INNOVATIONS JOURNALS

*Quality Improvement Project*

# Strengthening Reliability and Sustainability: Integrating Training Within Industry (TWI) in a Quality Improvement Collaborative

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Sources of Support: This study received public resources from the Brazilian Ministry of Health through PROADI-SUS and philanthropic resources from the participating institutions: Hospital Alemão Oswaldo Cruz, BP – A Beneficência Portuguesa de São Paulo, Hospital do Coração, São Paulo, Hospital Israelita Albert Einstein, Hospital Moinhos de Vento, and Hospital Sírio-Libanês.

Conflicts of Interest: None.

Submitted: Sep 17, 2024; First Revision Received: Oct 26, 2024; Accepted: Nov 27, 2024; First Published: Feb 11, 2025.

Borem P, de Moura RM, dos Santos HB, et al. Strengthening reliability and sustainability: integrating training within industry (TWI) in a quality improvement collaborative. *Glob J Qual Saf Healthc*. 2025; 8:35–42. DOI: 10.36401/JQSH-24-37.



## ABSTRACT

**Introduction:** Integrating process improvement tools into healthcare has shown promising results, yet the application of "training within industry" (TWI) still needs to be explored in this context. This study focuses on implementing job instruction (JI), one of the three components of TWI, within a large breakthrough series collaborative (BTS) in a middle-income country. **Methods:** We evaluated the deployment of JI during a nationwide initiative aimed at reducing three critical healthcare-associated infections (HAIs)—central line–associated bloodstream infections (CLABSI), ventilator-associated pneumonia (VAP), and catheter-associated urinary tract infections (CAUTI)—across 189 Brazilian public intensive care units (ICUs). Our quality improvement (QI) project outlines the integration of JI to enhance the reliability of care bundles and empower frontline teams to reduce variation, one fundamental condition to maintain ongoing improvements. **Results:** The implementation strategy included structured JI training for the hub's leaders, which facilitated the gradual adoption and customization of JI and visual management techniques into daily ICU care. We detailed the four stages of JI training, the content of each session, and how they were incorporated into the existing BTS framework alongside

visual management tools. The mean compliance to prevention bundles exceeded 90%, and the project results reached an overall reduction of 44%, 52%, and 54% for CLABSI, VAP, and CAUTI, respectively. **Conclusion:** Our findings suggest that JI can be seamlessly integrated into routine QI activities. This structure promotes consistency in carrying out each aspect of care bundles, preventing HAI and strengthening patient safety.

**Keywords:** healthcare-associated infections, job instruction, improvement science, quality control, quality improvement

## INTRODUCTION

Integrating improvement sciences in the healthcare sector has led to significant advancements. It has streamlined processes and effectively minimized "*muda*"—the Japanese term for nonvalue-adding activities—thereby enhancing patient care quality and healthcare delivery efficiency.[1–4] Various improvement strategies have been incorporated into infection prevention and control programs (IPCP), which have reduced the rates of healthcare-associated infections (HAI) due to better reliability of evidence-based prevention practices.[5,6]

Sartini et al.[6] showed that various lean healthcare methods, such as the Toyota production system (TPS), Lean Six Sigma (LSS), Robust Process Improvement (RPI), evidence-based practice, and plan-do-check-act cycles (PDCA), significantly prevent HAIs. Similarly, the Model for Improvement developed by Associates in Process Improvement and popularized by the Institute for Healthcare Improvement (IHI) throughout the Breakthrough Series Collaborative (BTS) effectively redesigns systems, thus improving quality and safety to prevent HAIs.[7]

Job instruction (JI), one of the three components of *training within industry* (TWI), is a systematic method for instructing employees in specific job tasks and skills.[8,9] According to Graupp and Wrona,[8] JI "trains supervisors how to instruct employees so that they can quickly remember to do a job correctly, safely, and conscientiously;" however, its application and use in IPCP remains underexplored. This study aimed to show the integration and adoption of JI and visual management within a large quality improvement (QI) initiative to prevent HAIs in a middle-income nation by assessing the reliability of care bundles during the intervention period.

