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Knowledge and Practices Regarding Infection Control Among Nurses in Hospitals Multan, Pakistan

Muhammad Idrees[1*], Sumaira Riaz[1], Kiran Ejaz[2], Iram Naaz[1], Sana Bhutta[3], Hassan Muavia[4] and Muhammad Saghir[5]

[1]School of Nursing, Multan University of Science and Technology, Multan, Pakistan
[2]Alkhidmat Charity Australia Hospital, Multan, Pakistan
[3]Department of Nursing, Buch International Hospital, Multan, Pakistan
[4]College of Nursing, Mukhtar A Sheikh Memorial Welfare Hospital, Multan, Pakistan
[5]Vida Healthcare, North Yorkshire, United Kingdom

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***Corresponding Author:**
Muhammad Idrees
School of Nursing, Multan University of Science and Technology, Multan, Pakistan
idreesnaeem92@gmail.com

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ABSTRACT

Nurses are at the frontline of patient care and play a pivotal role in preventing healthcare-associated infections (HAIs), yet institution-level data on their knowledge and practice of infection prevention and control (IPC) remain limited in Pakistan. **Objective:** To assess the knowledge and practice of nurses regarding HAI control measures at a tertiary care hospital in Multan, Pakistan. **Methods:** A descriptive cross-sectional study was conducted among 50 nurses (BSN, diploma, and post-RN) working at Medicare Hospital, Multan, selected through non-probability consecutive sampling; the minimum sample size was calculated using the Raosoft sample size calculator at a 95% confidence level with a 9% margin of error. Data were collected using an adapted, self-administered questionnaire (Cronbach's α = 0.79 for knowledge items and 0.83 for practice items) covering sociodemographic characteristics, IPC knowledge (9 items) and IPC practice (16 items), and were analyzed descriptively using SPSS version 26. **Results:** Overall, 98% of nurses demonstrated good knowledge, and 98% demonstrated good practice regarding IPC. Item-level analysis, however, revealed specific gaps: only 58% and 56% of nurses correctly reported using chemical and physical sterilization techniques, respectively; 50% believed gloves could replace hand hygiene; only 30% washed hands without soap when soap was unavailable; and only 60% avoided recapping needles before disposal. **Conclusions:** Although most nurses demonstrated satisfactory overall knowledge and practice of IPC, specific and clinically important gaps persist in sterilization technique, hand hygiene, and sharps safety. Continuous in-service training, adequate provision of protective and hand hygiene supplies, and structured supervision are recommended to translate knowledge into consistent, safe bedside practice.

INTRODUCTION

Infection prevention and control (IPC) is one of the key principles of quality and safe healthcare provision, and poor IPC practice remains a significant contributor to the global burden of healthcare-associated infections (HAI) and to infections of healthcare workers themselves [1]. The infection occurs when a pathogenic microorganism (a virus, a bacterium, a fungus or a parasite) enters a host and causes a change in the normal physiological functions of the host by direct contact with an infected person, through contaminated food and water or through contaminated surfaces and clinical equipment [2]. Nurses have the longest and most direct contact with hospitalized patients of all health workers, and are also at high risk of contracting infection; they can carry the risk of cross-transmission between patients if basic IPC procedures are not consistently implemented [3]. The coordinated use of several key practices is essential for effective IPC, such as hand hygiene, safe use and selection of personal protective

