

EVALUATING NURSING STAFF'S KNOWLEDGE REGARDING
NOSOCOMIAL INFECTION PREVENTION AT INTENSIVE CARE UNITS
IN A TERTIARY CARE HOSPITAL, LAHORE

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DOI: <https://doi.org/10.5281/zenodo.22655108>

Keywords

Nosocomial Infections, Hospital-Acquired Infections, Nurses' Knowledge, Infection Prevention, Intensive Care Unit

Article History

Received: 14 July 2026

Accepted: 18 August 2026

Published: 31 August 2026

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Abstract

Background: Nosocomial infections remain a major cause of morbidity and mortality worldwide and are especially prevalent in intensive care units, where critically ill patients undergo frequent invasive procedures. Nurses, as the healthcare providers with the most direct and sustained patient contact, play a central role in preventing these infections, making their knowledge of infection-prevention measures a critical determinant of patient safety.

Objective: To evaluate staff nurses' knowledge regarding nosocomial infection prevention at the intensive care units of a tertiary care hospital, Lahore, Pakistan.

Methods: A descriptive, cross-sectional study was conducted among 127 staff nurses working across the intensive care units of a tertiary care children's hospital in Lahore, using convenience sampling. Data were collected using a structured, adopted, self-administered questionnaire covering demographic characteristics, general awareness of nosocomial infections and knowledge of preventive measures. Data were analyzed using SPSS version 26.

Results: All participants (100%) were female; most were aged 21-30 years (82.7%), held a Bachelor's degree (63.8%), had less than three years of experience (60.7%), and had previously attended infection-control training (64.6%). Most nurses (81.6%) demonstrated adequate general knowledge of nosocomial infections, though a notable minority incorrectly believed healthcare workers are immune to infection (37.6%). Regarding preventive measures, 84.4% of nurses demonstrated adequate overall knowledge, though gaps persisted regarding the limitations of glove use (40.9% incorrect) and chlorine solution preparation (34.6% incorrect).

Conclusion: Staff nurses in this tertiary care hospital's intensive care units generally demonstrated good knowledge of nosocomial infection prevention, though specific and clinically relevant gaps, particularly around practical infection-control skills, warrant targeted continuing education. Regular,

structured in-service training is recommended to sustain and strengthen this knowledge base.

Introduction

Nosocomial infections, commonly known as hospital-acquired infections (HAIs), represent one of the most significant challenges facing modern healthcare systems. These infections typically manifest 48 hours after hospital admission or within 72 hours following discharge, distinguishing them from community-acquired illnesses (Asfaw, 2021). The term "nosocomial" derives from the Greek words "nosos" (disease) and "komeion" (to take care of), reflecting their intrinsic connection to medical care environments (Umbreen et al., 2023). The global burden of nosocomial infections is considerable. In developed nations with robust infection control systems, approximately 5-10% of hospitalized patients still acquire an infection during their stay (Raoofti et al., 2023). This prevalence doubles or triples in resource-limited settings, where 15-20% of patients develop HAIs due to overcrowding, inadequate sterilization protocols, and shortages of basic supplies (Asfaw, 2021).

Intensive care units consistently show infection rates several times higher than general wards (Khatrawi et al., 2023), a vulnerability driven by the critical condition of patients, frequent use of invasive devices that bypass natural barriers to infection, prolonged antibiotic exposure that selects for resistant organisms, and the constant movement of healthcare workers between patients (Kollef et al., 2021; Labovská, 2021).

A diverse range of pathogens contributes to nosocomial infections. Bacterial agents such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* frequently cause surgical site and urinary tract infections (Labovská, 2021), viral pathogens including hepatitis B and C pose threats through blood-borne transmission (Kollef et al., 2021), and fungal organisms such as *Candida albicans* (Suleyman & Alangaden, 2021). These organisms spread through several routes: contact transmission, either directly from healthcare workers to patients through improper hand hygiene or indirectly via contaminated

surfaces and equipment (Salmanov et al., 2023); airborne transmission in poorly ventilated areas; and blood-borne transmission through needle-stick injuries and improper handling of sharps (Isigi et al., 2023).