## METHODS

### Ethics and Consent Statement

Access to the "*Saúde em Nossas Mãos*" (SNM) collaborative database was approved by the local human research ethics committees ("*Certificado de Apresentação de Apreciação Ética*": 66698023.7.0000.0071). The database contained QI process indicators and had no identifiable information regarding participating institutions, healthcare professionals, or patients, eliminating the need for individual patient consent.

### Context

This QI initiative is a part of the Support Program for Institutional Development of the Unified Health System ("*Programa de Apoio ao Desenvolvimento Institucional do Sistema Único de Saúde*" or PROADI-SUS), a partnership program between the Brazilian Ministry of Health (BMoH) and the six Healthcare Entities of Recognized Excellence ("*Entidades de Saúde de Reconhecida Excelência*" or ESRE).[10] The SNM initiative aligns with the National HAI Prevention and Control Program and the National Patient Safety Policy, which aim to prevent HAIs in intensive care units (ICUs) using BTS methodology.

The first SNM cycle, spanning 2018–2020 and including 116 ICUs, notably reduced the incidence densities of three critical HAIs: central line–associated bloodstream infection (CLABSI), ventilator-associated pneumonia (VAP), and catheter-associated urinary tract infection (CAUTI),[7,11] resulting in a return on investment of 765%.[12]

For the second SNM cycle (2021–2023), 189 new ICUs received support from a dedicated team of 19 healthcare professionals called "*hubs improvers*." These 19 *improvers* were professionals from six ESREs, and their only job was to support the hospital's participants. The BMoH randomly allocated ICUs across the ESREs, overseeing approximately 32 participating institutions in each hub.

Despite promising outcomes, the frontline staff faced significant challenges in using checklists with the newly implemented quality control system. Checklists used to verify the reliability of each bundle element were overwhelming, inconsistent, and unsustainable. Consequently, the BMoH tasked our team with developing a more practical and alternative quality control and implementation method. After extensive deliberation and exploration of various methodologies within improvement sciences, JI emerged as a superior choice, offering a streamlined and efficient solution to meet the rigorous demands of healthcare quality assurance.

### Study Design

A quality improvement study was conducted following the Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0).[13]

### Rationale

To successfully implement QI projects, evidence-based changes need to be incorporated into clinical workflow and routines for patient care.[2] This requires adequate training and empowerment of healthcare professionals to enhance IPCP outcomes.[14] Leadership is critical in facilitating the adoption of preventive actions for QI efforts.[15] Team leaders must foster an environment to support evidence-based care delivery, with