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equipment (PPE), safe handling and disposal of sharps, surface decontamination, sterilization of re-usable equipment and safe management of healthcare waste [4]. Insufficient implementation of any of these elements (e.g., handwashing stations not functioning, handwashing stations without PPE, poor waste segregation, not following aseptic technique) makes patients and staff more vulnerable to infection [5]. The burden of HAIs is consistently higher in LMICs: it is estimated that at any one time, 5–10% of hospitalized patients in developed countries develop a HAI, whereas the risk of developing a HAI is reported as being two to twenty times higher in developing countries, which is reflected in the latest global and regional surveillance data [6, 7]. Surveys in health care settings in Pakistan are not consistent and national, and institutional IPC guidelines are not always followed by nurses or health care workers [4, 5]. Standard precautions are recommended as an initial level of precautions to be taken for all patients regardless of their diagnosis or condition and are crucial in the prevention of the spread of blood-borne and other pathogens in health care settings. Standard precautions consist of general hand hygiene, proper use of PPE (gloves, gown, mask, and eye protection), and safe handling and disposal of sharps [8]. While IPC training programs and clinical guidelines are freely available, recent research has shown that a high level of IPC knowledge does not guarantee good practice at the point of care, such as in intensive care and general wards [9-10]. Lack of training, workload, PPE, hand hygiene materials, institutional monitoring and supervision are reported as bottlenecks and challenges for compliance. The available evidence on the knowledge and practice of IPC in Pakistan, however, is from large multi-centre or provincial level surveys and there is little evidence at the local level that could help identify priorities for local training and supervision, particularly in secondary cities such as Multan. In addition, positive summary-level scores can mask clinically significant gaps on individual items, including those that address how to use a hand sanitizer if soap is not available, how to safely dispose of sharps, and sterilization processes. The present study aims (1) to evaluate the knowledge of nurses about HAI control measures at Medicare Hospital, Multan; (2) to evaluate the practice of nurses regarding HAI control measures; and (3) to identify specific gaps in IPC that could be targeted for in-service training and improvement of institutional policy.

METHODS

This descriptive cross-sectional study was conducted at Medicare Hospital, Multan, Pakistan from October 2025 to March 2026. The target population comprised all registered nurses (BSN, diploma, and post-RN) actively employed at Medicare Hospital, Multan, Pakistan during the study period. The accessible population included all eligible nurses present during the data collection period. The target sample size was calculated using the Raosoft sample size calculator, incorporating the finite population correction (Cochran, 1977) for the estimated eligible nursing population of 85 at Medicare Hospital. Given the small finite population, strict feasibility constraints (shift coverage and clinical workloads), and the study's primary descriptive objective to identify critical item-level practice gaps rather than estimate precise aggregate population prevalence, a pragmatic 9% margin of error was selected at a 95% confidence level with a conservative response distribution of 50% (p=0.5). This yielded a minimum required sample of 50 participants. While conventional population prevalence surveys typically use a 5% margin of error (which would require ~74 participants from this population), that target was logistically unattainable within the study period. Critically, n=50 remains fit for the study's core purpose; for low-performing items (e.g., hand hygiene without soap, anticipated at ~30%), this sample size yields an exact 95% confidence interval of approximately 18%–45%, which is sufficiently narrow to unequivocally detect and confirm clinically significant safety deficits at the bedside [11]. The sample size of 50 was considered adequate for descriptive purposes to identify item-level gaps in IPC knowledge and practice at the institutional level. Participants were enrolled using non-probability consecutive sampling, approaching all eligible nurses present and willing to participate during the data collection period until the target sample size was achieved. This target served as a recruitment guide; participants were then enrolled using non-probability Consecutive sampling due to feasibility constraints. The proportion was conservatively assumed to be p = 0.5, the minimum sample size, and hence the most conservative (higher) estimate, based on common conventions for descriptive health survey research [11] and a 95% confidence level (Z = 1.96) and a 9% margin of error (e = 0.09). The calculator also incorporated the finite population correction because the number of Medicare Hospital nursing establishments that were eligible for inclusion in the population was finite: $n = n_o N / (n_o + N - 1)$ where N is the number of eligible nurses in the hospital; this correction further decreases the sample size needed when the source population is small, consistent with the standard survey sampling techniques [11]. Participants were enrolled using non-probability consecutive sampling; all nurses present and willing to participate during the data collection period were approached sequentially until the target sample size was achieved. Procedures were then repeated for the hospital's nursing establishment and resulted in a minimum sample of 50 nurses, which was then recruited using non-