Patients in intensive care units face exceptionally high risk for hospital-acquired infections because of their critical condition and the invasive nature of required treatments (Obeagu et al., 2023). The frequent use of life-support devices such as ventilators, central venous catheters, and urinary catheters creates multiple entry points for pathogens (Bagkur et al., 2024), while immunosuppression from underlying illness or treatment further reduces patients' ability to fight infection (Khullar et al., 2024). Research indicates that 20-30% of ICU patients develop healthcare-associated infections during their stay, with these infections associated with substantially higher mortality than in non-infected ICU patients (Sugawara et al., 2021).

In this high-stakes environment, ICU nurses serve as the primary safeguard against infection transmission. Their constant presence at the bedside positions them uniquely to implement and monitor infection control measures, including ventilator-associated pneumonia prevention, central line care, and contact precautions (Phillips et al., 2021). However, observational studies reveal persistent gaps between knowledge and practice: while most ICU nurses understand proper hand hygiene principles, compliance rates before patient contact often fall below 50% in busy units (Harun et al., 2023), and appropriate use of personal protective equipment varies widely, with some nurses developing habits such as reusing gloves between patients. These lapses frequently stem not from a lack of knowledge but from workload pressures and competing clinical priorities.

Nurses who attend infection-prevention workshops or in-service training consistently achieve higher knowledge and compliance than untrained peers (Fortunka et al., 2024;

Dramowski et al., 2022). Demographic and institutional factors also shape nurses' infection-control proficiency: several studies link younger age, greater clinical experience, and higher formal qualification to stronger knowledge (Khatrawi et al., 2023; Labovská, 2021), while nurses in under-resourced settings, such as many hospitals in Pakistan, face systemic barriers, including limited staffing, restricted supplies, and inconsistent access to continuing education, that can undermine even well-trained nurses' efforts (Khatun, 2024).

Nurses are the healthcare workers in most frequent and sustained contact with patients, particularly in critical care units, making their knowledge a direct determinant of patient safety. Despite this, comparatively little local evidence describes the current state of nurses' knowledge regarding nosocomial infection prevention within Pakistani pediatric intensive care settings specifically. This study therefore aimed to evaluate staff nurses' knowledge regarding nosocomial infection prevention at the intensive care units of a tertiary care hospital in Lahore, Pakistan, in order to identify existing strengths and gaps that can inform targeted continuing education efforts.

Objective

- To evaluate staff nurses' knowledge regarding nosocomial infection prevention at the intensive care units of a tertiary care hospital, Lahore, Pakistan.

Methodology

The present study employed a descriptive, cross-sectional design. The study was conducted across the intensive care units, Medical ICU 1, Medical ICU 2, Surgical ICU, Cardiac ICU, Cardiac Surgery ICU, Neonatal ICU, and Surgical Neonatal ICU, of Children's Hospital Lahore, Pakistan. The required sample size was calculated using the standard formula for estimating a population proportion, $n = Z^2P(1-P)/e^2$, with a 95% confidence level ($Z = 1.96$), an expected knowledge proportion of 70% based on prior relevant studies, and a 5% margin of error, yielding 323 participants. This was adjusted for the

finite study population of 210 eligible nurses using the finite population correction formula, $n_{(adj.)} = n / [1 + (n-1)/N]$, yielding a final required sample size of 127 nurses. Participants were recruited using a convenience sampling technique. Eligible participants were registered nurses performing duty in the specified intensive care units who were willing to participate; nurses not directly involved in patient care, such as those in purely administrative roles, were excluded.

Data were collected using a structured, adopted, self-administered questionnaire comprising two sections: demographic information and a knowledge assessment. The knowledge assessment itself covered two domains: general awareness of nosocomial infections (8 items) and knowledge of preventive measures (11 items).

Ethical approval was obtained from the Institutional Ethical Review Committee prior to data collection, and the study was conducted in accordance with the World Medical Association's Declaration of Helsinki (2008). Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without any effect on their employment, and confidentiality of participant data was maintained throughout data collection, analysis, and reporting. Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics, frequencies and percentages for categorical variables, were used to summarize demographic characteristics and responses to individual knowledge items, and to calculate the overall proportion of nurses demonstrating adequate knowledge within each of the two knowledge domains.

Results

A total of 127 nurses completed the questionnaire, a 100% response rate. All participants (100%) were female. Most nurses were aged 21–30 years (82.7%, $n = 105$), held a Bachelor's degree (63.8%, $n = 81$), had less than 3 years of working experience (60.7%, $n = 77$), and had previously attended training or a workshop on nosocomial infection prevention (64.6%, $n = 82$) (Table 1).

