Infection Control & Hospital Epidemiology (2023), **44**, 2071–2073
doi:10.1017/ice.2023.146

SHEA

Concise Communication

The impact of the coronavirus disease 2019 (COVID-19) pandemic on a national project preventing healthcare-associated infections in intensive care units

Paula Tuma MD, PhD[3,6,a], José M. Vieira Júnior MD, PhD[5,a], Elenara Ribas MD[4], Karen C. C. D. Silva RN, BSN, MBA[1], Andrea K. F. Gushken MD, MS, MBA[2], Ethel M. S. Torelly RN, BSN, MS[5], Rafaela M. de Moura Pharm, MS[4], Bruno M. Tavares MD, MS[1], Cristiana M. Prandini RN, BSN[2], Paulo Borem MD[6], Pedro Delgado MS[6], Luciana Y. Ue PT[7], Claudia G. de Barros RN, BSN, MBA[3] and Sebastian Vernal MD, PhD[1,2,3,4,5] on behalf of the Saúde em Nossas Mãos Collaborative Study Group[b]

[1]Hospital Alemão Oswaldo Cruz, São Paulo, São Paulo, Brazil, [2]Hcor - Hospital do Coracao, São Paulo, São Paulo, Brazil, [3]Hospital Israelita Albert Einstein, São Paulo, São Paulo, Brazil, [4]Hospital Moinhos de Vento, Porto Alegre, Rio Grande do Sul, Brazil, [5]Hospital Sírio-Libanês, São Paulo, São Paulo, Brazil, [6]Institute for Healthcare Improvement, Cambridge, Massachusetts, United States and [7]Ministério da Saúde, Brasília, Distrito Federal, Brazil

Abstract

Beginning in 2018, a quality improvement collaborative initiative in Brazil successfully reduced the baseline incidence density of healthcare-associated infections in intensive care settings after 2 years. We describe the adaptations of the quality improvement interventions as the COVID-19 pandemic emerged and how the pandemic affected the project outcomes.

(Received 30 March 2023; accepted 2 June 2023; electronically published 18 July 2023)

Since the first case was reported in China in late December 2019, coronavirus disease 2019 (COVID-19) rapidly spread to other countries, extensively impacting the healthcare system worldwide.[1,2] On February 26, 2020, Brazil reported the first case and promptly became one of the most affected countries globally.[3]

In 2018, the Brazilian Ministry of Health promoted the initiative *Saúde em Nossas Mãos* (SNM) to reduce healthcare-associated infections (HAIs) in intensive care units (ICUs) using the quality improvement (QI) model called Breakthrough Series (BTS). This initiative succeeded in reducing the baseline incidence densities of central-line–associated bloodstream infection (CLABSI), ventilator-associated pneumonia (VAP), and catheter-associated urinary tract infection (CAUTI) in 116 ICUs after 2 years. Here, we describe the adaptations of this intervention as the COVID-19 pandemic emerged and how the pandemic affected the project's outcomes until its planned closing in December 2020.

Methods

Quality improvement collaborative

Throughout the project, the leading institutions performed continuous strategies to generate engagement and empowerment of the ICU teams on bundle compliance as well as QI tools for HAI safety control. These activities included in-person learning sessions, virtual learning sessions, and huddles, among others. Plan–do–study–act cycles were also used according to the BTS model. The theory of change was adopted through the driver diagram for each studied HAI. Adherence to the prevention bundles and hand hygiene (HH) were also assessed. Further detailed information on QI methodology, patient care, and relevant clinical indicators of the SNM project are available in a previous publication.[4]

Statistics

Shewhart charts were used to analyze the incidence density for each studied HAI. Time-series modeling (ARIMA) and correlation between bundles and HH compliance were calculated as previously reported.[4]

Ethics

This study was approved by the local Human Research Ethics Committee (CAAE no. 39657220.8.0000.5330).

