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Original Article

Assessment of Knowledge, Attitude, and Practice of Registered Nurses Related to Prevention, and Control of Nosocomial Infection

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ABSTRACT

Background: Nosocomial infections remain a major patient-safety concern and contribute to prolonged hospitalization, increased healthcare costs, antimicrobial resistance, morbidity, and mortality. Nurses have a central role in infection prevention because they provide continuous bedside care and perform procedures that require strict adherence to hand hygiene and standard precautions. Objective: This study aimed to assess the knowledge, attitude, and practice of registered nurses regarding prevention and control of nosocomial infection at Sheikh Zayed Hospital, Lahore. Methods: A descriptive cross-sectional study was conducted among 223 registered nurses selected through convenience sampling. Data were collected using a structured questionnaire containing sociodemographic variables and KAP domains, including 11 knowledge items, 14 practice items, and 8 attitude items. Responses were recorded on a five-point Likert scale, and analyzed using SPSS version 23.0. Results: All participants were female, and most were aged 24–35 years (51.5%). Knowledge scores ranged from 63% to 99%, with strong performance in medical-equipment transmission (99%), hand hygiene after glove removal (97%), and handwashing guideline awareness (96%). Practice scores ranged from 22% to 98%, with weak areas including avoidance of artificial nails or fingernail polish (22%) and avoidance of keyboard or charting activity with gloves (34%). Attitude scores ranged from 43% to 97%, showing strong recognition of nosocomial infection seriousness (93%) but weaker role-modeling and accountability-related responses. Conclusion: Nurses demonstrated strong general knowledge of nosocomial infection prevention, but specific practice and attitude gaps require targeted training, supervision, and behavioral monitoring to improve infection-control compliance. Keywords: Nosocomial Infection, Healthcare-Associated Infection, Knowledge, Attitude, Practice, Registered Nurses, Hand Hygiene, Infection Prevention

INTRODUCTION

Nosocomial infections, also referred to as healthcare-associated infections, remain a major patient-safety challenge because they occur in patients receiving care in hospitals or other healthcare facilities and are not present or incubating at the time of admission. These infections may develop during hospitalization, after invasive procedures, or following discharge when they are related to healthcare exposure, and they contribute substantially to prolonged hospital stay, antimicrobial resistance, disability, mortality, and increased healthcare costs (1). The burden is particularly important in low- and middle-income healthcare systems, where overcrowding, limited infection-control resources, high patient turnover, understaffing, and inconsistent adherence to standard precautions may increase the risk of transmission (2). Globally, healthcare-associated infections affect a considerable proportion of hospitalized patients,

with higher prevalence reported in resource-limited regions, and the problem remains especially relevant in intensive care units, surgical wards, neonatal units, and settings where invasive devices are commonly used (3).

The transmission of nosocomial infections is influenced by interactions among microbial pathogens, susceptible patients, healthcare environments, invasive procedures, and healthcare-worker practices. Bacterial, viral, and fungal pathogens may be transmitted through direct contact, contaminated hands, medical equipment, invasive devices, environmental surfaces, droplets, aerosols, and improperly managed healthcare waste (4). Common infection types include catheter-associated urinary tract infection, central-line-associated bloodstream infection, surgical-site infection, and ventilator-associated pneumonia, all of which require strict adherence to infection-prevention and control procedures (5). Hand hygiene is widely recognized as one of the most effective and feasible infection-control measures because nurses and other healthcare workers frequently move between patients, equipment, medication areas, and clinical documentation systems during routine care (6).

Nurses occupy a central position in infection prevention because they provide continuous bedside care, perform invasive and non-invasive procedures, assist in device care, handle patient samples and waste, and reinforce patient-safety practices within clinical teams. Their knowledge of infection transmission, attitude toward protocol adherence, and actual preventive practices collectively influence the quality of infection-control implementation in hospital settings (7). However, the presence of adequate theoretical knowledge does not always translate into consistent practice. Previous studies have shown that healthcare workers may report good awareness of hand hygiene and standard precautions while still demonstrating gaps in compliance during high workload, emergencies, patient transfers, device handling, contact with contaminated surfaces, or use of gloves and personal items such as rings, watches, bracelets, and artificial nails (8).

