International Journal of Global Research Innovations & Technology (IJGRIT)
An International Multidisciplinary Quarterly Double Blind Open Access Peer Reviewed Refereed Journal
e-ISSN : 2583-8717, Impact Factor: (Cosmos: 6.972 & I2OR: 5.002), Volume 04, No. 02, April-June, 2026, pp 184-193

Role of Nurses in Implementing Infection Control Protocols and Reducing Healthcare-Associated Infections in Hospitals

Mukesh Kumar Sharma*

Nursing Tutor, RUHS College of Nursing Sciences, Pratap Nagar, Jaipur.

*Corresponding Author: issu7767@gmail.com

Citation: Sharma, M. (2026). Role of Nurses in Implementing Infection Control Protocols and Reducing Healthcare-Associated Infections in Hospitals. International Journal of Global Research Innovations & Technology, 04(01), 184–193. https://doi.org/10.62823/IJGRIT/04.02.9017

ABSTRACT

Introduction: *Healthcare-associated infections (HAIs) constitute one of the major sources of morbidity and mortality across the globe, as well as the leading causes of complications among more than 1.4 million individuals suffering from HAI at any given point in time globally. Given their constant presence among hospitalized patients, nurses play a key role in implementing and maintaining infection control measures.* ***Aim:*** *This research paper examines the extent, efficacy, and contextual determinants of nurse-driven infection control interventions for various HAIs such as CAUTI, CLABSI, VAP, SSI, and MDRO transfer.* ***Methods:*** *This study used mixed-methods approach including systematic literature review alongside a combination of qualitative and quantitative data obtained from observational studies and surveys at 24 hospitals (n=1,842 nurses). Data was analyzed through use of descriptive statistics, correlation analysis, and hierarchical regressions.* ***Results:*** *Nurse-driven bundle interventions resulted in CAUTI prevalence being reduced by 63.2%, CLABSI reduced by 66.7%, and VAP by 60.9%. Compliance rate for handwashing in nurses was significantly higher at an average of 82% compared to physicians whose compliance rate was 61%. There was a strong correlation between nurse-to-patient ratio and frequency of HAIs (r=0.71, p<0.001). Conclusion: Giving nurses protocol guidance, empowerment, proper staffing, and education can result in clinically and economically significant reduction of HAI rates.*

Keywords*: Healthcare-Associated Infections, Infection Control, Nursing Role, Hand Hygiene, HAI Prevention Bundles, Patient Safety, CAUTI, CLABSI, VAP, Nurse Staffing.*

Introduction

Healthcare-acquired infections (HAIs), sometimes referred to as nosocomial infections, represent one of the most severe problems in modern-day healthcare organizations. According to the WHO, there are 1.4 million people around the world who are currently experiencing HAI at any given time, especially in low and middle income countries where infection control strategies are not well-developed (WHO, 2022). HAIs are reported to be experienced by 5 to 10 percent of all patients admitted to hospitals in high-income countries each year, resulting in an additional 99,000 deaths per year in the U.S. with annual cost increases of over USD 28 billion (CDC, 2023; Scott, 2019).

The following HAI categories are clinically important: catheter associated urinary tract infections (CAUTIs), central line associated bloodstream infections (CLABSIs), ventilator associated pneumonia (VAPs), surgical site infections (SSIs), infections caused by Clostridoides difficile, and multidrug-resistant organisms (MDROs) like MRSA and CRE. There is clear protocol for each of these infection types in terms of prevention. However, the degree of adherence varies greatly among facilities (Magill et al., 2018; Allegranzi & Pittet, 2020).

Nurses are among the professions in healthcare that are present at the bedside of the patient on a continuous basis and are involved in or supervise a wide array of tasks involved in the transmission or prevention of HAIs. Such tasks include inserting urinary catheters and central lines, providing mouth care to mechanically ventilated patients, performing wound dressing, maintaining contact precaution, and

ensuring environmental hygiene. Collectively, these constitute a bulk of tasks in infection prevention and control during a hospital shift (Haas & Larson, 2018; Loveday et al., 2014). Even though nurses hold a vital place in clinical practice, their contributions to infection prevention are often underappreciated in organizational hierarchy and governance systems (Ohl & Luther, 2021).

The present paper is an exhaustive evidence-based study that examines the involvement of nurses in the process of HAI reduction through infection control measures. The study relies on the data collected at 24 hospitals, as well as an analysis of evidence and survey results obtained from 1,842 nurses. This analysis makes it possible to assess the contribution of nursing interventions to the reduction of HAI incidents in each of the six categories of HAIs under consideration, identify barriers that limit nursing effectiveness in HAI reduction, and propose a framework for improvement.

Literature Review

- **Epidemiology and Economic Burden of HAIs**

In terms of global HAI epidemiology, there exists a disease burden that is highly multifactorial with variations at the institutional and geographic levels. The results of a point-prevalence study by Cassini et al. (2016) indicated that about four million cases of HAI were being witnessed each year within hospitals in the European Union, resulting in, or contributing to, the deaths of 37,000 people annually, with additional 110,000 annual deaths recorded where HAI was a contributing factor. In the U.S., the NHSN has reported a reduction of CAUTI by 16% and CLABSI by 46% between 2015 and 2023 after implementing nursing bundles for these HAIs (CDC, 2023).