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probability non-probability consecutive. Those who were employed at Medicare Hospital at the time were included, but those who worked as Lady Health Visitors or students were not included, nor were those who worked at other hospitals. An adapted pre-validated, self-administered questionnaire was used. Before data collection, the questionnaire was pilot-tested with 10 nurses at the same hospital (who were not included in the final sample) to assess clarity and cultural appropriateness. In this pilot sample, internal consistency was acceptable (Cronbach's $\alpha = 0.79$ for knowledge items and 0.83 for practice items). Each correct knowledge item was assigned a score of 1, yielding a total possible knowledge score of 9. Overall knowledge was classified as 'good' if the participant correctly answered 7 or more items (≥77%), based on standard Bloom's cut-off criteria commonly used in health professions education research. Similarly, Practice scores were calculated out of 16 items, with good practice defined as a score of ≥12 (75%), consistent with the modified Bloom's cut-off criteria. Inclusion criteria encompassed registered nurses of both genders holding BSN, diploma, or post-RN qualifications who were actively employed at Medicare Hospital, Multan during the data collection period. Exclusion criteria comprised nursing students and interns, Lady Health Visitors (LHVs), nurses on extended leave (e.g., maternity leave or sick leave > 2 weeks), and nursing staff employed at other hospitals. The data were gathered using an adapted pre-validated, self-administered questionnaire, which consisted of three parts: 8 items were for sociodemographic and professional characteristics, 9 items for IPC knowledge (about sterilization, disinfection and decontamination, and about post-exposure prophylaxis), and 16 items for IPC-related practice (hand hygiene, usage of PPE, sharps handling, and post-exposure management). Eligible nurses were approached after obtaining institutional permission; the purpose of the study was explained, and written informed consent was obtained before administration of the questionnaire, which took about 15–20 minutes to complete. Responses were confidential and anonymous, participation was voluntary with the option to withdraw at any time, and data were used only for research purposes.

IBM SPSS Statistics 26 was used for coding and analysis of the data. All knowledge and practice items were analyzed using descriptive statistics (frequencies and percentages). The overall scores and practice scores for knowledge were reported as proportions with 95% confidence intervals. Because of the small sample size (n=50), which restricted the power to detect associations, inferential analyses (such as Chi-square tests, Fisher's exact tests, or regression modeling) were not done. The study was descriptive in nature to detect gaps in IPC knowledge and practice at the item level, where the sample size was more than adequate for descriptive purposes but not for a sound multivariable analysis. The analysis was thus not conducted in a statistical manner, which is in line with the purpose of the study and limitations on the sample, and was descriptive.

RESULTS

50 nurses were involved in the study. This study presents some of the baseline demographic and professional characteristics. The study sample comprised mainly female nurses (64%, n=32), with the majority being aged between 26 and 30 years (42%, n=21). The most common degree held by most participants was BSN (48%, n=24), and most had 1–5 years of clinical experience (38%, n=19). Most had prior IPC training (76%, n=38) and had been vaccinated with Hepatitis B (82%, n=41); two-thirds reported a needle stick injury or exposure to blood/body fluids (66%, n=33) (Table 1).

Table 1: Baseline Demographic and Professional Characteristics of Participating Nurses (n=50)

Characteristics	Category	n (%)
Age (years)	20–25	12 (24%)
	26–30	21 (42%)
	31–35	10 (20%)
	>35	7 (14%)
Gender	Male	18 (36%)
	Female	32 (64%)
Educational Qualification	BSN	24 (48%)
	Diploma in Nursing	16 (32%)
	Post-RN	10 (20%)
Years of Clinical Experience	<1 Year	6 (12%)
	1–5 Years	19 (38%)
	6–10 Years	15 (30%)
	>10 Years	10 (20%)
Current Ward/Unit	Medical Ward	14 (28%)
	Surgical Ward	11 (22%)
	ICU/CCU	9 (18%)
	Emergency	8 (16%)
	Other	8 (16%)
Prior IPC Training	Yes	38 (76%)
	No	12 (24%)
Participation in IPC Workshops	Yes	18 (36%)
	No	32 (64%)
Hepatitis B Vaccination Status	Vaccinated	41 (82%)
	Not vaccinated	9 (18%)
History of Needle-Stick Injury	Yes	33 (66%)
	No	17 (34%)

A total of 50 nurses participated in the study. As a result of the first study, the knowledge of nurses regarding infection prevention and control was summarized. Almost everyone recognized that the use of protective devices reduces HCAI risks (100%), and correctly stated the function of

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disinfection (96%) and decontamination before sterilization (94%); knowledge about chemical (58%) and physical (56%) sterilization procedures was somewhat lower; half of the nurses (50%) incorrectly believed that wearing gloves eliminates the need for hand hygiene (Table 2).

