

# Reducing Central-Line–Associated Bloodstream Infections (CLABSI): An Improvement Project in a Specialized Tertiary Hospital

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## ABSTRACT

**Introduction:** Central-line–associated bloodstream infections (CLABSI) are preventable hospital-acquired infections that harm and prolong a patient’s hospital stay and increase unnecessary hospital expenditure. In collaboration with infection control and hospital epidemiology, the quality management department initiated a performance improvement project to address 144 CLABSI events in 2017. **Methods:** The performance improvement project team used brainstorming to create change ideas presented in a driver diagram. The team then applied plan-do-study-act (PDSA) cycles to implement and monitor the improvements. Finally, the team applied a bundle of interventions that included the following: (a) policies and procedures for central line insertion, maintenance and removal processes standardization, (b) physicians training for line insertion by simulation, (c) an awareness campaign that included recognizing healthcare workers and enhancing patient engagement, (d) performing root cause analysis for the CLABSI events, and (e) automation of central line insertion, and (f) maintenance bundles documentation in the hospital information system. **Results:** The CLABSI rate per 1000 patient days dropped from 1.5 per 1000 device days to 1.03 per 1000 device days. In addition, CLABSI events reduction was 24% by 2018. Then further reduction of 15% occurred by the end of 2019. Thus, the overall decrease in CLABSI events was 35% from the baseline number of events (i.e., 144 events) in 2017. Another achievement of the project is that 10 units reported zero CLABSI events in 2018 and 2019, of which four units had a high central line utilization rate, more than 40%. **Conclusion:** The implemented interventions effectively reduced the CLABSI events in the hospital. The project team will continue implementing more interventions with monitoring, aiming to achieve zero CLABSIs over time in all the hospital units.

**Keywords:** CLABSI, zero harm, hand hygiene, a central venous catheter (CVC)

## INTRODUCTION

Healthcare-associated infection (HAI) is one of the major causes of increased morbidity and mortality in hospitals, further contributing to increased hospital stay costs.<sup>[1]</sup> The formal definition of central-line–associated bloodstream infections (CLABSI) is an infection evidenced by a blood culture with associated clinical features that suggest an infection. In addition, CLABSI results from primary bacteremia; (i.e., bacteremia that is not attributable to a secondary source).<sup>[2]</sup> CLABSIs involve the presence of a central venous catheter (CVC). According to Centers for Disease Control and Prevention (CDC) surveillance data, the number of catheter-related bloodstream infections (CR-BSI) in in-

tensive care units (ICUs) across the United States is estimated to be 18,000, which has since steadily declined. This decline has primarily been attributed to official regulations involving central lines and the subsequent preventive and instructional measures, such as the promotion of proper hand hygiene techniques, management and sterilization of the inserted catheters, simulation training, the formation of a team, and the introduction of bundles and checklists.<sup>[3–5]</sup>

Currently, there is no centralized surveillance system within Saudi Arabia that monitors and addresses the incidence of CLABSI and other HAIs. However, the data from long-term incidence studies suggest that in Saudi Arabia and the Gulf Cooperation Council, including Kuwait, Oman, Bahrain, Qatar, and United Arab Emir-

**Table 1.** CLABSI events per hospital unit from 2017–2019

| Unit           | No. of CLABSI Events |      |      |
|----------------|----------------------|------|------|
|                | 2017                 | 2018 | 2019 |
| Inpatient      | 103                  | 73   | 69   |
| Intensive care | 41                   | 37   | 25   |
| Total          | 144                  | 110  | 94   |

CLABSI: central-line–associated bloodstream infection.

ates, CLABSI rates are much higher than the US hospitals contributing data to National Healthcare Safety Network (NHSN) reports. However, it is considerably lower than the pooled CLABSI rates from hospitals contributing to The International Nosocomial Infection Control Consortium data, mostly from developing countries.<sup>[6]</sup>

The CDC has a list of vital recommendations to prevent the occurrence of catheter-related bloodstream infections<sup>[7]</sup>:

- Hand hygiene with appropriate handwashing techniques
- Maximal sterile barrier precautions during CVC insertions
- Disinfection with chlorhexidine
- Proper selection of the CVC site
- Withdrawal of the catheter in the absence of an indication

Even though hospitals had no skilled catheter team, the frequency of CR-BSI has significantly reduced after implementing multiple educational and preventive policies, including catheter training with simulation, regular reinforcement of hand hygiene, and hand hygiene pre- and post-catheter insertion. Healthcare providers' implementation of bundles and checklists can positively reduce central-line bloodstream infections.<sup>[8,9]</sup>

In 2017, our hospital's Infection Control and Hospital Epidemiology (ICHE) report showed that 144 CLABSI events had occurred in inpatient units and ICUs (Table 1). The 144 cases of CLABSI were identified based on CDC and NHSN criteria. The CLABSI events criteria included the inpatient unit and ICU locations. In addition, the criteria defined the central lines used as a peripherally inserted central catheter, CVC, Hickman catheter, and port-a-cath. Some lines were inserted in the operating room and others in ICUs. CLABSI events increased expenditure and length of ICU stay for further management.