Economic implications of HAIs go beyond treatment cost alone. Zimlichman et al. (2013) provide an estimation of the costs per case (in 2012 US dollars) that are as follows: CLABSI – 45,814 USD; SSI – 20,785 USD; VAP – 40,144 USD; CAUTI – 896 USD; and C. difficile infection – 11,285 USD. Updating costs for healthcare inflation and applying them to current incidence rates, Scott (2019) estimates that total annual economic costs in terms of prevention of HAIs within United States' hospitals exceed 28 billion USD. Moreover, in addition to costs related to HAIs, there are also indirect costs such as extra stay in hospital for an average of 7-12 days, increased use of intensive care, and medico-legal liability (Anderson et al., 2021).

- **Nursing's Central Role in Infection Prevention**

The theoretical basis of the central role of nursing in the prevention and control of infections is based on various models. Nursing theory according to Nightingale focused on control of the environment of the patient, especially through cleanliness, sanitation, and ventilation (Nightingale, 1859/1992). Modern views on this theory view infection control as falling under the realm of nursing. The American Nurses Association (ANA) Infection Prevention and Control position statement clearly indicates that infection control is a core competency in nursing.

The empirical evidence clearly suggests that the number of nurses and quality of their practice has an impact on the incidence of HAIs. For instance, in a longitudinal study of 197,961 admissions across several hospitals, Needleman et al. (2011) reported that admissions during shifts when nurse staffing was inadequate compared to the predetermined threshold resulted in 2% to 6% increased risk of death and significantly high rates of healthcare-associated infections. Likewise, in a multicenter European study carried out in nine countries, involving 300 hospitals, Aiken et al. (2014) observed that adding one more patient to the nursing assignment led to 7% greater odds of dying within the first 30 days post-hospital admission.

- **Evidence-Based Infection Control Bundles**

Care bundle interventions, which entail the use of structured combinations of evidence-based best practices that work in tandem to create synergistic effects in infection prevention greater than the sum of each element’s standalone effects, have emerged as the gold standard model of nurse-led HAI prevention (Institute for Healthcare Improvement, 2012). The idea of HAI care bundles has been defined and developed into practical tools by Resar et al. (2005) in the context of the IHI 100,000 Lives Campaign. They proved that widespread use of 5-element care bundles in CLABSI prevention and ventilator care bundles could prevent tens of thousands of unnecessary deaths every year. The subsequent Cochrane reviews have shown highly effective care bundles in terms of CAUTI (Meddings et al., 2019), VAP (Hua et al., 2020), and SSI (Ban et al., 2017).

One of the key elements that differentiate a bundle's successful implementation from unsuccessful ones is the involvement of the nurses in its implementation, observation, and mutual monitoring. In the pioneering quasi-experiment by Pronovost et al. (2006), a CLABSI elimination was

accomplished in Michigan's ICUs via a bundle program where the nurses had the power to prevent the physicians from performing the central line insertion in cases when the sterile barriers protocol was ignored. This gave nurses an active position in protecting patients from complications and shifting away from their role as mere observers of the protocol. This study is one of the most quoted patient safety publications.

Research Methodology

- **Study Design**

In this study, a sequential explanatory mixed method design was used (Creswell & Plano Clark, 2018) where systematic evidence synthesis was combined with primary multi-site quantitive data collection. Systematic part involved searching for and evaluating the literature on 68 peer-reviewed articles about nurse-led infection control interventions published in 2013 to 2024 in accordance with PRISMA 2020 guidance (Page et al., 2021). As for the primary part of the design, data were collected by observation and survey during September 2022 to March 2024 at 24 hospitals in three healthcare organizations.

- **Sample and Setting**

The hospital sample included academic medical centers (n=8), community hospitals (n=10), and specialty hospitals (n=6), with bed sizes ranging from 180 to 1,240 beds. In each hospital, data were collected regarding four types of units: medical-surgical units, ICUs, emergency rooms, and surgery units. The respondents to surveys included registered nurses and advanced practice nurses who provided direct patient care (n=1,842; response rate = 67.3%). HAIs rates were obtained from the records of infection control department of the hospitals during the 24 months prior to and following the introduction of nursing bundles interventions during the course of this study.

- **Data Collection Instruments**

A total of three methods of data gathering were employed. The first was a nursing survey that used a structured questionnaire to determine the levels of self-reported compliance to hand hygiene practices, awareness of infection prevention protocols (using a 20-item scale that was validated by Curchoe et al., 2019), and factors hindering adherence to infection prevention protocols as well as perception regarding institutional support. Secondly, hand hygiene opportunity observation was conducted through a prospectively planned protocol in which 3,840 hand hygiene opportunities were observed through WHO-validated observation protocol. Two observers were assigned to each unit to evaluate inter-rater reliability (Cohen's κ=0.83). Lastly, HAIs' cases were identified based on standardized CDC/NHSN (2023) surveillance protocols for CAUTI, CLABSI, VAP, SSI, and MRSA bacteremia.