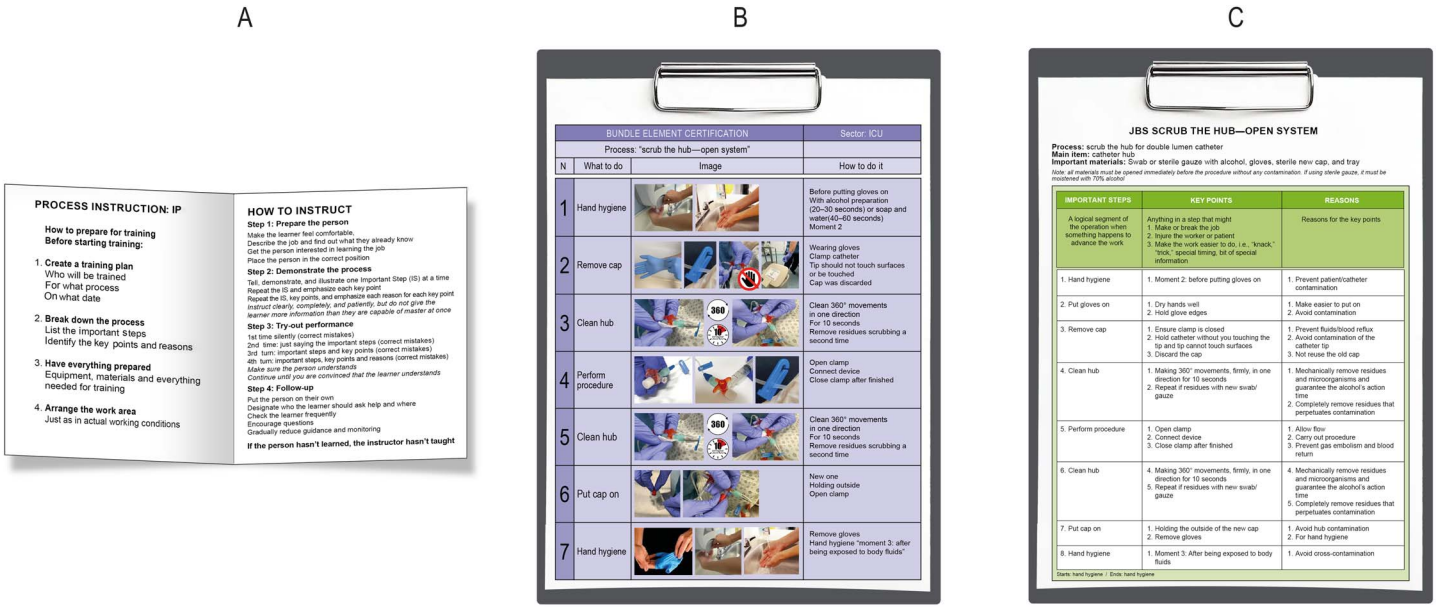


**Figure 1.** **A.** Job instruction card. The card needs to fit in the pocket (2.7 × 4.7 inches, folded up and laminated) and be used as a guide during the training. **B.** An example of a job breakdown sheet for "*scrub the hub open system*." **C.** Bundle element certification.

comprehensive system redesign and education as an essential foundation for success. This strategy involves delineating standardized procedures for each component of the care bundle, which is crucial to many QI initiatives.[16,17] These standards help leaders enable ICU staff to carry out these procedures accurately and effectively, thereby reducing variation.

## Intervention

We conducted two rounds of virtual training on JI for 19 "hubs improvers" and seven BMoH representatives. Each round had 14 and 12 participants, respectively, with each training session lasting 10 hours and spread over five consecutive days at a rate of 2 hours per day (10/5/2). Although we used the standard JI training curriculum recommended by the original source,[18] we tailored the content to suit the healthcare sector and presented it in a slide format. The flow of each session is described in Supplementary Table S1, available online.

All participants were asked to apply their learning in a practical setting, known as "going to the Gemba," and create a job breakdown sheet (JBS) based on their daily tasks. During the sessions, each participant had 10 minutes to present their JBS and receive the instructor's feedback. If a participant could not complete the training process within 10 minutes, the instructors would interrupt the presentation and open the floor for feedback.

The JI consisted of two parts (Fig. 1A). After all the requirements in part I are fulfilled, part II follows a four-step method: prepare the person, demonstrate the process, demonstrate the performance, and follow up.

After 10 hours of training, we invited the "improvers" to join weekly calls to support them in creating a JBS for all elements of the CLASBI, VAP, and CAUTI care bundles. They were asked to "go to the Gemba," observe the process, and create a JBS for each bundle element. These JBS were refined by running plan-do-study-act (PDSA) cycles and brought to meetings for refinement until they were complete, simple, and exact enough to be used for teaching purposes. Figure 1B shows an example of the tested JBS.

The JBS should be used to train every frontline professional one-to-one, pairing a single trainee with a single trainer. To determine training priority, we asked 19 "improvers" to share information with the QI team leader from each of the 189 hospitals. Subsequently, each QI leader devised a training plan sheet for their respective ICUs. Figure 2 outlines the training plan that should be displayed conspicuously for all unit members.