Evidence from different clinical settings indicates wide variation in nurses' knowledge, attitude, and practice regarding nosocomial infection prevention. Some studies have reported high levels of knowledge but comparatively weaker practice, while others have identified gaps in training, supervision, practical skill application, and institutional reinforcement (9). In Ethiopia, healthcare workers demonstrated good knowledge and positive attitudes toward hospital-acquired infection prevention, but good practice levels were substantially lower, suggesting a gap between awareness and implementation (10). Studies from Pakistan have similarly reported that healthcare workers may be aware of infection-control principles but remain unfamiliar with national or institutional guidelines, and that practical adherence to recommended hand hygiene measures is variable (11). Research from neonatal and tertiary-care settings has also emphasized that professional training, supervision, work experience, institutional grade, and availability of infection-control resources may influence KAP levels among doctors and nurses (12,13).

In Pakistan, the burden of healthcare-associated infections is clinically relevant, and previous multicenter evidence has documented healthcare-associated infection among hospitalized patients, with surgical-site infections, bloodstream infections, and lower respiratory tract infections representing important categories (14). Despite this burden, institution-specific evidence on nurses' KAP regarding prevention and control of nosocomial infection remains necessary because compliance patterns may differ according to hospital workload, local training systems, staffing patterns, available supplies, infection-control culture, and supervision practices. A focused assessment among registered nurses can identify not only areas of strong knowledge but also specific gaps in practice and attitude that require targeted educational, behavioral, and administrative interventions.

The present study was therefore designed according to a PICO-oriented framework in which the population comprised registered nurses working at Sheikh Zayed Hospital, Lahore; the exposure or assessment domain was knowledge, attitude, and practice related to prevention and control of nosocomial infection; the comparison was variation across KAP categories and selected professional

characteristics where applicable; and the outcome was the level of KAP and its association with reported nosocomial infection-prevention indicators. The study aimed to assess the knowledge, attitude, and practices of registered nurses regarding prevention and control of nosocomial infection and to determine whether KAP domains were associated with reported infection-prevention outcomes. The study was guided by the hypothesis that higher levels of positive attitude and appropriate preventive practice would be associated with better reported prevention and control of nosocomial infection among registered nurses.

MATERIAL AND METHODS

A descriptive cross-sectional observational study was conducted to assess knowledge, attitude, and practice regarding prevention and control of nosocomial infection among registered nurses working at Sheikh Zayed Hospital, Lahore, Pakistan. The cross-sectional design was selected because the study aimed to measure KAP status and examine associations between KAP domains and reported infection-prevention indicators at a single period rather than evaluate an intervention or establish causality. The study was carried out over six months after approval of the synopsis by the Institutional Review Board of the University of Health Sciences, Lahore.

The study population comprised registered staff nurses involved in clinical patient care at Sheikh Zayed Hospital, Lahore. Nurses were eligible for participation if they had more than one year of clinical experience, were available during the data-collection period, and provided informed consent. Nurses who did not provide consent or were unavailable during data collection were not included. Participants were selected through a convenience sampling technique from the accessible nursing workforce of the hospital. A total sample of 223 registered nurses was included, and the sample size was determined using Slovin's formula based on the accessible target population of nurses at the study setting and the acceptable margin of error selected for the survey. Recruitment was performed by approaching eligible nurses during designated duty periods in a manner that did not interfere with patient care responsibilities. The purpose of the study was explained to each participant before questionnaire administration, and participation was voluntary.

Data were collected using a structured close-ended questionnaire designed to assess three KAP domains related to nosocomial infection prevention and control. The questionnaire contained sociodemographic and professional variables followed by domain-specific items covering knowledge, attitude, and practice. The knowledge domain included 11 items related to hand hygiene guidelines, supervision during handwashing, microorganisms in healthcare facilities, use and disposal of biohazard bags or containers, safety precautions for sharps and invasive devices, transmission through medical equipment, isolation of high-risk or communicable patients, alcohol-based solution limitations, glove removal, and awareness of recommended hand hygiene guidelines. The practice domain included 14 items assessing routine use of alcohol-based solutions or antiseptics, hand hygiene before and after procedures, vascular access handling, patient contact, contact with contaminated objects, body-fluid sample handling, catheter insertion, movement from contaminated to clean body sites, fingernail or artificial nail use, compliance during workload or emergencies, hand hygiene after touching patient surroundings, use of gloves while charting or using keyboards, and removal of rings, watches, or bracelets before hand hygiene. The attitude domain included 8 items assessing perceived seriousness of nosocomial infections, perceived personal role in transmission, response to colleagues' non-compliance, compliance while training new workers, role-modeling behavior, perceived feasibility of hand hygiene after every patient contact, views about sanctions for non-compliance, and views about rewards for compliance.