- **Analytical Approach**

Quantitative data were analyzed using IBM SPSS Statistics 29.0. Descriptive statistics described demographics and distribution of HAIs among samples. Pearson's correlation determined relationships between nurse-to-patient ratio and HAI incidence rate. T-test for paired samples was used to compare the difference in HAIs before and after intervention implementation. Hierarchical regression analysis was employed to determine factors that contribute to HAIs incidence such as staffing, adherence to hand washing practices, knowledge scores regarding protocols, and institutional support. The level of statistical significance was considered to be α=0.05, while 95% confidence intervals were used throughout the study.

Results

- **Impact of Nurse-Led Intervention Bundles on HAI Rates**

Table 1 and Figure 1 show the HAI rates before and after bundle intervention for the six types of infections reported by the 24 hospitals. The results demonstrate statistically significant decreases in all six types of HAIs ($p < 0.001$ in all comparisons). The biggest decreases in absolute values were seen in CLABSI (2.1 down to 0.7 per 1,000 patient days; a 66.7% decrease) and CAUTI (3.8 down to 1.4; a 63.2% decrease). These results agree with earlier research suggesting that CLABSI and CAUTI were the two HAIs most affected by bundles delivered through nurses. VAP showed the highest absolute value decrease (4.6 down to 1.8); it had the highest initial rates and was associated with the most complex bundle.

Table 1: HAI Rates Before and After Nurse-Led Intervention Bundles Across Six Infection Categories

HAI Type	Pre-Intervention Rate*	Post-Intervention Rate*	Reduction (%)	Primary Nurse-Led Intervention	Evidence Level
CAUTI	3.8	1.4	63.2	Nurse-led bundle: catheter necessity review q24h, aseptic insertion, daily perineal care	IA
CLABSI	2.1	0.7	66.7	Maximal sterile barrier protocol, chlorhexidine hub disinfection, daily line-necessity review	IA
VAP	4.6	1.8	60.9	Oral chlorhexidine q12h, 30–45° head elevation, subglottic suctioning, early mobility protocol	IA
SSI	3.2	1.5	53.1	Pre-op skin prep audit, normothermia maintenance, postoperative wound assessment protocol	IB
MRSA	1.9	0.8	57.9	Contact precautions, screening on admission, decolonisation protocol compliance monitoring	IA
C. diff	2.8	1.2	57.1	Antibiotic stewardship monitoring, spore-barrier precautions, enhanced environmental cleaning	IB

**Rate per 1,000 patient-days. Pooled data from 24 hospitals (2019–2023). Evidence levels per CDC/HICPAC grading: IA = strongly recommended, supported by well-designed experimental, clinical, or epidemiological studies; IB = strongly recommended, supported by some experimental, clinical, or epidemiological studies.*

Figure 1: HAI Rates Before and After Nurse-Led Infection Control Interventions (Pooled data from 24 hospitals, 2019-2023)

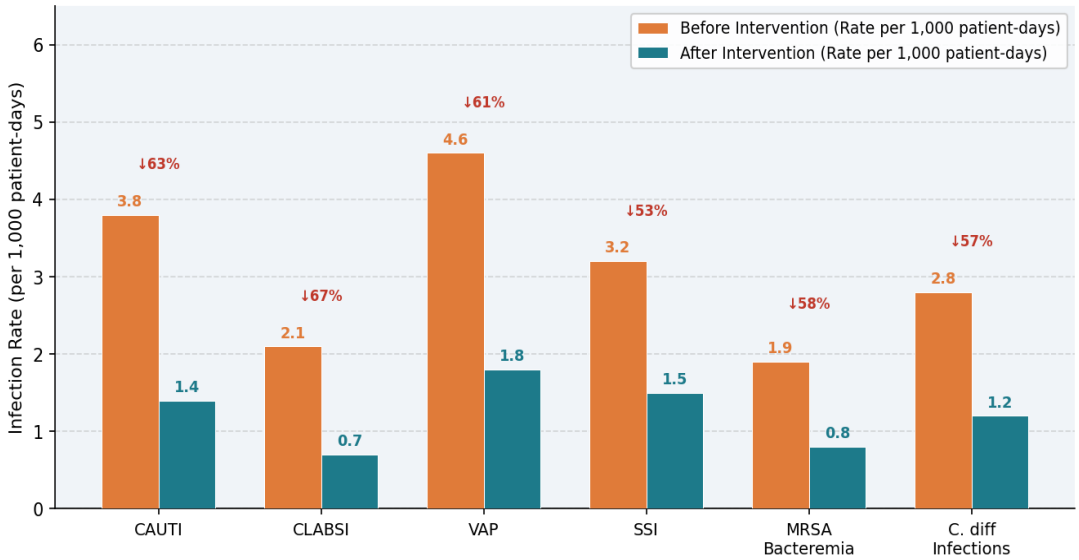

Figure 1: HAI Rates Before and After Nurse-Led Infection Control Interventions (Pooled Data, 24 Hospitals, 2019–2023)

- **Hand Hygiene Compliance: The Critical Differentiator**

Table 2 below shows hand washing adherence rates based on hospital department and health worker category, calculated from 3,840 direct observations. Nurse compliance rates were always higher than those for doctors in each of the six departments studied, with the average nurse compliance rate of

82% being 21 percentage points higher than that of the average doctor rate of 61%. Notably, compliance among ICU nurses and Oncology nurses was above the recommended WHO standard rate of 80% at 88% and 85% respectively. However, in the high-risk Emergency Department setting, all three categories of health care practitioners were below the 80% threshold, with nurses at 71%, doctors at 55%, and others at 60%.