While creating the JBS for each bundle element, we simultaneously requested that 19 "improvers" establish criteria with the frontline team to determine whether a process complied with the bundle. This crucial step aimed to minimize the variation across the 189 ICUs. Once the frontline team agreed on the criteria, we instructed the hub improvers to design Kamishibai cards (K-cards). These K-cards encapsulate the key points required to comply with the bundle elements. Green cards indicate compliance, whereas red cards indicate noncompliance. Further information can be found in a previous publication by our group.[19] These K-cards were integral components of an economical version of Kamishibai boards (K-boards), one for each analyzed HAI. The QI team hung the K-board on the ICU wall, which was visible to everyone, and used it to manage compliance with each element of the bundle for the

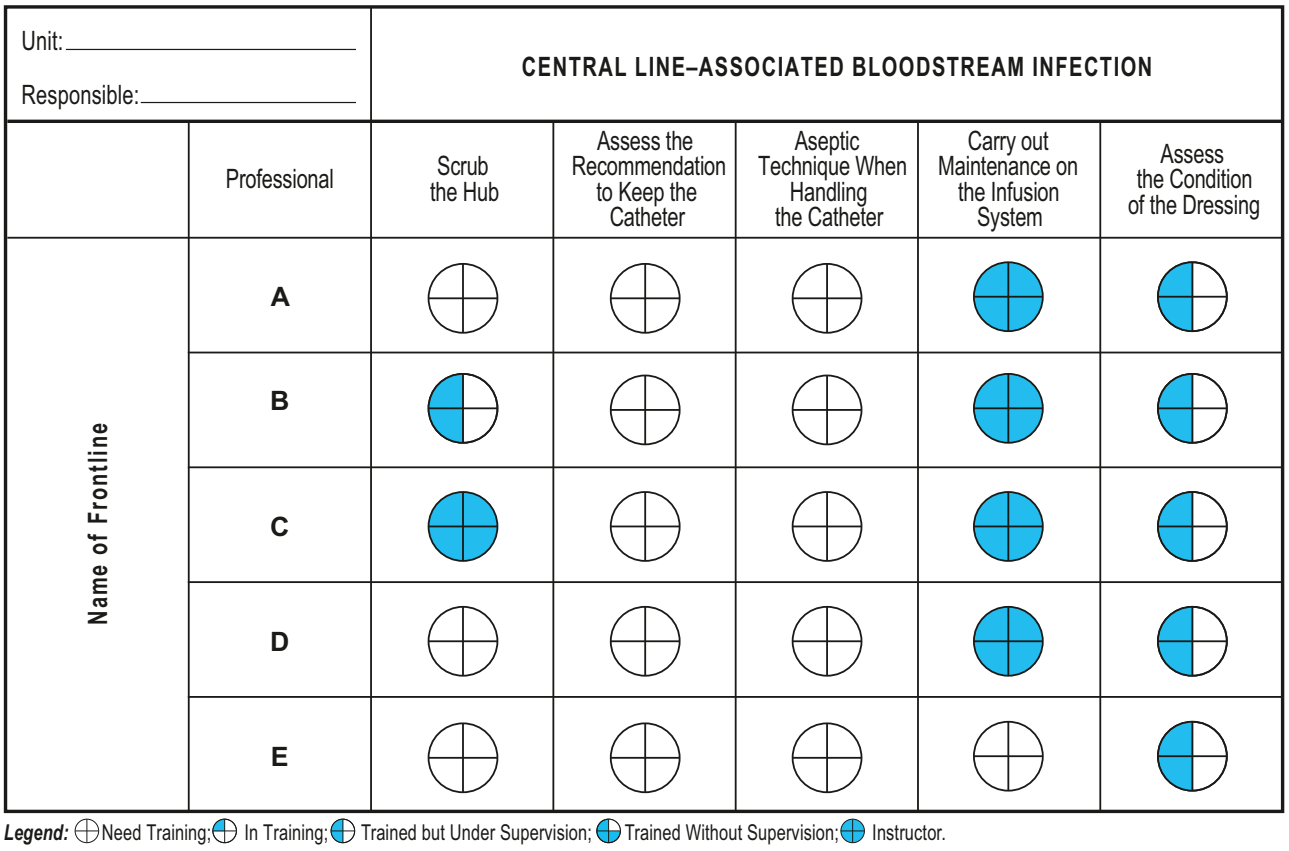


**Figure 2.** An example of job instruction first-year training plan for central line–associated bloodstream infection.

three infection objectives of this initiative (quality control).[19]