Results

Due to restrictions enforced during a pandemic, collaborative strategies were adapted, and virtual sessions were performed to keep healthcare workers engaged. In total, 29 weekly remote learning sessions were performed, with 27 adaptation topics (Supplementary Table 1S). Additionally, 24 infographics and 3 journal activities were also performed; 1,008 professionals attended

Corresponding author: Sebastian Vernal; Email: vernal.carranza@gmail.com
[a]Authors of equal contribution.
[b]Study group team members are listed in the supplementary files.
Cite this article: Tuma P, Vieira Júnior JM, Ribas E, *et al.* The impact of the coronavirus disease 2019 (COVID-19) pandemic on a national project preventing healthcare-associated infections in intensive care units. *Infect Control Hosp Epidemiol* 2023. 44: 2071–2073, doi: 10.1017/ice.2023.146

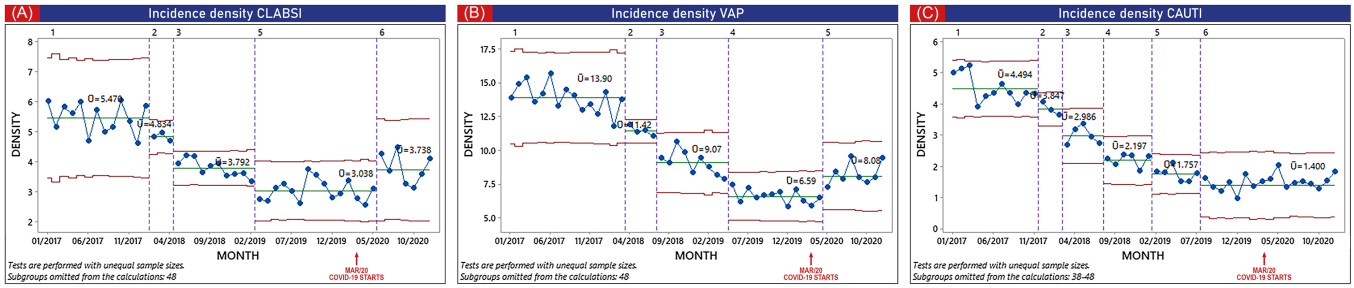

Figure 1. Shewhart charts between January 2018 and December 2020. (A) Incidence density of central-line–associated bloodstream infections (CLABSIs) per 1,000 catheter days. (B) Incidence density of ventilator-associated pneumonia (VAP) per 1,000 ventilator days. (C) Incidence density of catheter-associate urinary tract infections (CAUTI) per 1,000 catheter days. Note. Blue dots, monthly incidence density; green line, center line; red lines, upper and lower control limits.

these sessions. Furthermore, 180 virtual technical visits with the QI leadership team were conducted to discuss implementation of evidence-based changes to clinic workflow and patient care processes during the COVID-19 pandemic.

The SNM conducted monthly virtual-learning sessions to maintain communication with the ICUs teams and to monitor and benchmark the implemented QI practices. In these sessions, the teams could also share their learning experiences from the change tests and discussing their difficulties and to collectively identify solutions. The huddles took place in several ways, including visits using simple mobile devices, previous footage of hospital staff and subsequent virtual meetings, and telehealth equipment (see the Supplementary Material online).

Reducing HAI

Despite all the adaptations, the incidence densities of the studied HAI were negatively affected. From January 2018 to February 2020, the project reached a reduction of 43.5% in CLABSI, 52.1% in VAP, and 65.8% in CAUTI. After COVID-19, there was an increase of 21.03% (3.0 to 3.7 per 1,000 catheter days) in CLABSI (Fig. 1A) and an increase of 23.0% (6.5 to 8.0 per 1,000 ventilator days) in VAP (Fig. 1B). There was no change in incidence density from the baseline CAUTI rate (Fig. 1C). Time-series modeling shows a significant impact of COVID-19 in the achieved incidence density of CLABSI ($P = .007$) and VAP ($P < .001$).

Adherence to prevention bundles

Adhesion to the insertion and maintenance bundles for CLABSI remained stable after COVID-19 emerged (79.1% and 79.2%, respectively) without significant correlation with incidence density ($R = -0.59$; $P = .07$ and $R = .17$; $P = .62$, respectively). Adherence to the VAP prevention bundle remained steady (70.4%) with no significant correlation with incidence density ($R = -0.063$; $P = .86$). Finally, adherence to the insertion and maintenance bundles for CAUTI also remained stable during the pandemic (93.5% and 88.4%, respectively) without significant correlation with incidence density ($R = 0.417$; $P = .23$ and $R = 0.059$, $P = .87$, respectively). The increases in devices used during the pandemic must be highlighted. The use of the central venous catheters increased from 65.6% to 69.4%; the use of ventilators increased from 56.4% to 63.5%, and the use of urinary catheters increased from 48.8% to 54.6%.