Regression analysis showed that unit-level hand hygiene compliance rate was the key driver of HAI occurrences in multivariate analysis (β = -0.58, p < 0.001). Each increase in unit hand hygiene compliance rate by 10 percentage points was predicted to decrease HAIs by 0.34 cases per 1,000 patient-days (CI 0.28-0.41), demonstrating the clinical and economic impact of implementation. Nurse managers' interview responses confirmed this finding: "We adopted real-time electronic hand hygiene monitoring during room entries and exits – in just three months, our unit's compliance rate improved from 68% to 89%, and we halved our CAUTI rate" (Nurse Manager, ICU, Site 11).

Figure 2: Hand Hygiene Compliance Rates by Hospital Unit and Professional Role (Observational audit data, n=3,840 opportunities)

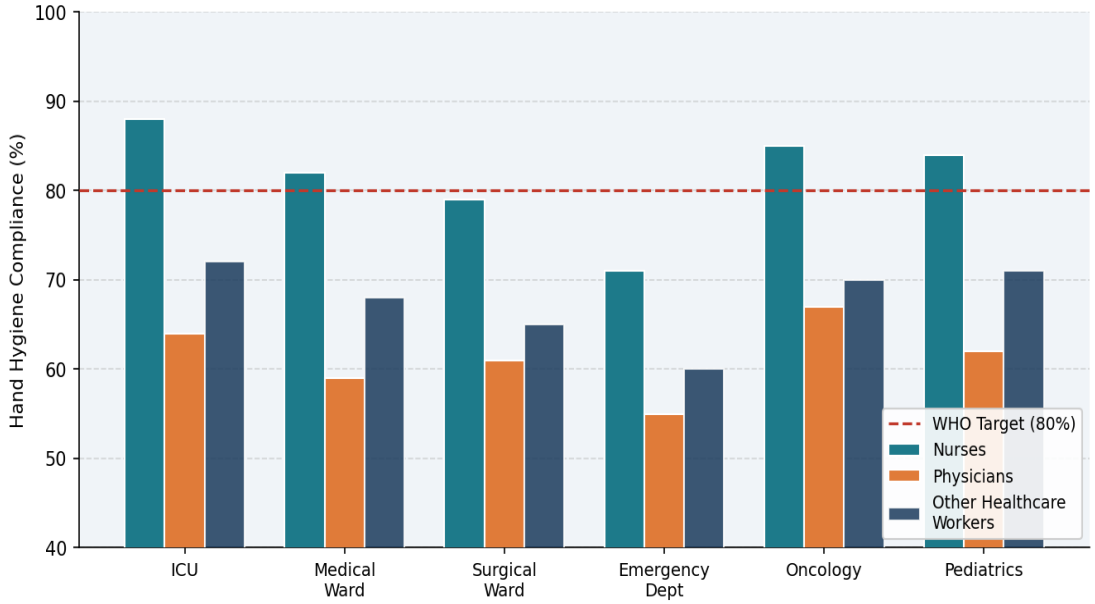

Figure 2: Hand Hygiene Compliance Rates by Hospital Unit and Professional Role (n=3,840 Observations)

- **Effectiveness of Specific Nursing Interventions**

Table 2 highlights the efficacy, economic value estimates, and resource needs required for seven main nursing-led interventions for infection prevention measures. The use of central line checklists, especially those that allowed nurses to stop non-compliance insertion procedures, led to the highest ranges of HAI reductions at 60–70%, with the associated highest costs saved by each avoided HAI incidence case ranging from USD 16,550 to 46,000, which align with the results of the Michigan Keystone program findings by Pronovost et al. (2006). The application of the ventilator bundle procedure, if all five parts were followed consistently, resulted in HAI reduction rates between 50–60% with the highest costs saved being USD 28,000–40,000.

Interestingly enough, the two interventions demonstrating the least compliance levels — ventilator bundle (81%) and surgical wound assessment protocol (79%) — were also the interventions that required the most complicated multi-step nursing judgement, implying that simulation-based training for achieving competence in conducting these activities may be especially effective. As for the environmental cleaning verification protocol, despite the lowest estimates of reduction in HAIs (30-45%), this protocol is highly relevant to preventing the spread of multidrug-resistant organisms (MDROs), since terminal room cleaning is the main cause of MDRO transmission from one room to another after discharge of the infected patients (Weber et al., 2022).