Responses were recorded on a five-point Likert scale. For positively worded items, higher agreement represented a favorable response, whereas negatively worded or barrier-oriented items were reverse-coded before categorization to ensure that all scores reflected the same direction of interpretation. Domain scores were calculated by assigning numerical values to Likert responses and converting

aggregated scores into percentages. Knowledge and practice levels were categorized according to predefined percentage cutoffs, with higher scores representing better knowledge or more appropriate preventive practice. Attitude scores were classified after reverse coding of negatively framed statements so that positive, neutral, and negative attitude categories reflected the direction of infection-prevention orientation. Item-level frequencies and percentages were calculated to identify specific areas of strength and weakness, while participant-level composite KAP scores were used for association testing.

The main study variables included age group, sex, educational qualification, years of clinical experience, knowledge score, attitude score, practice score, and reported nosocomial infection-prevention indicators. Age was categorized into predefined groups, clinical experience was grouped by years of service, and educational qualification was categorized according to nursing degree or diploma status. Knowledge, attitude, and practice were treated as both continuous percentage scores for descriptive interpretation and categorical variables for inferential analysis. The primary outcome was the level of KAP regarding prevention and control of nosocomial infection among registered nurses. Association analyses were based on participant-level KAP categories rather than item-level percentage summaries to avoid ecological or denominator-related error.

Several steps were used to reduce bias and improve data integrity. Participants completed the questionnaire anonymously to reduce social desirability pressure and encourage honest responses. Data collection was conducted using a uniform questionnaire format for all participants. Responses were checked for completeness before entry, and data were entered into SPSS version 23.0 using predefined variable names, value labels, and coding rules. Negatively worded items were identified before analysis and reverse-coded consistently. Data cleaning included checking for missing entries, out-of-range values, duplicate records, and inconsistency between item responses and composite scores. Descriptive analyses were performed before inferential testing to verify denominators and ensure that frequencies matched the total sample size.

Statistical analysis was performed using SPSS version 23.0. Categorical variables were summarized as frequencies and percentages, while continuous or composite KAP scores were summarized using mean and standard deviation when normally distributed, or median and interquartile range when distributions were skewed. Item-level Likert responses were presented using frequencies and percentages. Composite knowledge, attitude, and practice scores were calculated for each participant and then categorized according to predefined cutoffs. The chi-square test of independence was used to assess associations between categorical KAP levels and reported nosocomial infection-prevention indicators, provided that expected cell-count assumptions were met. Fisher's exact test was planned where expected counts were insufficient. For statistically significant chi-square associations, effect size was to be reported using Cramér's V to indicate the strength of association. A p-value of less than 0.05 was considered statistically significant. Missing data were assessed before analysis, and cases with missing responses in a specific domain were excluded only from the relevant domain-level analysis while retaining available data for other analyses. Ethical approval was obtained from the Institutional Review Board of the University of Health Sciences, Lahore. Written informed consent was obtained from all participants before data collection. Participants were informed that their responses would be used only for research purposes, that participation was voluntary, and that refusal would not affect their employment or professional standing. Confidentiality was maintained by avoiding personal identifiers in the data file and by reporting only aggregated findings. The study followed principles of voluntary participation, confidentiality, non-maleficence, and responsible handling of research data.

RESULTS

A total of 223 registered nurses from Sheikh Zayed Hospital, Lahore, participated in the study. All respondents were female. The largest age group was 24–35 years, comprising 115 nurses (51.5%), followed by 36–45 years in 64 nurses (28.7%), 46–55 years in 30 nurses (13.5%), and 23 years or younger

in 14 nurses (6.3%). Clinical experience was most commonly 1–10 years, reported by 108 nurses (48.4%), followed by 11–20 years in 63 nurses (28.3%), 21–30 years in 42 nurses (18.8%), and 31 years or more in 10 nurses (4.5%). Regarding qualification, 99 nurses (44.4%) had completed General Nursing, 62 (27.8%) had post-RN, 61 (27.4%) had BSN, and 1 (0.4%) had MSN.