Overall, despite pandemic repercussions, based on the intervention impact on historical baselines until the end of the SNM 3-year project, we achieved a 31.6% reduction in CLABSI, a 41.8% reduction in VAP, and a 68.8% reduction in CAUTI. Additionally, an estimated 7,634 infections might have been prevented, and assuming a mortality rate for each HAI analyzed as previously reported,[4] we calculated the potential of 2,687 lives saved.

Adherence to hand hygiene

Adherence during the SNM project rose from 70.3% to 76.2%, reaching a peak in March 2020 of 79.2%, and this rate remained stable during the pandemic, with no correlation to the augmentation of the studied HAI ($P > .05$ for all).

Discussion

Healthcare professionals suffered pressure during the pandemic, and most had to quickly reorganize to deliver adequate care to mitigate the impact of COVID-19. The ICU teams participating in the SNM project maintained evidence-based changes to clinic workflow and adhered to prevention bundles and HH. As a result, only CLABSI and VAP were significantly affected in a context of higher utilization of invasive devices and a profile of more severe critically ill patients. Remarkably, no repercussion for CAUTI incidence density was observed during the pandemic. Overall, the project reached a global reduction in HAIs, reinforcing the relevance of healthcare professionals' training and the resilience of the QI methods to improve patient care outcomes.

The International Nosocomial Infection Control Consortium also revealed increased CLABSI and VAP compared to prepandemic rates and without changes in CAUTI, as we also reported.[1] This impact was also observed in American ICUs.[5] In the same way, Porto et al[3] also reported a substantial increase in CLABSI incidence in Brazilian ICUs during the early months of the COVID-19 pandemic, but without significant variations in VAP incidence.

COVID-19 adaptations may have altered the usual staffing practices regarding the attention to traditional HAI prevention duties.[2,5] Likewise, the scarcity of healthcare personnel due to the considerable surge in ICU bed demand, the complexity of a new disease and correlated protocols, higher illness severity of patients, longer length of stay, and shortage of personal protective equipment (PPE) could have redirected healthcare workers toward the management of the pandemic, potentially affecting HAI control.[2,5–9]

All of the aforementioned factors may have contributed to the negative impact of COVID-19 on HAI prevention programs worldwide regardless of adjustments performed, even when new tools, such as remote support, virtual platforms, and online support were used during a QI intervention. Figure 2 summarizes the reported factors negatively associated with HAI control during

https://doi.org/10.1017/ice.2023.146 Published online by Cambridge University Press

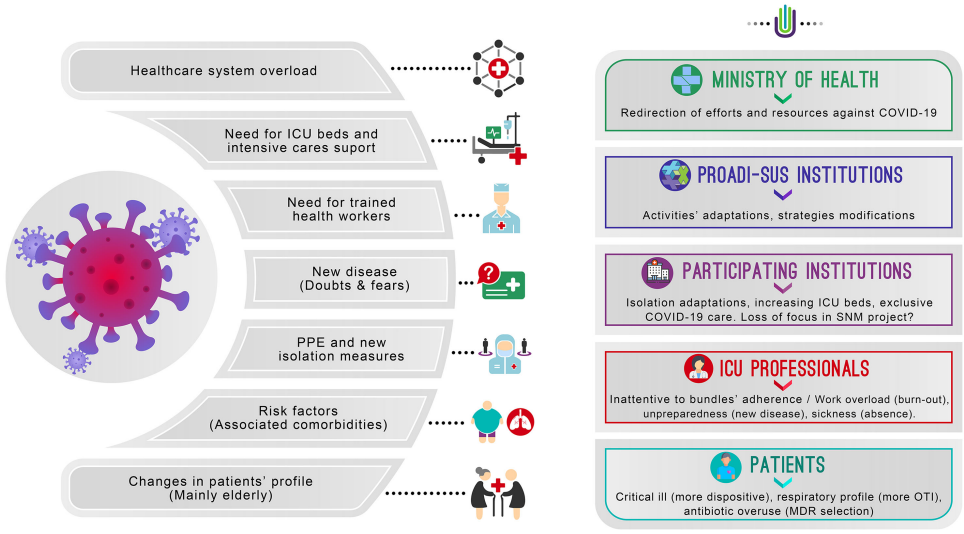

Figure 2. COVID-19 pandemic repercussions are negatively associated with healthcare-associated infection control and their potential involvement in the collaborative project.[1–3,5–10] Note. ICU, intensive care units; PPE, personal protective equipment; COVID-19, coronavirus diseases 2019; PROADI-SUS, Program for the Institutional Development of the Unified Health System; OTI, orotracheal intubation; MDR, multidrug resistance.

a pandemic and how they could have conceivably affected the SNM project. Additional studies performed during the pandemic also support the overview provided in Figure 2 (also see Supplementary Material online).