In collaboration with the ICHE, the quality management department formulated a multidisciplinary team to reduce CLABSI events. The project aimed to decrease the number of CLABSI events from 144 in 2017 to fewer than 101 (30% decrease) in all hospital units by December 31, 2019 (after 2 years). The director of the quality management department proposed the 30% decrease target based on her experience implementing a similar project in a hospital where she worked in Canada. This article provides insight into the interven-

tions implemented to achieve the project team's goal. The project was among the other eight projects selected and approved by the Performance Improvement Council (PIC) to reduce the patients' preventable harm. ICHE selected CLABSI and surgical site infection reduction, as there was an increase in the incidence of both types of infections in the hospital above the NHSN benchmark.

A retrospective cohort study published in 2017 using secondary data from 12 Ministry of Health referral hospitals in Saudi Arabia concluded that the country still faces certain infection control challenges, such as lack of compliance with the electronic surveillance system, a high rate of device-associated HAI, and high device-utilization ratios, especially in ICUs. In addition, the study called for more published studies on HAI rates that can serve as resources and references for future studies.<sup>[10]</sup>

Most of the published studies from Saudi Arabia focused on studying the CLABSI rate in the ICUs. However, this performance improvement project considered all the inpatient units, including the ICUs.

## METHODS

### Project Description

The performance improvement project was conducted in a specialized tertiary hospital with 1600 beds that provides advanced healthcare services. The hospital's main services are organ transplantation, cardiovascular, oncology, neurosciences, and genetics. In addition, the hospital is an academic medical center with 200 ICU beds, and on average, the hospital inserts approximately 450 central lines every month, or approximately 15 central lines daily.

The central line workload is measured by central line days. Central line days are the total number of days a central line is in place for each patient in inpatient units. On average, the hospital has 10,000 central line days each month, which means the hospital has approximately 333 patients who have central lines in the inpatient units that need central line care by nursing staff and monitoring for CLABSI by the infection control team.

The PIC approved the CLABSI performance improvement project. Quality Management staff coordinated the project per the hospital policies to conduct such hospital-wide improvement projects. Approval of the hospital institution research board was not required for the project.

The hospital leadership represented by the PIC prioritized and supported the project financially. In addition, Quality Management representatives followed a systematic performance improvement project methodology and documented the project activities. Hospital leaders facilitated engaging a multidisciplinary, highly experienced team of medical, nursing, Healthcare Information Technology Affairs (HITA), radiology, laboratory, and other healthcare providers.

Representatives from the CLABSI improvement project team wrote this article following the SQUIRE.2.0 guidelines to share the project interventions and encourage other hospitals to adopt similar work to reduce patient harm resulting from CLABSI events.<sup>[11]</sup>

## Interventions

As part of the team's brainstorming sessions, the team collected potential change suggestions that might assist the hospital in achieving its goal. In response, the team created a drivers diagram consisting of three critical drivers as follows:

1. A standardized insertion process
2. A standardized maintenance process
3. Other strategies

The team used the Preventing Harm from CLABSI, Health Research and Education Trust,<sup>[12]</sup> and Critical Care Driver Diagram and Change Package, Institute for Healthcare Improvement<sup>[13]</sup> as references for the developed drivers' diagram (Fig. 1). In addition, the project team members met monthly to implement and monitor the modifications the team members suggested.

As part of the plan-do-study-act (PDSA) cycles, the team implemented and assessed interventions in 2018 and 2019. The interventions undertaken during the two PDSA project cycles are summarized as follows.

### PDSA cycle 1

Standardizing hospital policies and procedures is vital in ensuring high-quality patient care; however, inconsistent practices can lead to hospital litigation, resulting in poor patient outcomes. Therefore, the team established a task force to unify rules and practices related to vascular line devices. In addition, a review of the hospital's policies and procedures revealed the need to standardize the policies in this critical practice area.