In addition to the K-cards, K-board, and JBS, we introduced a new document called the Bundle Element Certification (BEC). This document outlined the key points that mirrored the K-card and JBS and graphically illustrated the sequence of events, most importantly, the key points needed for bundle compliance (Fig. 1C).

A "certifier," who could be a peer, a nurse, a doctor, or someone in a leadership role, uses the BEC and the K-card and decides if the execution of the bundle element is reliable. We strongly advocate that the certifier be a team member rather than an external individual overseeing other jobs. The certifier's role also involves observing a peer performing a job, such as oral hygiene, and comparing the execution with the standards set in the K-card and BEC. If the frontline team omits something that could potentially harm the patient or themselves, the "Certifier" intervenes, halts the procedure, and requests a correction. If the missed step is not critical, the "Certifier" makes a note, discusses it with the provider, assesses the problem later, and proposes a solution. The "Certifier" decides whether the execution of the bundle element is reliable (green for reliable, red for unreliable), documents the reasons, and returns the K-card to the K-board.

JBS, K-card, K-board, BEC development, and four-step training were integrated into the BTS methodology to monitor frontline performance, control quality, and implement changes. Supplementary Table S2 describes the tools and their purpose.

## Measures

Our team selected the following measures: the number of "improvers" trained in JI, the number of people from the 189 ICUs trained by the "improvers," and the number of JBS created. The K-board was implemented in 177 of 189 participating ICUs (93.6%) in the second SNM cycle.[19]

Additionally, we present an example of the reliability of care bundles (e.g., central line catheter insertion bundles). These measures were collected monthly during the intervention period using the SimpleQI cloud-based platform to create run charts. This allowed ICU teams to assess their progress over time and facilitated hub improvers' discussions, mentoring, and feedback for evaluating sustainability.

The overall results of the SNM's main objective, reducing the density incidence of the three HAIs analyzed, are also provided for a better assessment of the QI intervention.