On the other hand, infection control practices became more visible and were reinforced during the pandemic. Hospitals strengthened intervention measures among healthcare providers including education, monitoring, and warning signs; as a result, many hospitals saw increased compliance with HH.[10] Here, HH adherence metrics remained stable, and compliance was not correlated with HAI. Telehealth and digital solutions created by the SNM project during the pandemic might have sustained the initiatives and compliance with the best practices of HAI control.

An understanding of whether and how COVID-19 impacted HAI rates is essential to guide resources, policies, and practices during the COVID-19 response. As we have reported, implementing evidence-based preventive bundles and QI science have high potential for HAI control, even in pandemic settings.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/ice.2023.146.

Acknowledgements. This SNM project was promoted through the support program for the institutional development of the Unified Health System (PROADI-SUS) and in collaboration with the Institute for Healthcare Improvement.

We thank all of the healthcare professionals who worked in the intervened ICUs; this project only succeeded with their empowerment and motivation. We also appreciate the technical and administrative teams of PROADI-SUS, who supported the development of this project.

Financial support. This work was supported by public resources from the Ministry of Health through PROADI-SUS and with philanthropic resources from the participating institutions: Hospital Alemão Oswaldo Cruz, Hospital do Coracao, Hospital Israelita Albert Einstein, Hospital Moinhos de Vento, and Hospital Sírio-Libanês.

Competing interests. All authors report no conflicts of interest relevant to this article.

References

1. Rosenthal VD, Myatra SN, Divatia JV, *et al.* The impact of COVID-19 on healthcare-associated infections in intensive care units in low- and middle-income countries: International Nosocomial Infection Control Consortium (INICC) findings. *Int J Infect Dis* 2022;118:83–88.
2. Wu H, Soe MM, Konnor R, *et al.* Hospital capacities and shortages of healthcare resources among US hospitals during COVID-19 pandemic, National Healthcare Safety Network, March 27th–July 14th, 2020. *Infect Control Hosp Epidemiol* 2021;43:1473–1476.
3. Porto APM, Borges IC, Buss L, *et al.* Healthcare-associated infections on the intensive care unit in 21 Brazilian hospitals during the early months of the coronavirus disease 2019 (COVID-19) pandemic: an ecological study. *Infect Control Hosp Epidemiol* 2023;44:284–290.
4. Tuma P, Vieira Junior JM, Ribas E, *et al.* A national implementation project to prevent healthcare-associated infections in intensive care units: a collaborative initiative using the Breakthrough Series model. *Open Forum Infect Dis* 2023;10:ofad129.
5. McMullen KM, Smith BA, Rebmann T. Impact of SARS-CoV-2 on hospital-acquired infection rates in the United States: predictions and early results. *Am J Infect Control* 2020;48:1409–1411.
6. Sturdy A, Basarab M, Cotter M, *et al.* Severe COVID-19 and healthcare-associated infections in the ICU: time to remember the basics? *J Hosp Infect* 2020;105:593–595.
7. Stevens MP, Doll M, Pryor R, *et al.* Impact of COVID-19 on traditional healthcare associated infection prevention efforts. *Infect Control Hosp Epidemiol* 2020;41:946–947.
8. Ranney M, Griffeth V, Jha AK. Critical supply shortages—the need for ventilators and personal protective equipment during the COVID-19 pandemic. *N Engl J Med* 2020;382:e41.
9. Fakih MG, Bufalino A, Sturm L, *et al.* Coronavirus disease 2019 (COVID-19) pandemic, central-line-associated bloodstream infection (CLABSI), and catheter associated urinary tract infection (CAUTI): the urgent need to refocus on hardwiring prevention efforts. *Infect Control Hosp Epidemiol* 2022;43:26–31.
10. Moore LD, Robbins G, Quinn J, *et al.* The impact of COVID-19 pandemic on hand hygiene performance in hospitals. *Am J Infect Control* 2021;49:30–33.