Using simulation to train physicians is an active learning strategy. The trainers use mannequins to replicate real-life clinical scenarios. To ensure that physicians receive sufficient training in the placement of central line catheters while keeping infection control in mind, the project team supported the acquisition of a simulator for adult critical care units (ICUs). Furthermore, the ICU's consultants designed and implemented online and hands-on training programs. The ICU residents who started their training rounds found the training extremely valuable.

Promoting hand hygiene compliance is crucial. Therefore, healthcare personnel and patients were invited to participate in the Hand Cleanliness Awareness campaign, which aimed to raise awareness of the importance of hand hygiene to improve patient outcomes and decrease CLABSIs (for images of the campaign materials, see Fig. 2 and Supplemental Appendix I, available online). The hand hygiene campaign's continuous activities included the following:

- Creating elevator posters for four different areas:

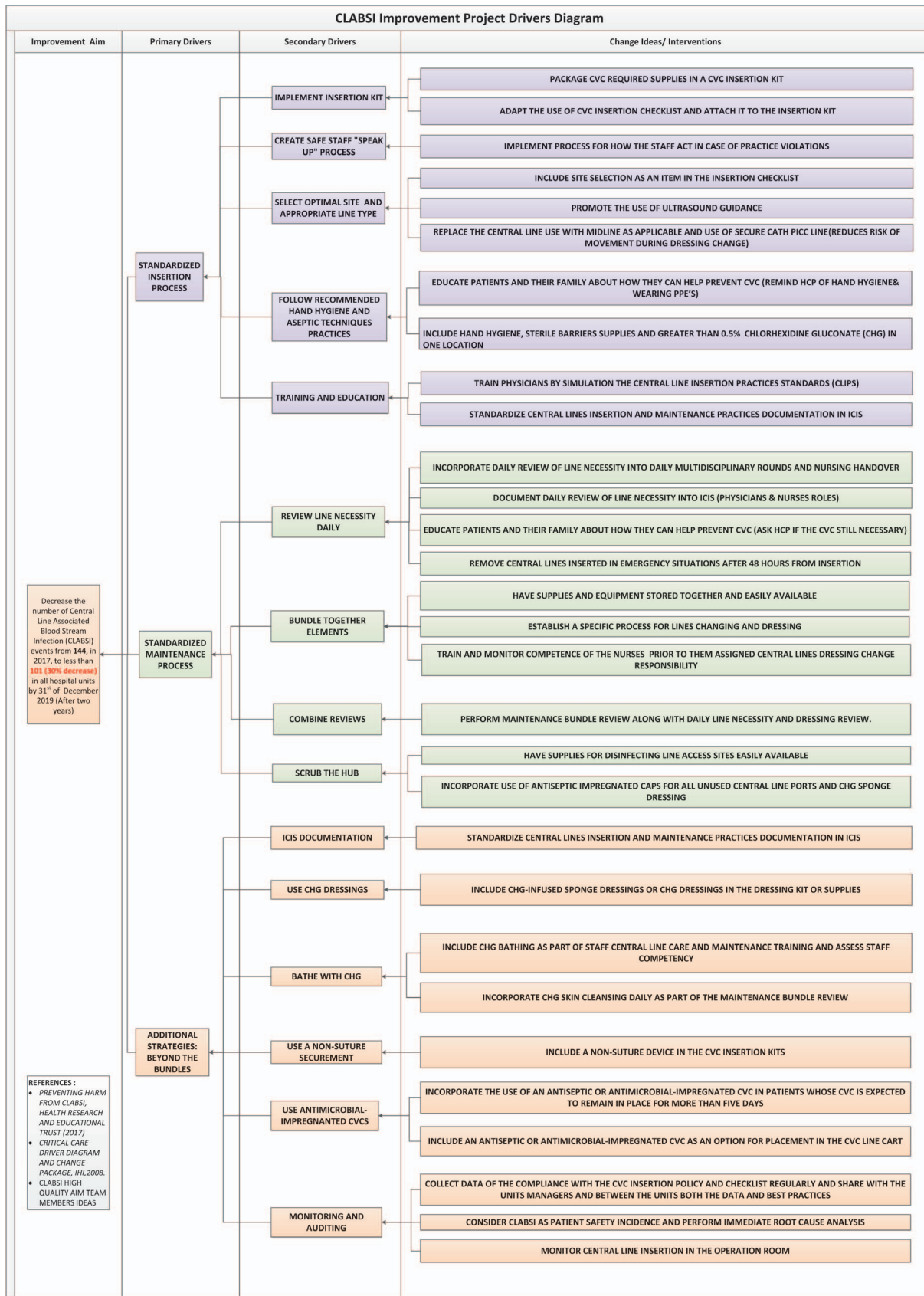
inpatient, outpatient, operating room, and general hospital. The messages included patient figures to focus the healthcare providers' attention on the impact of their appropriate practice on the patients and engage the patients in the care process.