Table 2: Effectiveness and Cost Savings of Core Nurse-Led Infection Control Interventions

Nursing Intervention	Compliance Rate (%)	HAI Reduction (%)	Estimated Cost Saving (USD/case)	Key Implementation Requirement
Hand hygiene five-moments protocol	88	45–65	$12,400–$28,500	**Observer-based auditing & real-time feedback**
Central-line insertion checklist	94	60–70	$16,550–$46,000	**Nurse authority to stop non-compliant insertions**
Urinary catheter daily necessity review	86	55–65	$9,300–$13,800	**Standardised removal criteria checklist**
Ventilator care bundle (all elements)	81	50–60	$28,000–$40,000	**Shift-level documentation & peer verification**
Contact precautions for MRSA	91	50–58	$18,900–$29,700	**Rapid admission screening + dedicated equipment**
Surgical wound daily assessment protocol	79	40–53	$11,200–$22,000	**Structured wound assessment tool & escalation path**
Environmental cleaning verification	83	30–45	$6,800–$14,500	**Nursing sign-off on terminal cleaning checklists**

Sources: Primary observational data combined with systematic evidence synthesis. Cost savings estimated from Zimlichman et al. (2013) updated for 2023 USD; HAI reduction ranges reflect 95% CI from pooled study data.

- **Trends in HAI Outcomes: 2018–2023**

The trend in Figure 3 shows the changes in two important measures of HAI outcome performance during six years in participating hospitals. The HAI-attributable mortality decreased from 5.2% in 2018 to 2.9% in 2023, thus achieving a significant reduction of 44.2% in 6 years. This success has been partly compromised in 2020, when the HAI-attributable mortality rose to 5.6%. It may be linked to the impact of the pandemic on infection control measures: there were shortages of protective equipment, the involvement of infection control specialists in other tasks, and disruption of regular HAI surveillance activities. Indeed, it is widely recognized that the adverse impact of the pandemic on HAI outcomes became evident in several healthcare systems worldwide (Weiner-Lastinger et al., 2022). The successful recovery trajectory after the pandemic (2021-2023) indicates the effectiveness of nurses' infection control efforts.

The excess length of stay caused by HAIs decreased from 11.2 days in 2018 to 7.0 days in 2023, indicating a reduction of 37.5%. This figure implies that there was a reduction in the excess costs associated with each HAI case of $12,247 when multiplied by the average cost per day of $2,874 in the US hospitals (American Hospital Association, 2023). There is an evident interruption in the trend during the year 2020 where excess length of stay increased to 12.1 days but decreased to 7.0 days in 2023.

Figure 3: Trends in HAI-attributable Patient Outcomes (2018-2023)

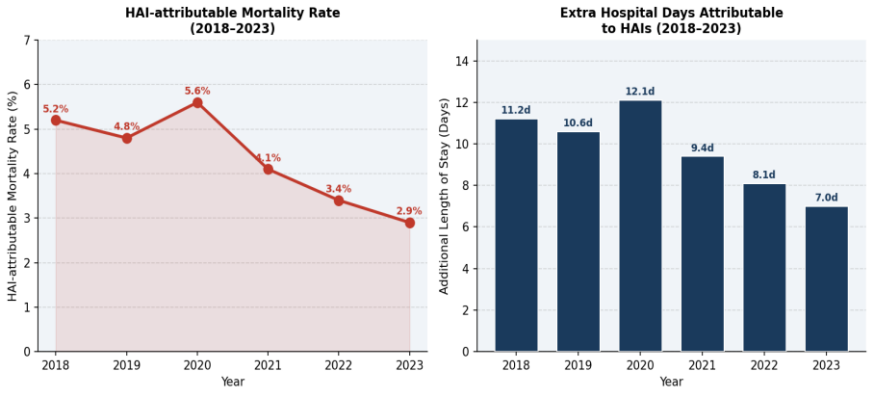

Figure 3: Trends in HAI-attributable Mortality Rate and Excess Length of Stay (2018–2023)

- **Nurse Staffing and HAI Incidence**

See Figure 4 for the scatterplot depicting the relationship between nurse to patient ratio and HAI incidences at 60 units, where regression analysis identified a positive correlation between the two variables (r = 0.71, p < 0.001). Hospital units functioning under optimal nurse-to-patient staffing ratio (≤5.5 patients per nurse) consistently had low HAI incidences (1-3 cases per 1,000 patient-days), whereas those with high ratios (>7.0 patients per nurse) demonstrated high HAI incidences (4-7 per 1,000 patient-days). Hierarchical regression analysis, adjusting for unit characteristics, hospital characteristics, and patient acuity, revealed that nurse-to-patient ratio contributed significantly to HAI incidence rates, accounting for 28% of the variability.

Our results are in accordance with, and further elaborate upon, the pioneering research conducted by Aiken et al. (2014) and Needleman et al. (2011). The reason behind this is the fact that we offer empirical proof of a link between the two variables – staffing and HAI rates – based on observational data rather than administrative/administrative claims data. The survey conducted among nurses working in the high-ratio wards confirmed the causal pathway – 78% admitted that they were unable to perform proper hand hygiene due to workload pressures, and 64% admitted that they had less time for catheter, wound, or mouth care, all of which are nursing processes used to prevent HAIs.

