Tracker by first identifying priority tasks by highlighting in yellow the column identifying the patient room number with a central line or indwelling urinary catheter. If activities were completed, the charge nurse filled in the corresponding bubble.

At the end of the safety huddle, the charge nurse reviewed incomplete activities, identified team members to complete priority care activities, and posted the Safety Tracker on the MDI board. At the end of the shift, incomplete activities were communicated to the incoming charge nurse as a next shift priority.

While the charge nurse was responsible for managing the day-to-day completion of Safety Tracker tasks, the COM was responsible for monitoring implementation and associated expenses. The COM reviewed the Safety Tracker through an audit process the next business day. During the audit, the COM investigated actions not completed by the time of the safety huddle. The COM verified activity completion through electronic medical record documentation. If an essential activity was not documented, the COM followed up with team members through in-person conversations or emails to determine gaps. From the COM communication with the staff, themes emerged, such as staff forgetting to document, not understanding the prioritization of activities, and not engaging the team to help accomplish the essential activities. Soon after initiating COM follow-up, the activity completion rate increased. Finally, as the owner of the unit budget, the COM monitored any expenses associated with the Safety Tracker initiative. The project was designed to be budget neutral. Initial costs reflected nonproductive staff expenses to develop the Safety Tracker, with no additional labor or purchasing of supplies.

Methods of communicating the Safety Tracker initiative included staff meetings, word of mouth from unit council members to peers, charge nurse day shift handoff to nightshift charge nurse, daily huddles with interprofessional colleagues, and emailed huddle information to staff and interprofessional colleagues. With the finalization of the Safety Tracker and the process detailed for all team members, a 10-day pilot using the Safety Tracker was implemented. After the pilot, staff feedback was solicited, with minor changes made to the Safety Tracker.

In reviewing process gaps through direct observation and team member feedback, our team noted that team members who floated to the unit were unaware of the Safety Tracker. A prior study also noted gaps in implementation and increased mental stress among nurses who were not familiar with VM.[17] Once the gap was recognized, the charge nurse or COM led a brief orientation for floating team members to communicate expectations while caring for patients within the unit.

Full implementation of the Safety Tracker in its final form (see Supplemental Digital Content, Figure, available at: http://links.lww.com/JNCQ/A948) began in December 2018. Space was created on the unit's MDI board to track the last HAI event date and record harm-free patient-days, which were reviewed during every safety huddle. Celebrations were planned for 30-, 60-, and 90-day harm-free milestones.

Data collection

The primary outcome of interest was the frequency of HAIs. Data related to CAUTI, CLABSI, and *C diff* infection were abstracted from daily internal organizational infection prevention reports from the 12 months prior, during, and 12 months postimplementation.

Although unanticipated, outcome data exhibited a decrease in device utilization. The Centers for Disease Control and Prevention defines device utilization as a "measure of the use of invasive devices and constitutes an extrinsic risk factor for HAI."[18] To assess device utilization, data on the number of central line-days or indwelling urinary catheter-days in a time period and the number of patient days in the corresponding time period were recorded.

Finally, we examined cost avoidance as a metric of whether the intervention lowered health care costs that could have potentially incurred from HAIs. Cost avoidance was assessed according to estimates from the Agency for Health care Research and Quality (AHRQ).[3]

Analysis

Harm events data from pre- and postimplementation periods were compared to determine whether the number of HAIs changed over the project period. The interprofessional team did not compute inferential statistics due to the small number of HAIs over the course of 12 months. For device utilization, the device utilization ratio was calculated by dividing the number of central line-days or indwelling urinary catheter-days in a specific time period on the same unit by the actual number of patient-days in the corresponding time period. Finally, cost avoidance was calculated by utilizing AHRQ cost estimates.

Ethical consideration

The hospital's institutional review board considered the initiative QI and not subject to human subjects review.

RESULTS

Before implementing the Safety Tracker, the acute care unit had 9 HAI events (CAUTI: n = 2; CLABSI: n = 1; and *C diff*: n = 6) in the previous 4 quarters. Hospital-acquired infection rates began to decrease in the first quarter postimplementation of the initiative. After 12 months, HAIs decreased to 1 event, an 88.9% reduction. In particular, hospital-acquired *C diff* infections decreased from 6 events in 2018 to 1 event in 2019 (Figure). Device utilization rates also decreased. The central line utilization ratio decreased from the 2018 ratio of 0.09 to the 2019 ratio of 0.08, and the indwelling urinary catheter utilization ratio decreased from the 2018 ratio of 0.08 to the 2019 ratio of 0.05.[18] The reduction in total HAIs resulted in an estimated care cost avoidance of $161 994, as calculated by AHRQ.[3]

DISCUSSION

The intent of this QI project was to decrease HAIs by addressing variability in practice in a high acuity care environment using VM. The intervention included introducing a standardized visual tool, called the Safety Tracker, focused on the activities most frequently missed in HAI prevention at our local hospital. As a result, implementation of the Safety Tracker decreased the incidence of HAIs.

