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ASSESSING THE ADHERENCE TO INFECTION CONTROL PROTOCOLS IN INTENSIVE CARE UNITS AT TERTIARY HOSPITALS IN LAHORE

Hadia Seerat[*1], Naila Maqbool[2], Fazeelat Asif[3], Azra Rehman[4], Savera Shahid[5], Muhammad Umar Farooq[6], Asma Kanwal[7]

*[*1]BSN, College of Nursing and Midwifery FJMU, Sir Ganga Ram Hospital Lahore, Pakistan*
[2]Assistant Nursing Instructor (ANI), College of Nursing and Midwifery FJMU, Sir Ganga Ram Hospital Lahore, Pakistan
[3]M Phil Microbiology, Abasyn University Islamabad Campus, Pakistan
[4]Post RN, MSN, Head of the Nursing Department Sahara Nursing College Narowal, Nursing Superintendent Sugra Shafi Medical Complex Narowal
[5]BSN, College of Nursing and Midwifery FJMU, Sir Ganga Ram Hospital Lahore, Pakistan
[6]BSN, College of Nursing, Government Teaching Hospital Shahdara Lahore, Pakistan
[7]Nursing Officer, Post RN, THQ Hospital Quaidabad, Pakistan

[*1]seeratt18@gmail.com

Corresponding Author: *
Hadia Seerat

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ABSTRACT

Background

Hospital-acquired infections (HAIs) continue to be a central concern to patient care, especially in Intensive Care Unit (ICU) where patients are highly vulnerable due to poorly functioning health conditions and immunocompromised conditions. Despite the established evidence-based protocols in infection control, there is usually inconsistency in compliance of the practices by healthcare workers. In Pakistan, there is a lack of information regarding the degree of compliance with the infection control procedures in ICU facilities, particularly in the tertiary care hospitals. The objective of this study was to determine the compliance of ICU nurses working in ranked tertiary hospitals in Lahore to infection control measures.

Materials and Methods

The study design was a descriptive cross-sectional study. The research was done in the Intensive Care Units of Sir Ganga Ram Hospital, Jinnah Hospital and General Hospital Lahore. The selected sample consisted of 300 ICU nurses who were identified through a convenience sampling method. A standardized Standard Precaution Adherence and Practice Questionnaire was used to collect the data. The data was summarized using descriptive statistics (frequency and percentages) and chi-square tests were used to establish relationships among demographic variables, hospitals, and infection control practices. The analysis of the data was done using SPSS version 26.0.

Results

The results revealed that there was a relatively high rate of compliance with infection control behaviour among ICU nurses where the overall rate of compliance with the 20 items of the standard precautions was about 84%. The highest level of compliance was seen in hand hygiene practices, usage of gloves when taking blood, sharps, and dealing with blood or body fluids. Nevertheless, the compliance on wearing gloves during changing of dresses and some low-risk or routine situations were observed to be less. Chi-square showed that there is no statistically significant relationship between the practices of infection control and gender or the hospital setting ($p > 0.05$).

Conclusion

The research results in the conclusion that the compliance of the ICU nurses with the infection control measures in the tertiary hospitals of Lahore is high; nevertheless, some gaps are still observed in the particular practices like the use of gloves during the change of dressing. There was no major difference in the basis of gender or hospital. It is suggested that the identified gaps should be filled through the focused training, constant monitoring, and support by the institution to support the infection control practices in the ICUs further.

Keywords:

Infection Control Protocols (ICP), Intensive Care Units (ICU), Hospital-Acquired Infections (HAIs), Compliance, Hand Hygiene, Personal Protective Equipment (PPE), Standard Precautions (SP).

INTRODUCTION

1.1 Background of the study:

The health care systems all over the world have serious issues with patient safety and hospital-acquired infection (HAIs) prevention. Intensive Care Units (ICUs) are among the most vulnerable hospitals where patients are usually in a critical condition and in which they also have weakened immunity. The appeal of infection control measures in ICUs is critical in reducing the risks of HAIs, which continue to be the most frequent cause of morbidity and mortality of hospitalized patients. Strict infection control measures are evidence-based practices that are essential in enhancing patient outcomes and achieving patient safety. Nevertheless, the lack of resources like proper training, psychological stress among the healthcare providers and barriers to proper implementation of these practices are frequent obstacles to the successful implementation of these practices.