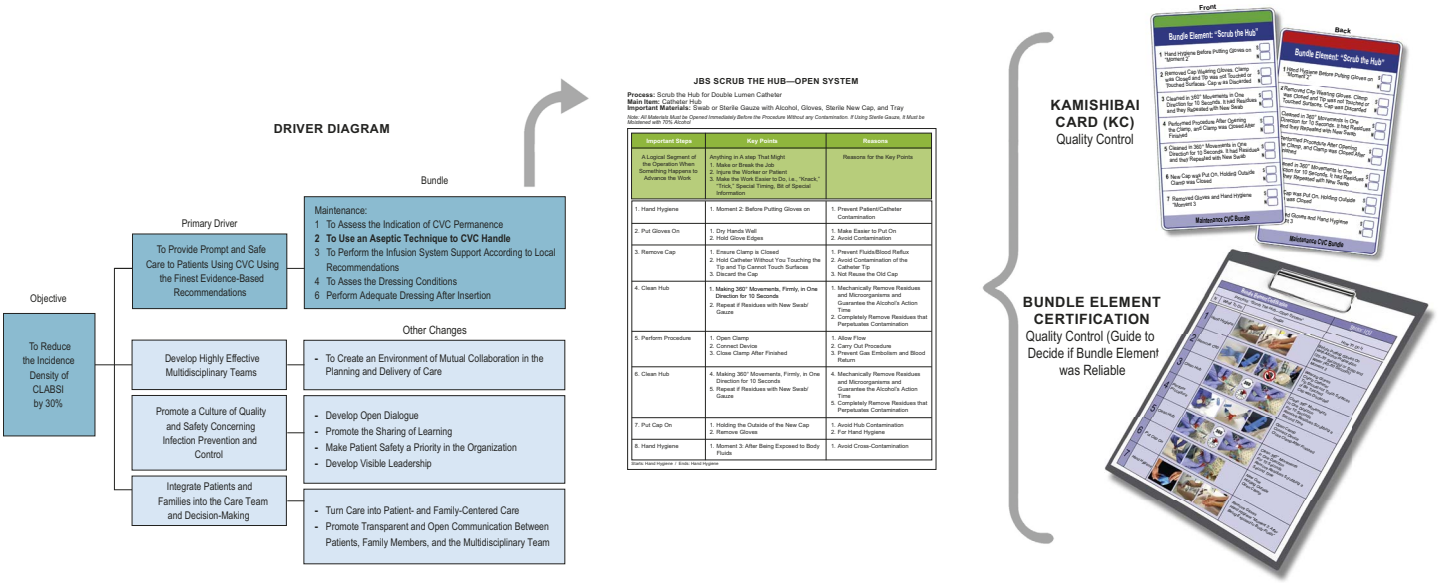


**Figure 3.** Integration workflow between the driver diagram, the Kamishibai cards, and job instruction.

## RESULTS

The "improvers" created 26 JBS, each focusing on selected elements of care bundles. Supplementary Table S3 summarizes the fundamental concepts of JI and the number of people trained. In subsequent sessions, these JBSs were reviewed, necessary improvements were made, and the participants were asked to test them with their frontline teams to further refine them using PDSA cycles.

One significant question raised by the participants was, "Which elements of the bundles are feasible for the creation of JBS?" This question sparked insightful discussions and learning opportunities during the planned training.

### Process Collection Data—Reliability of the Elements of the Bundle

Figure 3 shows the integration workflow between the Driver Diagram proposed during the QI Collaborative, K-cards, BEC, and JBS. The data displayed on the K-board were used to generate run charts at the end of the month (Fig. 4). The mean compliance with prevention bundles exceeded 90%, and the project results achieved overall reductions of 44%, 52%, and 54% for the CLABSI, VAP, and CAUTI, respectively.

### Adapted Strategy

The initial strategy was to equip 19 "improvers" with essential skills and transfer this knowledge to 10 representatives from each of the 189 participating ICUs, following a 10/5/2 training model. However, this approach had several limitations. Even after acquiring the necessary competencies, the trained professionals among the 19 "improvers" felt the need for further preparation to effectively disseminate knowledge. Moreover, competing priorities hindered their ability to conduct training. Consequently, representatives opted to revise their strategies. Rather than conducting comprehensive training sessions (10/5/2), they decided to assist hospitals in creating JBS, thereby offering more direct and practical support. This facilitated a more interactive and applied learning experience for the implementation of the method. In addition to aiding hospitals in developing the JBS, the "improvers" provided 189 ICU attendees (1898 healthcare professionals) with three virtual sessions, each lasting 2 hours, focused on the fundamental principles of JI.

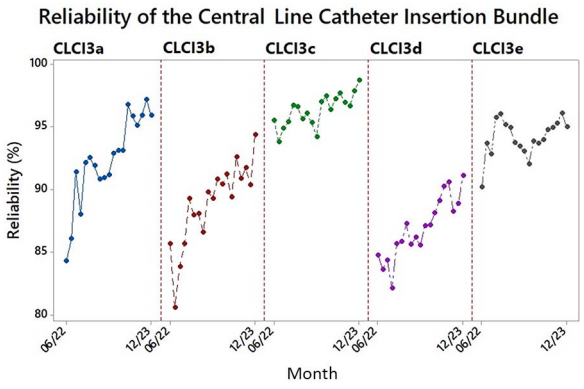


**Figure 4.** Elements of bundle reliability for central line–associated blood stream infection (CLABSI)–run chart June 2022 to December 2023–aggregated data from 189 intensive care units.
CLCI3a: Percentage of "evaluate the indication for central venous catheter insertion";
CLCI3b: Percentage of "select the most suitable location for central venous catheter insertion";
CLCI3c: Percentage of "use full-barrier precautions during central venous catheter insertion";
CLCI3d: Percentage of "use chlorhexidine for skin preparation";
CLCI3f: Percentage of "perform appropriate dressing after insertion."