Table 1. *Demographic Characteristics of Participants (N = 127)*

Variable	Category	n	%
Age (years)	21-30	105	82.7
	31-40	22	17.3
Level of Education	Diploma	41	32.3
	Bachelor's Degree	81	63.8
	Master's Degree	5	3.9
Working Experience (years)	Less than 3	77	60.7
	4-6	36	28.3
	7-9	14	11.0
Prior Training/Workshop on NCI Prevention	Yes	82	64.6
	No	45	35.4

Table 2 presents nurses' knowledge of general concepts related to nosocomial infections. Knowledge was strongest for identifying alternative terminology for NCIs (87.4%), the typical timing of onset (86.6%), and awareness of NCIs generally (85.1%). Knowledge was weakest

regarding healthcare workers' immunity to infection, with only 62.4% correctly recognizing that healthcare workers are not immune.

Overall, 81.6% of nurses demonstrated adequate general knowledge of nosocomial infections, while 18.4% did not (Figure 1).

Table 2. *Nurses' General Knowledge Regarding Nosocomial Infections*

Knowledge Item	Knowledgeable n (%)	Not Knowledgeable n (%)
1. Awareness about NCIs	108 (85.1%)	19 (14.9%)
2. Alternative name for NCIs	111 (87.4%)	16 (12.6%)
3. Time of onset	110 (86.6%)	17 (13.4%)
4. Medical transmission of NCIs	105 (82.7%)	22 (17.3%)
5. Person-to-person transmission	101 (79.6%)	26 (20.4%)
6. Transmission through contact	108 (83.1%)	19 (14.9%)
7. Immunity of healthcare professionals	79 (62.4%)	48 (37.6%)
8. Knowledge of risk	107 (84.3%)	20 (15.7%)