The major idea of the given research is infection control practices (ICP) in intensive care units, namely, compliance with the standard procedures by health care workers. Infection control can be defined as the efforts applied to avoid infection transmission within a healthcare facility, especially in such a place as an ICU, where patients are considered to be high-risk. Historically, the ICPs have developed together with the medical knowledge and technology. Strategies used to prevent infections at the world level have been influenced by the introduction of guidelines by the organizations such as the world health organization (WHO) and the centers disease control and prevention (CDC) among others. Nevertheless, even after these guidelines were put in place, there is still discrepancy in the application of infection control methods in hospitals, particularly in critical care units, in various regions.

The significance of following the procedures of infection control also cannot be overestimated, especially when it comes to ICUs. Studies have established that properly established infection control interventions can considerably lower the rates of HAIs thus enhancing patient recovery rates and lowering hospitalization rates. Recent research points to the current issue of high compliance to infection control measures in ICUs, which means that in spite of the guidelines, the compliance is frequently compromised by knowledge gaps in healthcare workers, organizational inefficiencies, and emotional stressors, particularly in high-pressure settings such as the ICU. The rate of non-adherence to infection control measures in ICUs has reportedly ranged globally, 30-40%, with lower compliance rates reported in the less resource endowed and supported regions.

In different parts of the world, studies have shown that compliance of healthcare workers with infection prevention measures have direct effect on health care facilities in terms of occurrence of HAIs. Recent reports indicate that hand hygiene and wearing of personal protective gear (PPE), are the most effective methods of infection control in preventing infections spread within the ICUs. Systematic review established that these interventions were multimodal and therefore showed significant effectiveness than single interventions in enhancing adherence to the practices as a result of multimodal interventions including education and feedback. In Pakistan, hospital-based studies have reported similar

trends in Pakistan, with high levels of knowledge regarding infection control measures and low levels of compliance in practice, implying there are discrepancies between their awareness and their actual behavior.

The difficulties of efficient infection prevention in the ICUs are complex. Poor organizational barriers such as lack of resources, staffing, and other institutional support are major factors that contribute to failure to comply. Moreover, individual elements like stress, burnout, and fatigue in the healthcare professionals also influence their capacity to adhere to the infection control measures on a steady basis as well. The issue is complicated by social and cultural including a lack of motivation, change resistance and a lack of leadership. It is only possible to face all these challenges by adopting a multifaceted approach that does not only aim at enhancing the knowledge and skills of healthcare workers but also makes sure that healthcare systems are well-prepared to facilitate the application of infection control measures.

The success of the measures is dependent on the willingness of the organization to adopt the infection control measures. The influence of leadership, the involvement of the staff, and the organizational culture is hardly exaggerable. Leadership is required to make the environment conducive where people are comfortable to follow guidelines and develop a culture of safety. Moreover, policies and infrastructure of hospitals should be harmonized to help infection control practices to be implemented effectively so that healthcare workers could have the tools and means they required to do their work with efficiency.

As far as theoretical approaches are concerned, various models can be used to learn about the factors that contribute to the compliance of healthcare workers with infection control measures, including the Health Belief Model and the Theory of Planned Behavior. These models emphasize the perceived susceptibility to infections, the perceived severity, and the perceived benefits of following infection control practices, along with the impact of behavioral intentions and perceived control over decisions to adhere to the practices among others.

Although a lot has been done in terms of studying infection control practices, there still is a great gap in the information about the exact factors affecting the adherence in the ICUs, especially with references to tertiary care hospitals in Lahore, Pakistan. Past research has placed emphasis to physical factors like hand hygiene and use of PPE, however less investigation has been done to determine the psychological and organizational factors that might influence compliance. This paper will try to address this gap by examining not only the physical side of the issue of infection control but also the emotional and psychological struggles that happen among healthcare providers in the ICU environment. The knowledge of these will help in the development of better intervention measures in boosting compliance with infection control procedures and ultimately, improving patient safety.

1.2 Problem Statement:

In the ICU settings of tertiary hospitals in Lahore, there are significant gaps in adhering to infection control protocols, despite healthcare workers' awareness of their importance. Key barriers include insufficient training, lack of resources, emotional stress, and inadequate institutional support. These challenges result in higher risks of hospital-acquired infections (HAIs), longer hospital stays, and poor patient outcomes. This study aims to identify the factors affecting adherence to infection control practices and explore effective strategies to improve compliance, ultimately enhancing patient safety and reducing infections in ICUs. Therefore, it is crucial to examine the barriers and propose interventions for better infection control in these settings.