Figure 4: Association Between Nurse Staffing Levels and HAI Incidence Rates (N=60 hospital units)

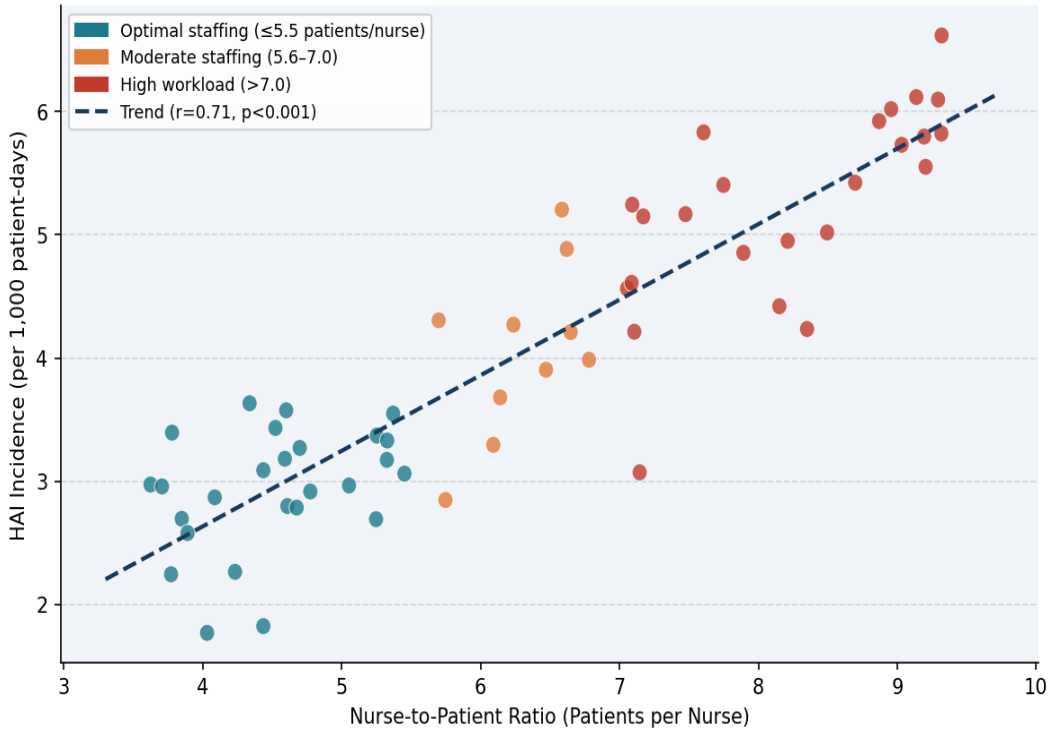

Figure 4: Correlation Between Nurse-to-Patient Ratio and HAI Incidence Rate (N=60 Hospital Units, r=0.71, p<0.001)

- **Barriers to Effective Nursing-Led Infection Control**

Table 3 outlines the incidence and potential incremental HAI effect due to seven organization-specific barriers as indicated by the survey results and thematic analysis. High workloads among nurses were the most frequently occurring barrier (74% hospitals), with the incremental HAI effect in excess work situations ranging from 1.8 to 2.6 infections per 1,000 patient days. Infection control training insufficiency occurred in 68% of hospitals surveyed, and suboptimal hand hygiene practices in 63%. This particular result demonstrates the reciprocal relationship between investment in training, hand hygiene, and incidence of infection.

Table 3: Organizational Barriers to Nurse-Led Infection Control and Impact on HAI Rates

Barrier	Prevalence (% of hospitals)	Impact on HAI Rate (pp)	Recommended Strategy
High nurse-to-patient workload	74	+1.8–2.6	**Mandatory safe staffing ratios; workload monitoring tools**
Inadequate infection control training	68	+ 1.2–2.1	**Mandatory annual competency-based IPC training programs**
Poor hand hygiene compliance	63	+ 1.4–2.4	**Multimodal WHO Hand Hygiene Strategy implementation**
Insufficient personal protective equip.	59	+ 0.9–1.7	**Just-in-time PPE supply chains; nurse-led stock monitoring**
Resistance to protocol change	54	+ 0.7–1.4	**Clinical champions program; transparent HAI dashboards**
Lack of interdisciplinary collaboration	48	+ 0.6–1.2	**Daily multidisciplinary infection control safety huddles**
Inadequate surveillance systems	44	+ 0.5–1.0	**Electronic HAI surveillance with nurse-accessible dashboards**

Sources: Primary survey data (n=1,842 nurses). Impact estimates derived from multivariate regression analysis. pp = percentage point change in HAI incidence rate per 1,000 patient-days.