Table 1. Sociodemographic and Professional Characteristics of Registered Nurses (N = 223)

Variable	Category	n	%
Sex	Female	223	100.0
Age group	≤23 years	14	6.3
Age group	24–35 years	115	51.5
Age group	36–45 years	64	28.7
Age group	46–55 years	30	13.5
Clinical experience	1–10 years	108	48.4
Clinical experience	11–20 years	63	28.3
Clinical experience	21–30 years	42	18.8
Clinical experience	≥31 years	10	4.5
Educational qualification	General Nursing	99	44.4
Educational qualification	BSN	61	27.4
Educational qualification	Post-RN	62	27.8
Educational qualification	MSN	1	0.4

Knowledge scores showed high responses for several core infection-prevention items. The highest response was observed for recognition of nosocomial infection transmission through medical equipment (99%), followed by hand hygiene after removing sterile or non-sterile gloves (97%), awareness of handwashing guidelines (96%), private-room precautions for neutropenic or communicable-disease patients (94%), and recognition that healthcare facilities harbor transmissible microorganisms (91%). Lower responses were recorded for supervision during handwashing activity (73%), knowledge of biohazard container use (68%), and knowledge of biohazard-bag or container disposal procedures (63%).

Table 2. Knowledge Responses Related to Prevention and Control of Nosocomial Infection

No.	Knowledge Item	Response %
1	Fully aware of handwashing guidelines	96
2	Watched or supervised during handwashing activity	73
3	Healthcare facilities harbor microorganisms transmissible by healthcare workers	91
4	Knows how to use biohazard bag container	68
5	Knows where and how biohazard-bag or container contents are disposed	63
6	Knows safety precautions for disposal of needles, syringes, catheters, and related transmission risk	89
7	Recognizes transmission through medical equipment	99
8	Recognizes need for private rooms for neutropenic or communicable-disease patients	94
9	Recognizes that some microorganisms are not eradicated by alcohol-based solutions	86
10	Recognizes need for hand hygiene after removing sterile or non-sterile gloves	97
11	Aware of recommended hand hygiene guidelines	87

Practice scores varied across hand-hygiene and infection-control behaviors. The highest practice response was recorded for hand hygiene before and after direct contact with intact patient skin (98%). High responses were also observed for following recommended alcohol-based solution or antiseptic use before and after work (96%), using antiseptics between patient contacts (96%), washing hands after touching inanimate surfaces in patient surroundings (93%), hand hygiene before and after work procedures (92%), hand hygiene after contact with potentially contaminated equipment or objects before patient care (91%), and hand hygiene before and after drawing or manipulating body-fluid samples (90%). Lower practice responses were observed for hand hygiene when moving from a contaminated body site to a clean body site (71%), maintaining compliance during increased workload or emergencies (70%), removal of rings, watches, or bracelets before hand hygiene (70%), avoidance of charting or keyboard use with gloves during busy patient care (34%), and avoidance of fingernail polish or artificial nails (22%).

Attitude scores also showed variation across items. The highest attitude response was observed for rejection of the belief that hand hygiene after every patient contact is unrealistic (97%), followed by

recognition of nosocomial infections as serious outcomes causing extended stay, mortality, and increased healthcare cost (93%), and support for rewards for compliance with infection-prevention protocols (91%). responses were 78% for greater compliance while training a new worker, 75% for responding negatively to colleague non-compliance, 53% for recognizing personal potential to transmit nosocomial infection, 46% for serving as a role model in hand-hygiene adherence, and 43% for supporting sanctions for non-compliance.