- Creating a video of appropriate hand hygiene practices. The film is shown on the hospital elevator displays and the hospital TV educational channel throughout the day. Healthcare providers in the film adhere to appropriate hand hygiene procedures when maintaining and managing a patient's central catheter. It also depicted numerous incorrect tactics that might result in hand contamination and, as a result, CLABSI occurrences.
- Taking part in the 2019 World Health Organization Hand Hygiene SAVE LIVES campaign. The project team produced Arabic and English banners and other instructional materials to raise hand hygiene awareness. The ICHE department staff developed a standardized hand hygiene awareness presentation that is shared with the staff in the clinical and non-clinical settings. In addition, quality Champions and ICHE personnel delivered information on hand hygiene practices to encourage compliance with the infection control policies and procedures.
- Initiating a recognition program for healthcare providers who demonstrate adequate and ongoing compliance with hand hygiene practices. The project team handed weekly golden color cards with gift vouchers in a well-designed card to the personnel audited by the unit managers, who maintained consistent hand cleanliness throughout the week. The objective was to instill a culture of good behavior recognition in the workplace.

Patients' participation in healthcare leads to improved health outcomes, including enhanced infection management through basic measures such as appropriate hand cleanliness, which can substantially influence the development of CLABSI. This crucial area was considered while developing hand hygiene promotion posters in Arabic and English, including illustrations. In addition, the project team created posters and brochures to encourage patients to speak up and ask healthcare providers to wash their hands before conducting any physical activity for them. Finally, the project team distributed the posters and brochures to all patient care areas.

### PDSA cycle 2

**Sharing CLABSI prevention success stories:** The project team noticed from the CLABSI events per unit data that some units maintain zero CLABSI events despite the high line utilization. The team wanted to spread the strategies that the successful units do to prevent CLABSI events to the other units. The project team members conducted a workshop titled "Formula for Success in CLABSI Prevention."



**Figure 1.** Drivers diagram for the CLABSI improvement project. Cath: catheter; CLABSI: central-line-associated bloodstream infection; CVC: central venous catheter; HCP: healthcare provider; ICIS: Integrated Clinical Information System PICC: peripherally inserted central catheter; PPE: personal protective equipment.



**Figure 2.** Inpatient elevator poster for the handwashing campaign. Additional photographs are included in Supplemental Appendix I.

During the workshop, head nurses from various hospital units discussed their strategies to reduce CLABSI in their units, hoping that other units would adopt similar strategies in the future.

**Conducting root cause analysis for all CLABSI events:** A critical measure to improve patient care and safety is discovering and addressing the adverse events and near misses in clinical practice to identify preventive measures. Root cause analysis (RCA) is a systematic method developed for CLABSI events to review possible infection causes. The following steps were followed when conducting RCA of all CLABSI events: First, in collaboration with the ICHE representative, the unit manager prepares an analytical report that includes the

findings and pitfalls (refer to Supplemental Appendix II for the RCA report that was internally developed by the hospital nursing quality team). Second, the meeting is arranged to discuss the CLABSI event with representatives from ICHE and the quality management department. Then, the ICHE followed up to ensure the RCA recommendations were implemented.

**Standardizing documentation for vascular device bundles:** In collaboration with the Health Information Technology Affairs staff, bundle requirements and nursing documentation for the vascular devices were consolidated and implemented into the Integrated Clinical Information System (ICIS). In addition, ICHE shared monthly reports for nursing staff compliance with the bundles with the head nurses. Tables 3 and 4 include the insertion and maintenance bundle elements implemented in ICIS and their calculated scores.

## RESULTS

During PDSA cycle 1, the project team members observed variations in the practice among various inpatient units during their meetings. In addition, several hospital policies and procedures covered certain central line insertion and maintenance aspects, and no policy covered the guidelines for selecting the type of line to be used in different patient situations. As a result, the team initially prioritized the creation of standardized policy and procedure and then worked on standardizing the training materials for physicians and nursing training. Subsequently, the CLABSI events were reduced by 24% by the end of 2018.

During PDSA cycle 2, the unit managers' success stories in preventing the CLABSI events emphasized the following as strategies that helped in CLABSI prevention:

- Completion of the training and competency checks for the nursing staff on central line maintenance including physicians' training by simulation on insertion of the lines.
- Strict use of the type of lines and the supplies indicated in the hospital policies and procedures during the insertion and maintenance of the central line.