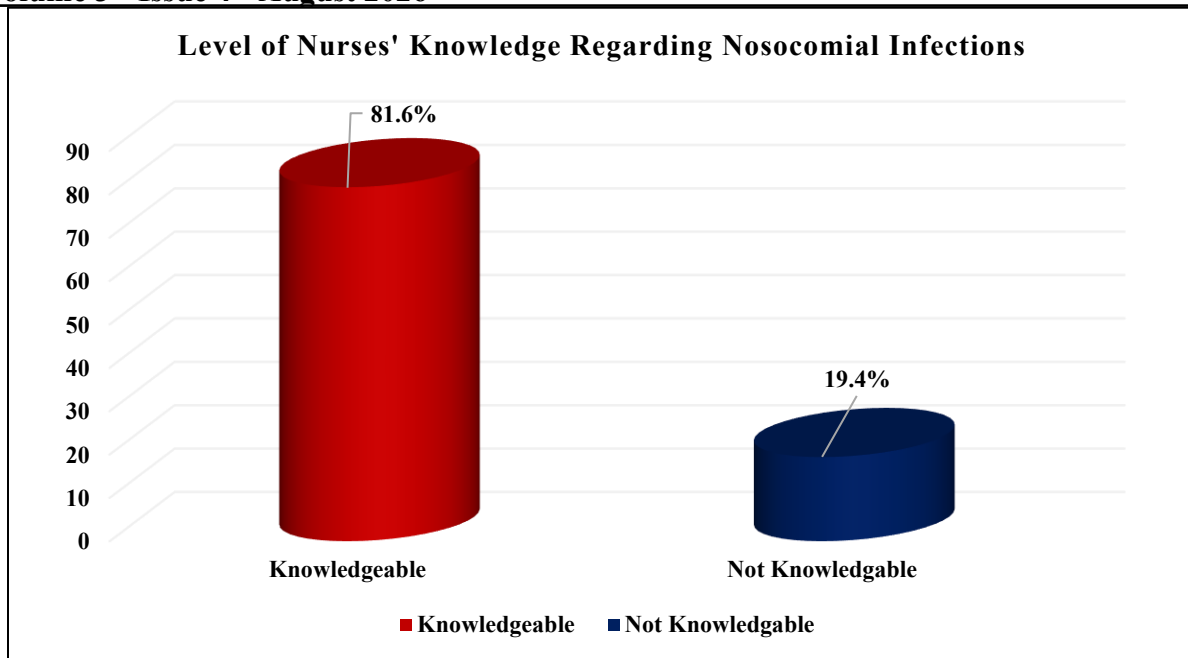
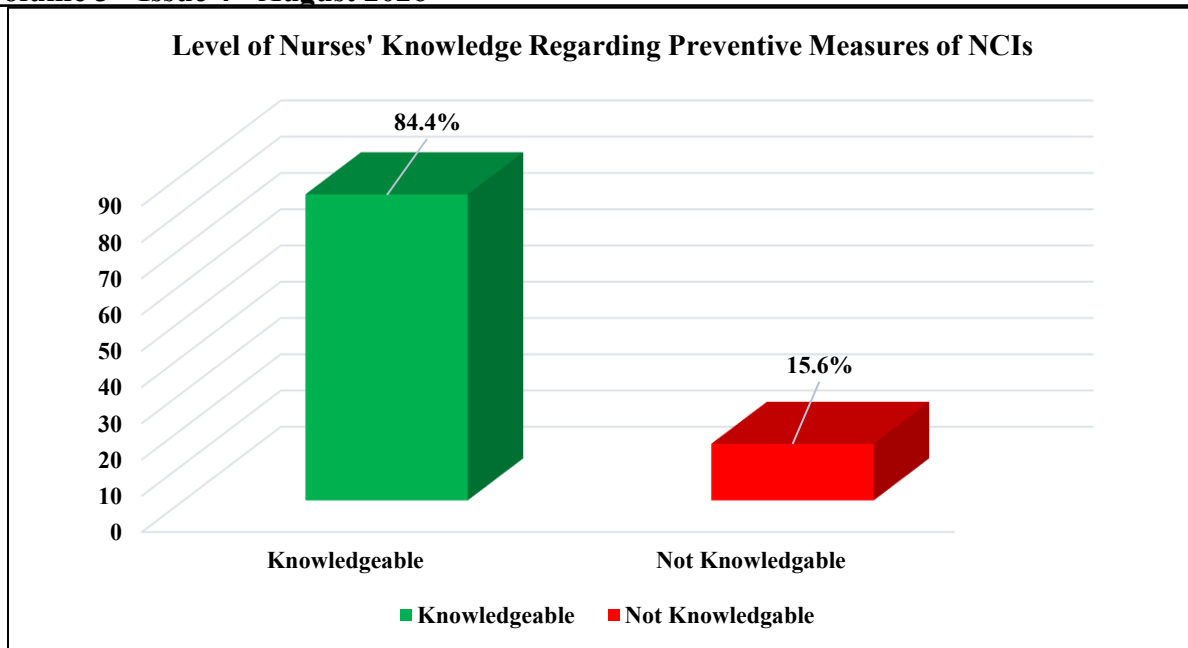


Table 3 presents nurses' knowledge of specific preventive measures. Knowledge was strongest for handwashing's role in reducing transmission (97.6%), general awareness of infection prevention (96.9%), correct waste bucket usage (96.9%), and needle-stick injury transmission risk (96.1%). Knowledge was weakest regarding the

limitations of glove use, with only 59.1% correctly recognizing that gloves alone do not provide complete protection, and regarding proper chlorine solution preparation (65.4% correct). Overall, 84.4% of nurses demonstrated adequate knowledge of preventive measures, while 15.6% did not.

Table 3. Nurses' Knowledge Regarding Preventive Measures for Nosocomial Infections

Preventive Measures Item	Yes n (%)	No n (%)
1. Heard about infection prevention	123 (96.9%)	4 (3.1%)
2. Gloves provide complete protection	75 (59.1%)	52 (40.9%)
3. Handwashing reduces NCI transmission	124 (97.6%)	3 (2.4%)
4. Hand hygiene	112 (88.2%)	15 (11.8%)
5. Correct glove usage	116 (91.3%)	10 (9.7%)
6. Hand washing before procedures	113 (89%)	14 (11%)
7. Same gloves reused for multiple patients	96 (75.6%)	31 (24.4%)
8. Correct type of waste buckets	123 (96.9%)	4 (3.1%)
9. Preparing chlorine solution correctly	83 (65.4%)	44 (34.6%)
10. Equipment/instrument disinfection duration	91 (71.7%)	36 (28.3%)
11. Disease transmission by needle-stick injury	122 (96.1%)	5 (3.9%)