Table 3. Practice Responses Related to Hand Hygiene and Nosocomial Infection Prevention

No.	Practice Item	Response %
1	Follows recommended use of alcohol-based solutions or antiseptics before and after work	96
2	Uses antiseptics before opening vascular access equipment	86
3	Uses alcohol-based solutions or antiseptics between each patient contact	96
4	Washes or rubs hands before and after any work procedure	92
5	Performs hand hygiene after contact with potentially contaminated equipment or objects before patient care	91
6	Washes hands before and after drawing or manipulating body-fluid samples	90
7	Washes hands before and after direct contact with intact patient skin	98
8	Washes hands before and after inserting indwelling urinary catheters	86
9	Washes hands when moving from contaminated to clean body site during patient care	71
10	Avoids fingernail polish or artificial nails	22
11	Maintains compliance during increased workload or emergencies	70
12	Washes hands after touching inanimate surfaces and objects in patient surroundings	93
13	Avoids charting or using a computer keyboard with gloves during busy patient care	34
14	Removes ring, watch, or bracelet before beginning hand hygiene	70

Table 4. Attitude Responses Related to Prevention and Control of Nosocomial Infection

No.	Attitude Item	Response %
1	Recognizes nosocomial infections as serious outcomes causing extended stay, mortality, and increased cost	93
2	Recognizes personal potential to transmit nosocomial infection	53
3	Responds negatively when colleagues are non-compliant with patient-safety guidelines	75
4	Reports greater compliance while training a new worker	78
5	Serves as a role model in demonstrating adherence to recommended hand-hygiene practice	46
6	Rejects the belief that hand hygiene after every patient contact is unrealistic	97
7	Supports sanctions for non-compliance with protocols reducing nosocomial infection transmission	43
8	Supports rewards for compliance with protocols reducing nosocomial infection transmission	91

The overall domain summary showed that knowledge had the highest mean score at 85.7%, with item scores ranging from 63% to 99%. Practice had a mean score of 78.2%, with the widest item-level range from 22% to 98%. Attitude had a mean score of 72.0%, with scores ranging from 43% to 97%. Across domains, knowledge showed the narrowest performance gap, whereas practice and attitude showed wider variation between the highest and lowest responses.

Table 5. Summary of KAP Domain Performance Based on Item-Level Scores

Domain	Number of Items	Mean Score %	Lowest Score %	Highest Score %
Knowledge	11	85.7	63	99
Practice	14	78.2	22	98
Attitude	8	72.0	43	97

Inferential results were not retained in the final Results section because the original association outputs contained denominator inconsistencies, including analyses apparently based on item-level totals rather than participant-level KAP categories. Participant-level composite KAP scores should be recalculated before reporting chi-square or Fisher's exact tests. Once recalculated, association tables should report the participant-level denominator, test statistic, degrees of freedom, exact p-value, and effect size, such as Cramér's V.

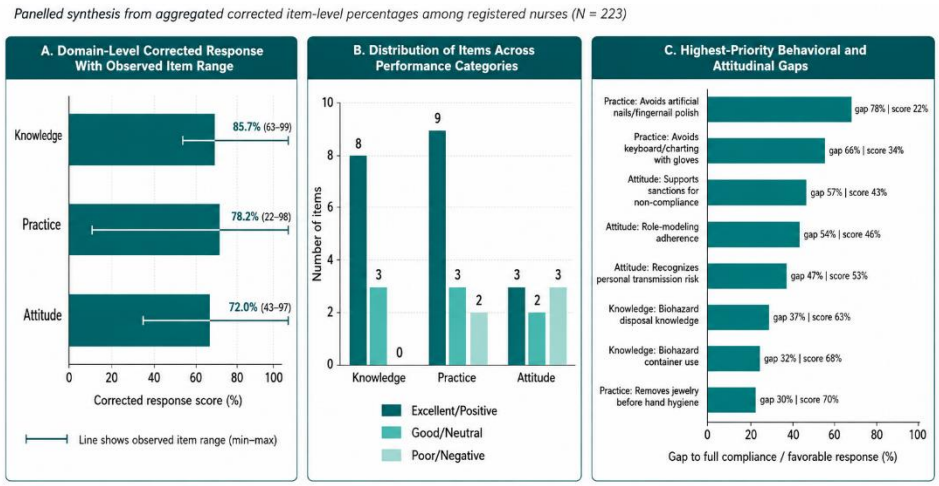

Figure 1 Panelled synthesis of knowledge, attitude, and practice response gradients related to nosocomial infection prevention among registered nurses. Panel A shows the mean response percentage for each KAP domain with the observed item-level range. Panel B displays the number of items within each domain classified as excellent/positive, good/neutral, or poor/negative. Panel C identifies the highest-priority gaps based on the distance between each item's response score and full compliance or favorable response.