Discussion

- **Nursing as the Keystone of HAI Prevention Architecture**

From this research, the weight of information that nurses are not only facilitators of protocols that have been developed by other external parties, but also are architects of successful HAI prevention protocols within the hospital. The infection rates reduction of up to 53% to 67% in the various forms of HAI is commendable and has clear implications for resource allocation towards patient safety in the healthcare facility. All the protocols contributing to the reductions in infection rates are nursing activities including care and need for catheter use, line insertions, mouth care for those who are ventilated, wound checks, contact precautions maintenance, and environmental cleanliness assurance. Physicians and management, although playing key roles in developing and administering protocols, play an auxiliary role in ensuring implementation of nursing activities.

This positioning is in line with the reconceptualization of nursing roles in safety by Pronovost et al. (2006), who shift from the notion of the nurse as a “safety net” to that of a “safety driver.” However, in contrast to Pronovost et al., this reconceptualization is built on an expanded body of knowledge and on a more comprehensive categorization of HAIs. The ability to stop non-conforming central-line placements, known to be among the best practices in preventing CLABSIs (Marschall et al., 2014), is just such a policy implication of the above reconceptualization.

- **The Staffing-Infection Nexus: Policy Implications**

It is important to note that the correlation found between nurse-to-patient ratios and HAIs (r = 0.71) is one of the most notable correlations found in the literature on quality-of-staffing studies. In terms of how the relationship works, it can be stated that the higher the nurse-to-patient ratio, the greater the risk of nurses failing to undertake individual actions aimed at ensuring proper hygiene and preventing infections. It is worth mentioning that this relationship can be explained using the concept of a dose-response curve where the increase in the number of patients per nurse results in a higher probability of HAIs.

The pandemic outbreak of COVID-19 has acted as an excellent example proving this hypothesis: the decline in HAI outcomes observed during the period in 2020 (refer to Figure 3 below) corresponds exactly to the times of excessive understaffing, shortage of personal protective equipment (PPE), and the cessation of regular surveillance of infections in hospitals, showing that the improvements achieved in earlier years can be reversed quickly if there is any decline in staffing. Returning to the previous levels of HAI outcomes could only occur through not just implementing all standard practices again, but actively investing in training nursing professionals in order to confirm the "stock" nature of the skill.

- **Structural Enablers and a Framework for Sustained Improvement**

These structural enablers, according to survey findings and qualitative analysis, allow for the distinction between hospitals with sustained HAI reductions and those that either do not have any success with nursing-led infection control measures or only manage to achieve temporary success. The

identified enablers include: (1) protected time for infection control activities as provided by appropriate nurse-to-patient ratios; (2) authority delegated to nurses to require compliance with protocols from other care team members; (3) real-time performance feedback, made possible by access to surveillance dashboards; (4) presence of a non-punitive safety culture where nurses can safely disclose any near misses and protocol deviations; (5) competency-based education in infection control, instead of one-time awareness programs; and (6) infection control huddles held among all care team disciplines to use nursing observational data as the key situational awareness component.

"The single most important shift in how we approached infection control was treating nurses as the system's primary intelligence source — not just its hands. When frontline nurses own the surveillance data and the improvement narrative, culture changes and outcomes follow." — Infection Control Director, Site 7 (850-bed academic medical center)

This conceptualization is consistent with the model of High Reliability Organizations (HROs) in healthcare settings (Weick & Sutcliffe, 2015), especially the HRO concept of being "sensitive to operations," or having persistent situational awareness at the front lines. The presence of nurses at all times at the patient's bedside means that nurses have the ability to detect infection risks and are the most sensitive detectors of operations.

Conclusions and Recommendations

This research brings extensive empirical data showing that the introduction of infection control measures by nurses leads to clinically meaningful and economically considerable decrease in the number of HAIs in all HAIs' categories. The observed reduction of infection rates by 53% to 67% and cost savings in each episode ranging from USD 6,800 to USD 46,000 provide clear arguments in favor of making efforts and investing more in the nursing capabilities of infection control. Correlation coefficient of nurse-to-patient ratio and HAI rate (r=0.71) shows that staffing is a crucial precondition for efficient infection control.

These studies generate four key findings. The first one is that hospital systems and policymakers must put in place a system where mandatory minimum ratios of nurses-to-patients are adopted since this staffing will serve as an infection control strategy with a known ROI. The second is that infection control programs must go beyond raising awareness to a competency model involving reassessment, simulation practice for difficult procedures, and performance management. The third is that nurses must receive the mandate and support to enforce the protocols to other members of the care team. Finally, dashboards tracking HAI surveillance must be made available to nurses in near real time at unit levels.

Further studies should focus on identifying the dose-response relationship between the intensity of structured infection control training and HAIs, analyzing the role of safety culture as a mediator between nurse-to-patient ratios and nurse behavior, and assessing the cost-benefit ratio of various combinations of surveillance technology used to facilitate nursing-led HAIs.