## DISCUSSION

The conventional approach to collecting process data involves extensive checklists encompassing all elements of the bundles. Although effective during collaborative efforts, this can be burdensome for teams. Unfortunately, we observed that most teams abandoned process data collection after the collaborative phase concluded, rendering this method unsustainable. This paper describes an alternative process for real-time, quality-controlled process data collection that uses the K-board daily.

When integrated with care bundles, JI can be beneficial for implementing changes after testing them. This enables caregivers to comprehend the procedures involved in each element of the bundles and interconnection among these elements as part of a broader process within a QI collaborative, contributing to reliability and sustainability. This strategy can assist ICU teams in understanding the significance of each step of the elements and its effect on the overall quality of care given to critically ill patients (value stream).[20] This strategy eliminates steps that do not add value, enhancing patient outcomes by decreasing variation and harm since the JBS is now the standard work.

Nicolay et al.[21] demonstrated the potential of various improvement tools to reduce infection rates in the surgical environment of the 34 studies analyzed, nine focused on continuous QI, five on Six Sigma, five on total quality management, five on PDSA or PDCA cycles, five on statistical process control or statistical quality control, four on improvement sciences, and one on LSS.[21] While the application of improvement sciences in various healthcare settings has been sufficiently reviewed in recent years,[22–28] the use of JI has yet to be explored thoroughly.

Recently, a team from Italy and Canada published a systematic review on using Lean methodology to reduce HAIs.[6] Of the 22 studies included, 14 used HAIs as the primary outcome measure, while eight focused on healthcare worker compliance. A meta-analysis of 14 studies showed that Lean approaches have a protective effect in reducing HAIs (relative risk = 0.50; 95% CI 0.38–0.66). Of note, a stratified meta-analysis of different improvement sciences variations showed that applying improvement sciences, TPS, and LSS significantly reduced HAIs (relative risk = 0.30; CI 95% 0.11–0.86 and relative risk = 0.46; CI 95% 0.23–0.93, respectively). However, using Lean, Lean/PDSA, RPI, and TPS did not significantly reduce HAIs.[6] Other LSS tools, such as defining, measuring, analyzing, improving, and controlling cycles, are also used to reduce HAIs in critical care settings.[29,30] Because the effects of HAIs require a broad and multifaceted intervention within our initiative, which includes compliance with prevention bundles, healthcare professional training, and adherence to hand hygiene, further details about this outcome are presented in our final QI report.

IHI outlines that the key to sustaining improvement is to focus on the daily work of frontline managers, supported by a high-performance management system that prescribes standard tasks and responsibilities for managers at all organizational levels.[31] In summary, organizations should clearly define standard work and jobs, which is critical for IPCP.[32] Our QI teams were heavily involved in frontline engagement, creating tailored materials and conducting rigorous training to support change and standardize the methods used during the BTS collaborative.

To the best of our knowledge, this study is the first to document the use of JI to prevent the three key HAIs concurrently within a large collaborative BTS. Furthermore, it was among the first to prevent HAIs in Latin America. JI is a beneficial supplementary tool for training ICU teams to identify and manage procedures to prevent HAIs, a crucial aspect of IPCP.[14] By dividing these intricate tasks into smaller, more manageable steps, JI made executing care bundles for each HAI more efficient and safer.

Moreover, JI training can enhance effective communication and teamwork, which are crucial for delivering high-quality care.[33,34] Reaping the benefits of this tool requires changes in leadership attitudes, values, and behaviors. This approach fosters a dialogue between frontline staff and leaders (*"nemawashi"* in Japanese) to create a structure that supports problem-solving and includes all professionals involved in patient care. This exchange of ideas amalgamates the necessary and available resources to meet the goals set by our collaborative (*"Hoshin Kanri"* in Japanese).