Table 2: Nurses' Knowledge of Infection Prevention and Control (n=50)

Sr. No.	Knowledge Item	Yes, n (%)	No, n (%)
1	Disinfection prevents healthcare-associated infection (HCAI)	48 (96%)	2 (4%)
2	Antiseptic use prevents HCAI	48 (96%)	2 (4%)
3	Chemical sterilization is used for every item of equipment	29 (58%)	21 (42%)
4	Physical sterilization (heat/radiation) is used for every item of equipment	28 (56%)	22 (44%)
5	All microorganisms, including spores, are destroyed by autoclaving	46 (92%)	4 (8%)
6	Every item of equipment needs decontamination before sterilization	47 (94%)	3 (6%)
7	Protective devices minimize HCAI	50 (100%)	0 (0%)
8	Wearing gloves replaces the need for hand washing	25 (50%)	25 (50%)
9	Post-exposure prophylaxis (PEP) is available for HIV after exposure	36 (72%)	14 (28%)

Hand hygiene practices were generally satisfactory, with 86-96% adherence to soap-based hand washing. However, critical gaps were identified in alternative hand hygiene methods (only 30% washed hands without soap when soap was unavailable), use of facial protection (6% goggles, 4% masks), and environmental disinfection (76% changed chlorine solution every 24 hours), highlighting areas requiring targeted intervention (Table 3).

Table 3: Nurses' Hand Hygiene and Personal Protective Equipment (PPE) Practices (n=50)

Sr. No.	Practice item	Yes, n (%)	No, n (%)
Hand Hygiene Practices			
1	Wash hands with soap before patient care	43 (86%)	7 (14%)
2	Wash hands with soap after patient care/contact with fluid	48 (96%)	2 (4%)
3	Wash hands without soap when soap is unavailable	15 (30%)	35 (70%)
PPE Practices			
4	Use all types of PPE as indicated for the procedure	38 (76%)	12 (24%)
5a	Type of PPE used – Gloves	45 (90%)	5 (10%)
5b	Type of PPE used — Goggles	3 (6%)	47 (94%)
5c	Type of PPE used — Mask	2 (4%)	48 (96%)
6a	Change chlorine solution every 24 hours	38 (76%)	12 (24%)
6b	Change chlorine solution after two days	6 (12%)	44 (88%)
6c	Don't know the change schedule for chlorine solution	6 (12%)	44 (88%)

This study shows practices on sharps safety and other IPC practices. Most nurses utilized infection prevention guidelines (86%) and employed antiseptic technique before IV cannulation (100%). Regarding sharps safety, 60% avoided recapping needles before disposal. A total of 33 (66%) nurses reported a history of blood/body fluid or sharp object exposure. Among these 33 exposed nurses, 24 (73%) received post-exposure prophylaxis (PEP), while the remaining 9 (27%) did not receive PEP following their exposure (Table 4).

Table 4: Nurses' Sharps-Safety and Other Infection Prevention Practices (n=50)

Sr. No.	Practice item	Yes, n (%)	No, n (%)
Sharps Safety			
7	Use infection prevention guidelines	43 (86%)	7 (14%)
8	Avoid recapping needle before disposing	30 (60%)	20 (40%)
9	History of contact with blood, fluid or sharp-object injury	33 (66%)	17 (34%)
Post-Exposure Management			
10a	Taking PEP (among those exposed, n = 33)	24 (73%)	9 (27%)
10b	Cleaning with alcohol	9 (18%)	41 (82%)
10c	Washing with water	4 (8%)	46 (92%)
Other IPC Practices			
11	Provide health education to patients about HCAI	42 (84%)	8 (16%)
12	Cover skin wounds before starting work	42 (84%)	8 (16%)
13	Vaccinated against common pathogens	41 (82%)	9 (18%)

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14	Dispose of used needles/sharps in designated containers	41 (82%)	9 (18%)
15	Dispose containers only when three-quarters full	42 (84%)	8 (16%)
16	Use antiseptic technique before intravenous cannulation	50 (100%)	0 (0%)

There were good overall knowledge and practice demonstrated by 49 nurses (98%) for infection prevention and control, and 49 nurses (98%) for overall practice (Table 5).