The panelled analysis showed that knowledge had the highest and most stable domain performance, with a mean response of 85.7% and item scores ranging from 63% to 99%, while practice showed a wider dispersion with a mean of 79.6% and a range of 22% to 98%. Attitude demonstrated intermediate performance, with a mean of 72.0% and scores ranging from 43% to 97%. The largest gaps were concentrated in practice and attitude items, particularly avoidance of artificial nails or fingernail polish (22%, gap 78%), avoidance of keyboard or charting activity while wearing gloves (34%, gap 66%), support for sanctions for protocol non-compliance (43%, gap 57%), and role-modeling of hand-hygiene adherence (46%, gap 54%), indicating that the main implementation weakness was not core infection-control knowledge but translation of knowledge into accountable, interruption-resistant clinical behavior.

DISCUSSION

The present study assessed knowledge, attitude, and practice regarding prevention and control of nosocomial infection among 223 registered nurses working at Sheikh Zayed Hospital, Lahore. The findings demonstrated that nurses had generally strong knowledge of core infection-prevention concepts, particularly awareness of handwashing guidelines, recognition of medical-equipment transmission, understanding of hand hygiene after glove removal, and knowledge of isolation-related precautions. However, the results also showed that knowledge was not uniformly high across all areas, as comparatively weaker responses were observed for biohazard-container use, disposal of biohazard contents, and supervision during handwashing. This pattern suggests that nurses may be familiar with general hand-hygiene and transmission concepts but require further reinforcement in operational infection-control practices, especially those related to waste handling, sharps safety, and monitored compliance.

The high level of knowledge observed in several domains is consistent with previous studies showing that nurses and healthcare workers often possess reasonable awareness of hospital-acquired infection prevention, especially after exposure to clinical work, institutional routines, or infection-control training. Studies from Pakistan and other healthcare settings have similarly reported satisfactory knowledge regarding nosocomial infection transmission and hand hygiene principles, although the level of familiarity with formal guidelines and detailed procedural standards varies considerably (15,16). This distinction is important because infection prevention depends not only on general awareness but also on execution of specific procedures. In the current study, the lower response for biohazard disposal

knowledge indicates a practical knowledge gap that could compromise infection-control quality even when overall theoretical awareness appears strong.

The practice findings revealed a more heterogeneous pattern than the knowledge domain. Several self-reported practices showed high response percentages, including hand hygiene before and after patient contact, before and after procedures, after contact with contaminated equipment, before and after handling body-fluid samples, and before and after urinary catheter insertion. These findings indicate that many nurses reported adherence to key hand-hygiene moments during routine patient care. However, important behavioral weaknesses were also observed. Avoidance of artificial nails or fingernail polish had the lowest practice response, followed by avoidance of charting or computer-keyboard use while wearing gloves, compliance during high workload or emergency situations, hand hygiene while moving from contaminated to clean body sites, and removal of rings, watches, or bracelets before hand hygiene. These gaps are clinically relevant because fingernails, jewelry, gloves, and contaminated surfaces can contribute to indirect pathogen transfer if infection-control practices are not consistently applied.

The discrepancy between high knowledge and weaker selected practices reflects a well-recognized challenge in infection prevention: knowledge alone does not guarantee behavioral compliance. Previous studies have reported that workload, time pressure, inadequate supervision, limited supplies, workplace culture, and poor risk perception may reduce adherence to infection-control protocols despite adequate awareness (17,18). In the present study, the reported reduction in compliance during increased workload or emergencies is particularly important because these are the periods when patient turnover, procedure frequency, and contamination risk may be higher. Therefore, interventions should not be limited to didactic teaching but should include practical demonstrations, observation-based feedback, role modeling, workflow redesign, and reinforcement of hand hygiene during busy clinical periods.