**Table 2.** Units with zero CLABSI events in 2018 and 2019

|                                  | CLABSI Events | Patient Days | Line Days | Utilization Rate, % |
|----------------------------------|---------------|--------------|-----------|---------------------|
| <b>Intensive care</b>            |               |              |           |                     |
| Special Surgical Care Unit-B     | 0             | 8001         | 5058      | 63.2                |
| Neonatal Intensive Care Unit-2   | 0             | 4344         | 190       | 4.4                 |
| Medical Intensive Care Unit-D    | 0             | 304          | 125       | 41.1                |
| Coronary Care Unit               | 0             | 9469         | 3877      | 40.9                |
| <b>Inpatient</b>                 |               |              |           |                     |
| Postpartum Unit                  | 0             | 10221        | 54        | 0.5                 |
| Orthopedics Plastic Surgery Unit | 0             | 15709        | 1507      | 9.6                 |
| High Dependency Unit             | 0             | 1089         | 161       | 14.8                |
| Solid Organ Transplant Unit      | 0             | 3368         | 982       | 29.2                |
| Cardiac Holding Unit             | 0             | 158          | 137       | 86.7                |
| Gynecology/Obstetric Unit        | 0             | 6176         | 1065      | 17.2                |

CLABSI: central-line-associated bloodstream infection.

**Table 3.** CLABSI insertion care bundle and compliance scoring

| Bundle Element                        | Answer Options          | Scoring             |
|---------------------------------------|-------------------------|---------------------|
| Patient identified                    | Yes                     | 1                   |
|                                       | No                      | 0                   |
| Consent completed                     | Yes                     | 1                   |
|                                       | No                      | 0                   |
| Reason for insertion                  | Hemodynamic monitoring  | 1                   |
|                                       | Therapeutic             | 1                   |
|                                       | Sampling                | 1                   |
| Sterile technique maintained          | Yes                     | 1                   |
|                                       | No                      | 0                   |
| Maximum barrier precaution compliance | Yes                     | 1                   |
|                                       | No                      | 0                   |
| Insertion site prepared with          | Chlorhexidine gluconate | 1                   |
|                                       | Povidone iodine         | 1                   |
|                                       | Alcohol                 | 1                   |
|                                       | Other                   | 1                   |
| Clamp lumens                          | Yes                     | 1                   |
|                                       | No                      | 0                   |
|                                       | NA                      | Excluded from score |

CLABSI: central-line-associated bloodstream infection; NA: not applicable.

- Daily assessment of the central lines' needs to reduce the catheter days.
- Checking any signs of infection during the multidisciplinary unit rounds and addressing lines issues on time.
- The proper seal of the CVC dressing from all edges.
- The regular sharing of the CLABSI events, and hand hygiene compliance rate with the nursing staff.

The regular conduction of the RCA investigations revealed the following as the most significant contributing factors for CLABSI events:

- Low hand hygiene compliance
- Long-term CVC utilization rate
- The femoral line is the most common site of temporary CVCs, which accrued more infection than other CVCs
- Low vascular devices care bundle compliance rate
- Shortcuts in cleaning line hubs before using the lines; e.g., the curo cap was not covered at all intravenous-line ports because of time restrictions, nursing acuity, and in some cases, a shortage of supplies.
- Other multidisciplinary team members, such as hemodialysis nurses, use the CVC lines without proper practice competency checks
- Inadequate training of some float nurses to handle and maintain the lines

Besides the bundles' compliance reports, the RCA reports enhanced collaboration among the ICHE, HITA, and the nursing staff to improve nurse training to comply with the vascular device bundles and their documentation. In addition, the HITA team collaborated to develop a tutorial video to increase the bundles' awareness among nursing staff.