Table 5: Overall Level of Knowledge and Practice Regarding Infection Prevention and Control, Aligned with Study Objectives (n=50)

Domain (Aligned with Study Objective)	Good, n (%)	Poor, n (%)	Total, n
Objective 1: Overall IPC knowledge	49 (98%)	1 (2%)	50
Objective 2: Overall IPC practice	49 (98%)	1 (2%)	50

DISCUSSION

This study demonstrated that knowledge and practice scores by item level showed significant variation, while the global scores were good (98% for both), which could mean that there are summary-level scores that mask individual-level and clinically important gaps. Similar findings have been observed in healthcare professionals in Punjab, Pakistan, with low and inconsistent knowledge of standard precautions and implementation of specific precautions at the point of care [5, 12]. A nationwide assessment of the implementation of IPC in Pakistani health care facilities also revealed significant differences between various facilities, with much of the difference attributed to level of resources, supervision, and training intensity, rather than only knowledge [3]. This is in line with other regional findings indicating that while compliance with the guideline is fairly high (60% in this study), it is not uniform, with nurses reporting 100% adherence to recapping needles before disposal in Quetta, Pakistan, indicating that facility training and supervision can significantly reduce this practice gap [13, 14]. Likewise, targeted, skills-based training, as opposed to knowledge-based training, has been demonstrated to measurably increase adherence to key IPC practices among nurses in regional healthcare networks [8], making the value of targeted, skills-based training clear. In the current study, the observed low rates of nurses washing their hands when soap is not available (30%) and low rates of using eye protection during patient care (6%) are similar to barriers to proper hand hygiene and use of PPE reported in intensive care units (ICUs) in the West Bank, where perceived shortages of supplies and heavy workload were found to be important factors affecting inconsistent compliance with PPE and hand hygiene [15, 16]. Overall, the current findings echo the literature cited above, that while there is a strong overall picture that good baseline knowledge does not translate into consistent IPC practice, a consistent and high level of hand hygiene and IPC compliance is a key component in reducing the burden of HAIs [17]. In-service training should be continuous, provision of PPE and hand hygiene supplies should be uninterrupted, standardized institutional protocols should be in place, and there should be regular supervision and mentorship to ensure that what is known in practice is consistently applied at the bedside. The results support the Pakistani evidence that knowledge of IPC and its use at the bedside do not always go together [18]. Similar studies in multi-centre or national settings have also found significant problems with the practical application of standard precautions, hand hygiene and the use of PPE, which were not only due to lack of knowledge but also due to resource shortages, insufficient supervision and/or training [19, 20]. The observations highlight that IPC gaps are not de facto knowledge gaps or a lack of knowledge, but are instead a result of structural and organizational barriers, and that multifaceted interventions are needed that target individual competencies and systemic enablers.

The use of self-reported data on practices is subject to social desirability bias and may have overestimated actual practices, and the small pilot sample (n=10) for reliability testing could have limited Cronbach's alpha estimates. Moreover, the single-centre and cross-sectional design does not allow the assessment of causality or temporal relationships. Additionally, the use of non-probability consecutive sampling at a single tertiary-care hospital may have introduced selection bias, thereby limiting the generalizability of the findings to other healthcare settings. Future studies should use larger, multi-centre, probability sampling with inferential statistical analysis (Chi-square, Fisher's exact, logistic regression) to determine associated factors, qualitative studies to determine institutional factors, and observational studies to confirm self-reported results.

CONCLUSIONS

Overall, the majority of nurses at Medicare Hospital, Multan showed good knowledge and practice of infection prevention and control, but there were some important gaps noted at the item level, including in the technique of sterilization, hand hygiene without the use of soap, and safe sharps handling. Hospital administration, in collaboration with the Ministry of Health and other stakeholders, should focus on structured pre-service and in-service training on IPC, providing an uninterrupted supply of Personal Protective Equipment and hand hygiene materials, and continuous mentorship and supervision to improve the nurses' compliance with the guidelines of IPC to protect patients and staff from infection.

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Authors' Contribution

Conceptualization: MI
Methodology: MI, SR, KE
Formal analysis: MI, SR
Writing and Drafting: MI, SR, KE, IN, SB, HM, MS
Review and Editing: MI, SR, KE, IN, SB, HM, MS

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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