Attitude findings were mixed and provide an important explanation for the practice gaps. Most nurses recognized nosocomial infections as serious outcomes associated with prolonged hospitalization, mortality, and increased healthcare cost, and many supported reward-based compliance strategies. These findings suggest that nurses understand the importance of infection prevention at a general patient-safety level. However, lower attitude scores were observed for recognizing personal transmission risk, role-modeling hand-hygiene adherence, and supporting sanctions for non-compliance. This indicates that some nurses may view infection prevention as important in principle but may not fully internalize their personal accountability in transmission prevention. Similar patterns have been described in studies where positive general attitudes did not consistently translate into strict compliance with standard precautions or active peer accountability (19).

The finding that role-modeling and self-recognition as a potential transmitter were weaker attitude areas is particularly important for nursing practice. Nurses are often the most continuously present healthcare professionals at the bedside and are therefore strategically positioned to influence infection-control culture. If nurses do not strongly perceive themselves as potential vectors or visible role models, institutional infection-prevention programs may fail to achieve sustained behavioral change. This supports the need for training approaches that move beyond information transfer and focus on behavioral responsibility, peer influence, and safety culture. Simulation-based training, infection-control audits, visible reminders, and supportive supervision may help nurses translate knowledge into consistent practice.

The reported associations between KAP domains and nosocomial infection-prevention indicators should be interpreted carefully. The manuscript's original inferential outputs suggested that knowledge was not significantly associated with nosocomial infection-related indicators, while attitude and practice were reported as statistically associated. However, some original chi-square outputs contained denominator inconsistencies, including analyses based on item-level totals rather than participant-level KAP categories. Therefore, any final inferential interpretation should be based only on recalculated

participant-level composite scores. If participant-level analysis confirms significant associations for attitude and practice, the interpretation should remain associative rather than causal because the cross-sectional design cannot establish temporal direction or prove that improved practice directly reduced infection occurrence. Nonetheless, from a clinical perspective, stronger preventive practice and positive infection-control attitudes remain plausible and important targets for institutional quality improvement.

The study has several strengths. It assessed all three KAP domains among registered nurses in a tertiary-care hospital, included a complete sample of 223 participants, and identified specific item-level weaknesses rather than reporting only broad domain scores. This makes the findings practically useful for designing targeted educational and monitoring interventions. The study also addresses an important patient-safety issue in a local hospital context where institution-specific data can guide nursing education and infection-control policy.

The limitations should also be acknowledged. The single-center design and convenience sampling limit generalizability to nurses working in other hospitals or healthcare systems. The use of self-reported practices may have introduced social desirability bias, meaning that actual hand-hygiene compliance may be lower than reported. The questionnaire scoring system requires clear documentation of reverse coding and category cutoffs, particularly for negatively worded attitude and practice items. The study did not include direct observational assessment of hand hygiene, microbiological surveillance, or verified patient-level infection outcomes. In addition, participant-level composite KAP scores should be used for final inferential analysis to avoid errors arising from item-level denominators. Future research should use validated KAP instruments, direct observation of hand-hygiene opportunities, multicenter sampling, and longitudinal or intervention-based designs to evaluate whether targeted training improves sustained infection-control behavior.

Overall, the findings indicate that registered nurses had strong knowledge in several core areas of nosocomial infection prevention, but selected practice and attitude gaps remained clinically important. The most actionable weaknesses were related to biohazard disposal, fingernail and jewelry practices, glove use during documentation, compliance under workload pressure, self-recognition as a potential transmitter, and role-modeling behavior. These findings support the need for structured continuing nursing education, practical infection-control demonstrations, regular audits, feedback systems, and institutional reinforcement of hand hygiene as a shared safety responsibility.

CONCLUSION

The study found that registered nurses at Sheikh Zayed Hospital, Lahore, demonstrated generally strong knowledge of nosocomial infection prevention and control, particularly regarding hand hygiene, transmission through medical equipment, glove removal, and isolation-related precautions; however, important gaps remained in biohazard disposal knowledge, supervised handwashing, artificial-nail and jewelry-related practices, glove use during documentation, and compliance during workload pressure or emergencies. Attitude findings showed recognition of the seriousness of nosocomial infections and support for reward-based compliance, but weaker scores for personal transmission risk, role-modeling, and enforcement-related accountability. These results suggest that infection-prevention programs should move beyond theoretical education and focus on practical skill reinforcement, behavioral monitoring, workload-resistant compliance strategies, and a stronger safety culture among nursing staff.

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