The impact of the Safety Tracker was found not only in human terms but also in economic terms, as the intervention was cost-effective. As anticipated, there were no additional costs beyond nonproductive time in creating the Safety Tracker. In 2019, 8 fewer patients experienced HAIs in this acute care unit. Unexpectedly, device utilization decreased, medical treatments of HAIs were averted, and hospitalization costs were reduced by more than $160 000.

Projects of this type blend clinical practice and LM and build new knowledge for efficient patient care.[19] The success of this project arose from following evidence-based processes in designing and testing a VM intervention that advanced staff uptake of research-based clinical practices. Success was also due to creating a culture wherein staff held each other accountable and understood Lean processes. At the unit level, the staff recognized that choosing not to follow evidence-based activities was a choice to potentially harm patients. As the staff began to check the Safety Tracker routinely and collaborate to complete it, the culture shifted to one that highly valued patient safety and harm reduction.

This project illustrated the transformation LM can bring to a unit that is evolving toward high-reliability and nursing autonomy.[20] Team members shared knowledge, learned together, expressed the meaningfulness of work, and refined the skills of giving and receiving feedback. Teamwork was strengthened through collaboration to complete tasks and routinely recited the mantra that reflected the good choices they were making.

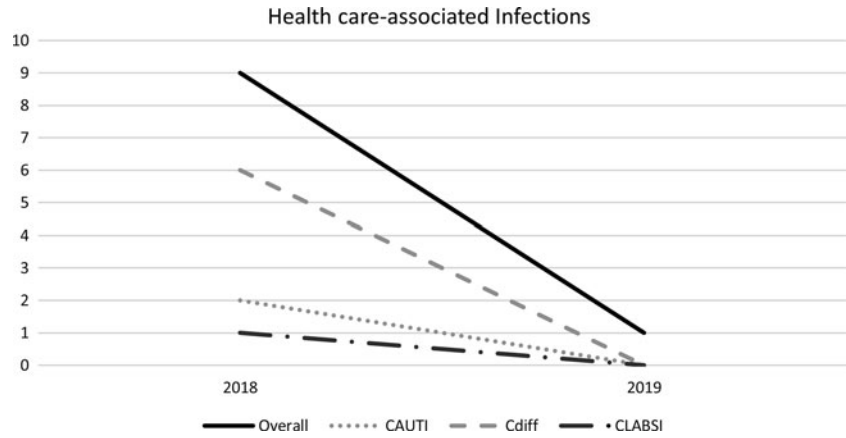

Figure. Annual comparison of health care–associated infections. CAUTI indicates catheter-associated urinary tract infection; *C diff*, *Clostridioides difficile* infection; CLABSI, central line–associated bloodstream infection.

The team also recognized this project was not like past rapid improvement events in which LM tools were applied for quick solutions to problems. Rather, this project integrated LM principles into the daily rhythm of care in a sustainable and transferrable manner and kept team members focused on value and waste/harm.[21] As huddles and the Safety Tracker "pulled" team members into a continuous flow of delivering safe care, a culture of LM was strengthened.[21]

This project incorporated knowledge gained from prior studies of VM implementation.[22,23] For example, this project used a simple board to share information relative to strategic goals, allowed quick identification of goal attainment, involved managers in the process as well as frontline team members, organized daily team meetings around the VM, and designed countermeasures from the VM data.[22,23] This project also addressed common barriers to successful use of VM, including planning for a pilot phase, engaging the support of organizational leaders, and drawing on an emerging organizational culture valuing LM.[23] Similar to a study in pediatric health care, this project achieved desired patient outcomes.[22]

Limitations

This QI initiative had limitations. The Safety Tracker was implemented on only one acute care unit. In addition, we limited our scope to 3 HAIs over 12 months. Our organization had already established an LM, evidence-based practice culture, wherein interprofessional teams were empowered to ask questions and implement change. Organizations with different workplace cultures may experience different results. Despite these limitations, this low-cost intervention can be expanded and replicated in other settings, with leaders tailoring the Safety Tracker to gaps identified in their units.

CONCLUSIONS

Implementing the Safety Tracker was associated with a decrease in HAIs. The VM intervention successfully standardized best practices, thereby limiting variability and encouraging staff compliance. Future plans include implementing this Safety Tracker on all units throughout the hospital. This initiative can be replicated in diverse settings following the key components: including interprofessional engagement, following evidence-based practices for designing VM, disseminating carefully crafted communication, incorporating safety huddles with each shift, recognizing and appreciating staff, and removing implementation barriers while instituting rigorous accountability at all levels.

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