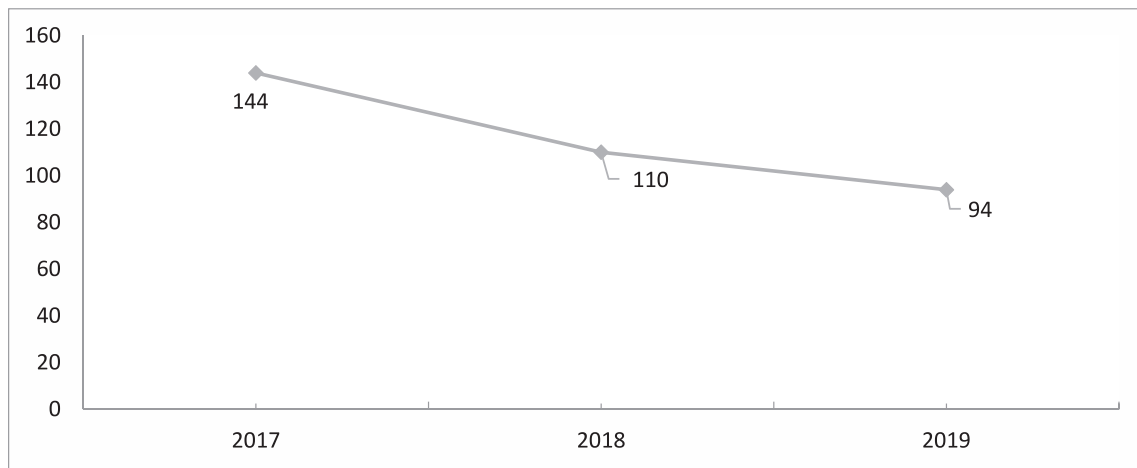
An additional decrease of 15% was achieved in CLABSI events by the end of 2019 from the reported events in 2017. Thus, the overall decrease of CLABSI events over 2018 and 2019 was 35%, slightly exceeding the performance improvement project team's goal of reducing CLABSI by 30% over the 2 years from 2017 (Figs. 3 and 4).

The average CLABSI rate was reduced from a baseline of 1.5 per 1000 central line days in Jan 2017 to 1.03 per 1000 central line days in December 2019. Figure 4 illustrates shift improvement in the first three quarters of 2017 and the second and third quarters of 2019. In addition, a significant shift was shown in 2019, reducing the CLABSI rate to 0.3 per 1000 central lines, below the NHSN benchmark of 0.8.

**Table 4.** CLABSI maintenance care bundle and compliance scoring

| Bundle Element             | Answer Options  | Scoring               |
|----------------------------|---|-----------------------|
| Hand hygiene performed     | Yes   | 1                     |
|                            | No  | 0                     |
| Line requirement discussed | Yes   | 1                     |
|                            | No  | 0                     |
|                            | NA  | Excluded from scoring |
| Daily maintenance bundle   | Apply disinfection caps on all unused lumen closure   | 1                     |
|                            | Change IV sets for continuous infusions per policy    |                       |
|                            | Replace dressings when compromised (wet, soiled)      |                       |
|                            | Scrub the hub for each with an appropriate antiseptic |                       |
|                            | Use sterile devices to access catheters               |                       |
|                            | Use sterile technique during dressing changes         |                       |
| Daily bathing              | CHG bathing   | 1                     |
|                            | Washing with soap                                     | 1                     |
|                            | NA  | Excluded from scoring |
| Line access                | Hub scrubbed for 30 seconds                           | 1                     |
|                            | Disinfectant cap used                                 | 1                     |
|                            | NA  | Excluded from scoring |
| Dressing changed           | Yes   | 1                     |
|                            | Not required  | Excluded from scoring |

CHG: chlorhexidine gluconate; CLABSI: central-line-associated bloodstream infection; IV: intravenous; NA: not applicable.



**Figure 3.** Total annual central-line-associated bloodstream infection (CLABSI) events from 2017 to 2019.

The average quarterly hand hygiene compliance was 87%, and the target was 80% (Fig. 5).

Ten units maintained zero CLABSI from 2018 to 2019, with a high central line utilization rate (Table 2).