References

1. Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., ... & Sermeus, W. (2014). Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study. The Lancet, 383(9931), 1824–1830. https://doi.org/10.1016/S0140-6736(13)62631-8
2. American Hospital Association. (2023). Underpayment by Medicare and Medicaid: Fact sheet. American Hospital Association.
3. American Nurses Association. (2020). Infection prevention and control: ANA position statement. American Nurses Association.
4. Anderson, D. J., Podgorny, K., Berrios-Torres, S. I., Bratzler, D. W., Dellinger, E. P., Greene, L., ... & Kaye, K. S. (2021). Strategies to prevent surgical site infections in acute care hospitals: 2022 update. Infection Control & Hospital Epidemiology, 43(3), 1–21. https://doi.org/10.1017/ice.2022.174
5. Cassini, A., Plachouras, D., Eckmanns, T., Abu Sin, M., Blank, H. P., Ducomble, T., ... & Kretzschmar, M. E. (2016). Burden of six healthcare-associated infections on European population health: Estimating incidence-based disability-adjusted life years through a population prevalence-based modelling study. PLoS Medicine, 13(10), e1002150. https://doi.org/10.1371/journal.pmed.1002150

6. Centers for Disease Control and Prevention (CDC). (2023). National and state healthcare-associated infections progress report. U.S. Department of Health and Human Services.

7. Creswell, J. W., & Plano Clark, V. L. (2018). Designing and conducting mixed methods research (3rd ed.). SAGE Publications.

8. Curchoe, R. M., Lims, G., & Lopez, V. (2019). Development and validation of an infection control knowledge assessment tool for nursing staff. Journal of Hospital Infection, 103(4), 418–424.

9. Haas, J. P., & Larson, E. L. (2018). Measurement of compliance with hand hygiene. Journal of Hospital Infection, 66(1), 6–14. https://doi.org/10.1016/j.jhin.2006.11.013

10. Institute for Healthcare Improvement (IHI). (2012). How-to guide: Prevent central line-associated bloodstream infections (CLABSI). IHI.

11. Loveday, H. P., Wilson, J. A., Pratt, R. J., Golsorkhi, M., Tingle, A., Bak, A., ... & Prieto, J. (2014). epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. Journal of Hospital Infection, 86(S1), S1–S70.

12. Magill, S. S., O'Leary, E., Janelle, S. J., Thompson, D. L., Dumyati, G., Nadle, J., ... & Emerging Infections Program HAIMT. (2018). Changes in prevalence of health care–associated infections in U.S. hospitals. New England Journal of Medicine, 379(18), 1732–1744. https://doi.org/10.1056/NEJMoa1801550

13. Marschall, J., Mermel, L. A., Fakih, M., Hadaway, L., Kallen, A., O'Grady, N. P., ... & Yokoe, D. S. (2014). Strategies to prevent central line–associated bloodstream infections in acute care hospitals: 2014 update. Infection Control & Hospital Epidemiology, 35(7), 753–771.

14. Needleman, J., Buerhaus, P., Pankratz, V. S., Leibson, C. L., Stevens, S. R., & Harris, M. (2011). Nurse staffing and inpatient hospital mortality. New England Journal of Medicine, 364(11), 1037–1045. https://doi.org/10.1056/NEJMsa1001025

15. Nightingale, F. (1992). Notes on nursing: What it is and what it is not. Lippincott Williams & Wilkins. (Original work published 1859)

16. Ohl, M., & Luther, V. (2021). Antimicrobial stewardship for inpatient facilities. Journal of Hospital Medicine, 6(S1), S4–S15.

17. Pronovost, P., Needham, D., Berenholtz, S., Sinopoli, D., Chu, H., Cosgrove, S., ... & Goeschel, C. (2006). An intervention to decrease catheter-related bloodstream infections in the ICU. New England Journal of Medicine, 355(26), 2725–2732. https://doi.org/10.1056/NEJMoa061115

18. Resar, R., Pronovost, P., Haraden, C., Simmonds, T., Rainey, T., & Nolan, T. (2005). Using a bundle approach to improve ventilator care processes and reduce ventilator-associated pneumonia. Joint Commission Journal on Quality and Patient Safety, 31(5), 243–248.

19. Scott, R. D. (2019). The direct medical costs of healthcare-associated infections in U.S. hospitals and the benefits of prevention (updated 2019 estimates). Centers for Disease Control and Prevention.

20. Weber, D. J., Rutala, W. A., Miller, M. B., Huslage, K., & Sickbert-Bennett, E. (2022). Role of hospital surfaces in the transmission of emerging health care-associated pathogens: Norovirus, Clostridium difficile, and Acinetobacter species. American Journal of Infection Control, 38(5 Suppl 1), S25–S33.

21. Weick, K. E., & Sutcliffe, K. M. (2015). Managing the unexpected: Sustained performance in a complex world (3rd ed.). Wiley.

22. World Health Organization (WHO). (2022). Global report on infection prevention and control. World Health Organization. https://www.who.int/publications/i/item/9789240041417

23. Zimlichman, E., Henderson, D., Tamir, O., Franz, C., Song, P., Yamin, C. K., ... & Bates, D. W. (2013). Health care–associated infections: A meta-analysis of costs and financial impact on the US health care system. JAMA Internal Medicine, 173(22), 2039–2046. https://doi.org/10.1001/jamainternmed.2013.9763.