The success of our intervention also relied on leadership and coordinators, fostering an environment conducive to continuous learning and frontline engagement, and ensuring that resources were allocated to build capabilities. Effective QI systems require constant and reliable data, stakeholder engagement at all levels, and infrastructure for sustainable improvement[35] as proposed by the BTS model and reinforced by the tools presented. We reinforce that fostering an improvement-driven organizational safety culture and ensuring resource availability are pivotal for achieving sustained success in healthcare interventions.[35,36] Furthermore, as discussed,[19] to achieve sustainable change, QI initiatives must become a new way of working rather than something added to routine clinical care, avoiding further expenses and time constraints for the frontline.[37] We emphasize that "perfection" is a continually evolving process of enhancement and improvement.[38] Therefore, the pursuit of perfection is an unending journey, and it necessitates the continuous dedication, commitment, and effort of healthcare teams to cultivate a patient safety culture, as suggested by the BTS methodology.

### Limitations

Our study has some limitations. First, although this approach is effective in standardizing processes, the

rationale for selecting JI over alternative training methodologies can be further strengthened by a more detailed discussion of the theoretical frameworks that underpin our choice. Incorporating insights from other training models or frameworks might provide a more comprehensive understanding of why JI is suited to the healthcare setting and highlight any potential limitations or areas where alternative methods could complement or enhance its application. Further studies are needed to better understand the advantages and challenges of the theoretical tools for supporting sustainability during QI initiatives.

Second, while the framework outlined in this manuscript may not fully account for the reliability of each element of the bundle, verifying whether subsequent results are sustained over a longer period remains crucial.

Third, BTS collaboratives include a range of QI activities that occur simultaneously; therefore, the actual effect of JI on reducing HAIs cannot be evaluated alone. Further research is needed to gain a deeper understanding of the role of JI in QI initiatives and in preventing HAIs.

Fourth, 1836, 1749, and 1289 PDSA were documented by the hubs for CLABSI, VAP, and CAUTI, respectively; however, it was impossible to identify whether these PDSAs were specifically related to refining the JBS.

Lastly, it would have been desirable to assess knowledge acquisition/retention as part of a learning process or to use a learning evaluation framework. In addition, further studies are needed to examine the background and characteristics of the participating professionals, such as professional category, previous QI training, and career experiences, to provide additional insight into contextual factors.

### Practical Implications

The granular breakdown of care bundle components into clear, more accessible, and sequential instructions by JI minimizes process variability and maximizes consistency during execution. It fosters comprehensiveness among frontline teams, ensuring that they grasp the significance of every procedural step and the underlying rationale, effectively melding theoretical knowledge with clinical applications. JI also meticulously documents standard operating procedures and consolidates requisite materials, equipment, and educational strategies to guarantee uniform implementation. JI transcends beyond a mere pedagogical technique and acts as a lever for transformative progress. Through dedicated investments in workforce training and the adoption of JI as a benchmark for instruction, healthcare administrators can ensure safer and more efficient care delivery systems. Thus, our methodology emerges as a feasible approach for testing in similar healthcare environments and offers opportunities for customization (i.e., specific Kamishibai components, BEC, and JBS, according to specific QI methods and outcomes) for spreading purposes.

## CONCLUSION

JI emerged as a strategic enhancement of QI initiatives within the BTS model, enabling harmonious integration. The methodologic approach to training with JI equips staff with the competencies to execute care processes with increased precision and awareness. This structure promotes consistency in each aspect of the care bundle, which is critical for strengthening patient safety.

## Acknowledgments

The authors thank all the healthcare professionals working in the ICUs; this project only succeeded because of their empowerment and motivation. We are also grateful to the PROADI-SUS technical and administrative teams, who supported the development of this project. We would like to thank Editage (www.editage.com.br) for English language editing.

## Supplemental Material

Supplemental materials are available online with the article.

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