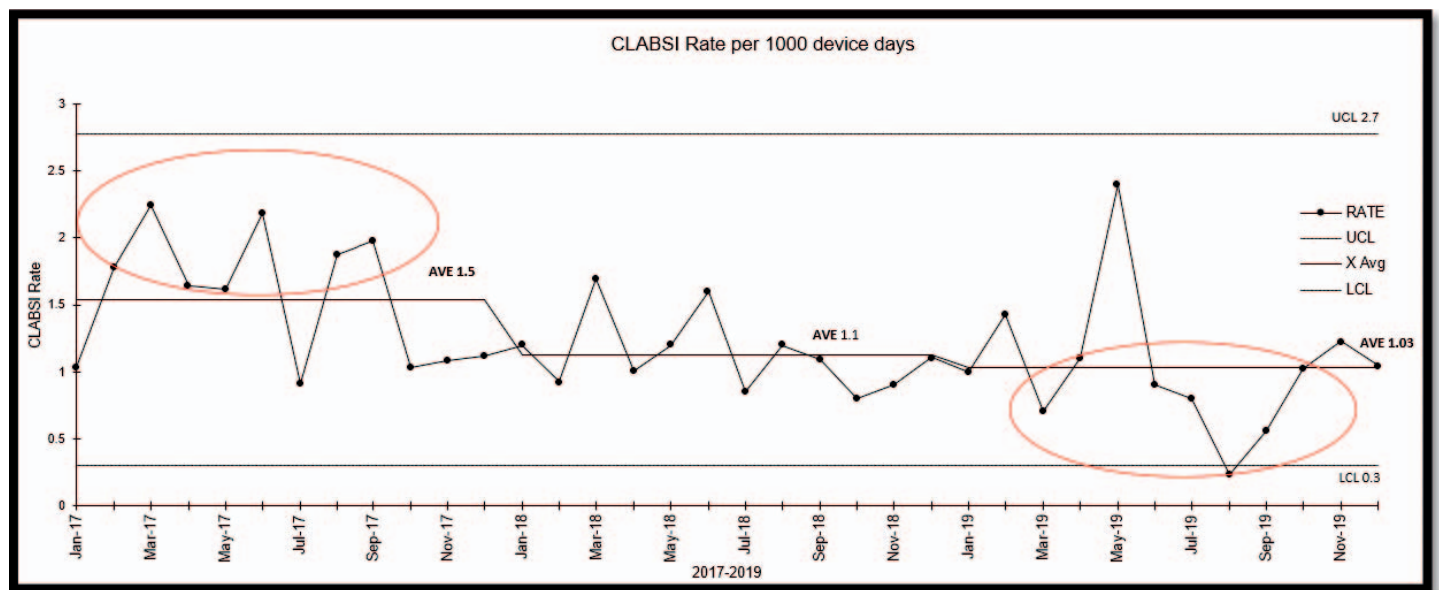
**DISCUSSION**

Hospital leaders pay close attention to avoidable harm such as CLABSI incidents as part of their journey and commit to reducing patient harm risk. The improvement project was part of the hospital’s journey to reduce patient harm (i.e., Zero Harm Journey).

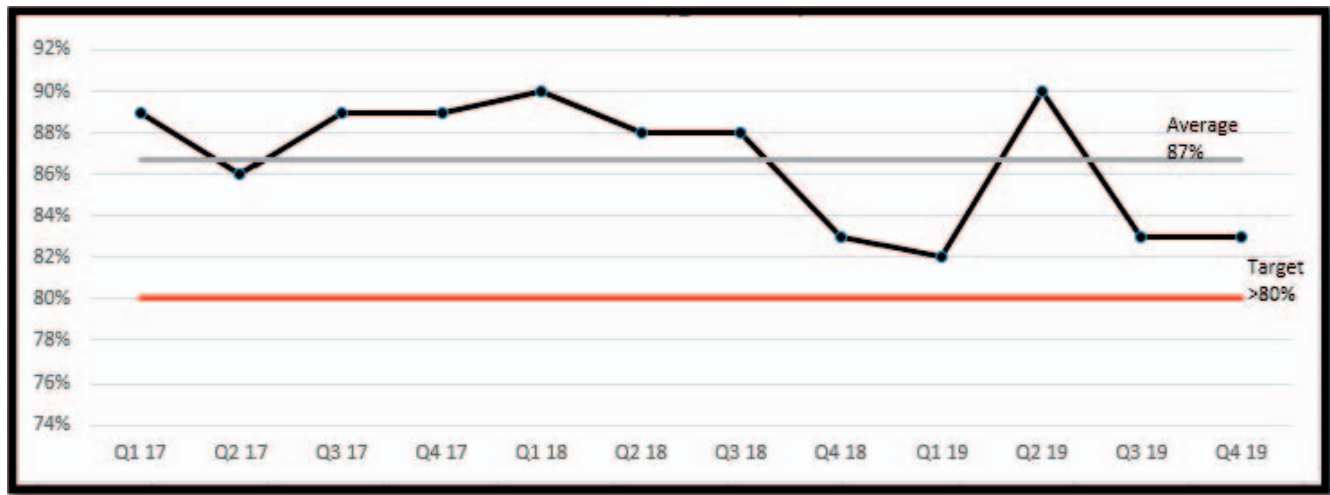
A close relationship between quality management and the ICHE team was critical to the project’s success. ICHE provided the support and advice to develop the bundles

in the Electronic Patient Health Record to monitor healthcare providers’ compliance with them. In addition, they assisted in developing teaching materials for healthcare providers. The quality management team developed and coordinated the project meetings and brainstorming sessions, developed driver diagrams, participated in CLABSI events and RCA sessions, and documented the project team members’ agreed-upon actions.