Discussion

The present study revealed that most nurses (81.6%) possessed adequate general knowledge of nosocomial infections, with particularly high accuracy in identifying what NCIs are (85.1%), their alternative terminology (87.4%), and their typical timing of onset (86.6%). These findings are broadly consistent with Sula et al. (2025), who reported that 84% of nurses correctly defined NCIs, and with Asfaw (2021), who found 88% accuracy in recognizing transmission routes; together, this consistency suggests that foundational NCI education has been broadly effective in this and comparable nursing populations. In contrast, Salu et al. (2023) found that nearly 70% of ICU nurses in Ghana lacked adequate knowledge of NCI preventive measures, a considerably lower level than observed here. This disparity may reasonably reflect the present sample's high rate of prior in-service training (64.6%), since Salu et al. (2023) specifically identified training attendance as the strongest predictor of adequate knowledge, increasing the odds of being classified as knowledgeable by nearly ten-fold.

Despite this generally strong general knowledge, a specific and clinically important gap emerged: only 62.4% of nurses correctly recognized that

healthcare workers are not immune to nosocomial infections, meaning more than a third of participants may overestimate their natural protection. A similar misconception was reported by Salmanov et al. (2023), where 35% of nurses erroneously believed their natural immunity fully protected them from NCIs. This is a meaningful finding because a false sense of personal immunity could plausibly reduce a nurse's motivation to consistently follow protective protocols such as hand hygiene and personal protective equipment use, even when other knowledge domains are strong.

Regarding knowledge of preventive measures specifically, 84.4% of nurses demonstrated adequate knowledge overall, with near-universal recognition of basic prevention concepts (96.9%) and the importance of handwashing (97.6%). However, a notable contradiction emerged regarding glove use: although 91.3% of nurses correctly identified when gloves should be worn, only 59.1% understood that gloves alone do not provide complete protection against transmission, and 24.4% believed reused gloves were acceptable across multiple patients provided there was no visible contamination. This pattern, strong awareness of when to act paired with a specific misconception about the limits of that action,

suggests nurses may be over-relying on gloves as a protective barrier. This is consistent with the broader knowledge-practice gap described by Bengono (2024), who found that positive attitudes toward infection control did not reliably translate into full practical compliance, attributing this gap to time constraints and workplace culture rather than knowledge deficits alone.

A second notable gap concerned more technical preventive skills where only 65.4% of nurses correctly identified proper chlorine solution preparation, and 71.7% correctly identified appropriate equipment disinfection duration, compared to near-perfect awareness (96.1%) of needle-stick injury transmission risk. This pattern may indicate that current training places greater emphasis on acute-risk scenarios than on routine environmental disinfection practices. Khatrawi et al. (2023) similarly noted that while ICU nurses worldwide generally demonstrate good infection-prevention knowledge, specific gaps in technical and procedural areas remain common even where overall scores are high. This contrasts with the considerably lower overall knowledge reported by Khatun (2024), where less than half demonstrated adequate HAI-prevention knowledge.

Conclusion

This study found that staff nurses in the intensive care units of this tertiary care hospital generally possessed good foundational knowledge of nosocomial infection prevention, however, specific and clinically relevant gaps persisted, notably a widespread misconception regarding healthcare workers' immunity to infection, an over-reliance on gloves as a complete protective barrier, and incomplete knowledge of chlorine solution preparation and equipment disinfection procedures, areas where a knowledge gap could plausibly translate into a real lapse in infection control practice.

These findings should be interpreted in light of certain limitations. The descriptive, cross-sectional design does not allow for examination of cause-and-effect relationships between nurses' characteristics and their knowledge, and the quantitative approach did not capture detailed

contextual information about the specific barriers nurses face in applying this knowledge in practice. Additionally, the study was conducted among nurses at a single tertiary care hospital, which may limit the generalizability of findings to other healthcare settings, and it focused exclusively on nursing staff rather than the broader multidisciplinary healthcare team involved in infection prevention.

Based on these findings, hospital administration should organize regular, structured in-service training sessions specifically targeting the identified gap areas, healthcare worker immunity misconceptions, the practical limitations of personal protective equipment, and proper disinfection procedures, rather than relying solely on general infection-control refreshers. Nurses should be encouraged to actively engage in ongoing professional development, including workshops and conferences, to remain current with evolving infection-prevention guidelines. Future research should extend to multiple hospitals and incorporate qualitative or observational methods to clarify how identified knowledge gaps translate into actual bedside practice.

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