The project team met monthly to evaluate the team’s efforts to reduce the CLABSI rate in the hospital and ensure that interventions were effective for all departments involved. During their meetings, the team members reviewed and analyzed the CLABSI events per unit to focus their efforts and detect any possible trends.



**Figure 4.** CLABSI rate from 2017 to 2019. Red ovals indicate improvement in the first three quarters of 2017 and the second and third quarters of 2019. AVE: average; CLABSI: central-line-associated bloodstream infection; LCL: lower control limit; UCL: upper control limit.



**Figure 5.** Quarterly percentage of hand hygiene compliance from 2017 to 2019 for hospital unit staff.

In addition, to ease the monitoring of the project progress and enhance data transparency, the hospital developed a Zero Harm dashboard accessible to all hospital staff through the hospital intranet webpage. The dashboard displayed the monthly CLABSI events per unit and the total events per month and year. The ICHE team assigned to different hospital units collected and validated the CLABSI improvement project data elements.

The ICHE team monitors CLABSI routinely as part of the hospital's active surveillance program. It is mandatory by the local health authority to include CLABSI in the hospital surveillance plan, and the international hospital accreditation of Joint Commission International requires the hospital to develop a surveillance plan based on the risk assessment. The infection control risk assessment showed a high rate of CLABSI compared with the NHSN benchmark.

An active surveillance approach is adopted for CLABSI surveillance, where the infection control team reviews all potential inpatients who might develop CLABSI during their stay in the hospital. The hospital uses an electronic surveillance system that triggers patients who might develop CLABSI using an algorithm based on CDC and NHSN criteria. For example, for any patient with a central line on-site for more than 2 days and positive blood culture, the system will add this patient to the ICHE worklist for further investigation to confirm if it is a CLABSI event.

The main key challenges that the project team faced initially were the lack of standardization of the practice, healthcare providers' training on central line insertion and maintenance, and the monitoring of the bundles' documentation. Before implementing advanced interventions to reduce CLABSI infections, the team worked on reducing variations in the practice among various units.

The units that consistently showed high compliance with the CLABSI bundles were observed to reduce infections over the performance improvement project period. This outcome is consistent with a similar outcome from other publications for the performance improvement projects conducted in ICUs and non-ICUs.<sup>[14–16]</sup>

One of the challenging patient categories was the incontinent patients. During the RCA exercise, it was found that some patients might have their lines contaminated with stool. The situation was due to the delay in the timely cleaning of the patients because of insufficient staffing. Another concern was the unavailability of waterproof covers for isolating the central lines from water during shower taking. Both situations could increase the risk of CLABSI. Therefore, the team collaborated with the hospital supply chain to acquire the needed central line plastic covers. Also, the nursing leadership provided additional nursing staff to support the units with incontinent patients.

Not many published improvement projects explain the improvement tools used for CLABSI reduction. In addition, many hospitals in Saudi Arabia still use manual documentation of the insertion and maintenance bundles. Therefore, the study will be a resource for other hospitals to implement similar interventions to decrease CLABSI events and eventually reduce patient harm.

### Limitations

The improvement project was conducted in only one tertiary hospital branch; therefore, the data might not be generalizable for the whole hospital. There is a plan to extend the project interventions to another hospital branch in another city and evaluate the CLABSI events and rate reduction.

One of the limitations of the intervention was the inability to obtain a pediatric simulator, so simulator training was limited to the physicians who placed adult



central lines. However, the hospital is working toward acquiring a pediatric simulator for the training.

## CONCLUSION

Implementing the various interventions described in this article reduced the number of CLABSI events from 144 to 94 (i.e., 50 events). In addition, the decrease in CLABSI events reduced the excess mortality by 0.15. Excess mortality is defined as the number of additional deaths due to a given hospital-acquired condition (HAC) and is shown as the number of deaths per HAC case. For CLABSI, there are 0.15 excess deaths for each CLABSI event,<sup>[17]</sup> so this project saved approximately seven lives and reduced patient harm and suffering.

Standardizing the policies, procedures, practices, training, and supplies based on evidence-based guidelines for CLABSI prevention is essential to reduce patient harm due to CLABSI events. In addition, continuous monitoring of the CLABSI events, hand hygiene and bundles compliance, and sharing with the healthcare providers assist in sustaining the improvement efforts over time and allow shared learning among various teams.

The project's successful outcome created a positive competition among the inpatient units that formulated internal CLABSI reduction teams to facilitate the implementation of the project interventions.

The project team continued monitoring the CLABSI events that continued to decrease to achieve the ultimate target of zero CLABSI. In addition, the project will be expanded to another new hospital branch to verify their impact on CLABSI reduction.

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