1.3 Significance of the Study:

The study has practical implications on enhancing patient safety and minimizing hospital-acquired infections (HAIs) in the ICU. Its findings will present important information on the determinants of compliance with the infection control measures, including knowledge, attitudes, and institutional support that healthcare workers have. This study can be used to influence specific interventions related to the improvement of compliance, including training, improved resource distribution, and

leadership engagement by determining important barriers. The findings can be used to design better policies, enhance the clinical practice, and close gaps in the current knowledge about infection control in the healthcare system of Pakistan. Finally, it is possible to use the findings to make enhancements in patient safety and quality of care in critical care units as a whole.

1.4 Research Question:

- What is the compliance rate with infection control measures among personnel of the ICU of tertiary hospitals in Lahore?

1.5 Research Objective:

- To determine the extent of compliance with infection control guidelines in Intensive Care Unit (ICU) of tertiary hospitals in Lahore.

1.6 Conceptual Definitions of Key Terms:

1.6.1. Standard Precaution Adherence and Practice: This is the introduction of universal infection control measures, including hand hygiene, wearing gloves and protective clothing, to avoid the transmission of infections in medical care environments (Ghorbanmovahhed et al., 2023).

1.6.2. Hospital-Acquired Infections (HAIs): The infections that patients obtain in the course of their hospitalization, which were not there or not developing when they were admitted (Fried, 2023).

1.6.3. Intensive Care Unit (ICU): This is a special section of a hospital in which patients with life threatening illnesses or injuries are treated and monitored intensively (Talbot et al., 2024).

1.6.4. Personal Protective Equipment (PPE): Unique clothing or equipment that healthcare professionals put on to cushion themselves against the danger of infection by infectious agents (Gašpert, 2025).

1.6.5. Adherence: The level of compliance of healthcare workers with the implemented infection control measures, such as hand hygiene and PPE use procedures and other safety processes (Ghorbanmovahhed et al., 2023).

1.7 Hypotheses of the Study

The following hypotheses were developed, basing on the goals of the study:

1. **H_{01}:** ICU staff gender has no significant impact on their compliance with infection control practices.

H_{11}: Gender of ICU staff and their practice of adhering to infection control practice are significantly associated.

2. **H_{01}:** No significant difference exists in infection control among the ICU based staff of Sir Ganga Ram Hospital, Jinnah Hospital, and General Hospital Lahore.

H_{11}: ICU personnel in the three hospitals differ significantly on practices of infection control.

LITERATURE REVIEW

2.1 Theoretical Background:

"Determinants of Nurses compliance with Infection prevention and control practices in critical care units". A total of 155 nurses in hospitals located in South West Bank participated in the cross-sectional study where a structured questionnaire was used in data collection. Stratified random sampling was utilized. The outcomes were 71% good adherence to IPC practices by nurses and 39.4 % moderate knowledge. The main results were that critical care experience ($\beta = 3.542$, $p < 0.05$) and institutional support ($\beta = 0.246$, $p < 0.01$) were important predictors of compliance. The researchers found that IPC should be better adhered to with the help of improved education and institutional support (Batran et al., 2025).

The other systematic review and meta-analysis involved the study of the strategies that enhance the compliance with infection control measures (ICMs) by healthcare workers in the ICUs. The researchers identified 103 intervention studies and discovered that the use of multimodal interventions (education, feedback, simulation) resulted in 23.6% and educational interventions only improved by 16.13%. The review findings were that compared to education, multimodal interventions are more effective in healthcare-associated infections (HAIs) prevention and needs to be implemented widely in healthcare settings (Alshehari & Saeed, 2024).

Likewise, in one study, the qualitative design was used to determine obstacles to hand hygiene adherence among ICU healthcare workers during the COVID-19 pandemic. The semi-structured interviews took place among 25 medical staff, and the data was gathered in one

of the teaching hospitals in Kerman, Iran. The paper established three primary obstacles namely the individual barriers (poor attitude and lack of knowledge), management barriers (poor training and poor role modeling), and organizational barriers (heavy workloads and inadequate equipment). Although there was greater compliance in the pandemic, these barriers impeded the adherence to hand hygiene. The research recommends that these problems should be addressed by offering better training, designing wards better and equipping them with the required tools to ensure conformity (Ahmadipour et al., 2022).

This descriptive cross-sectional research design was to measure the compliance with infection control practices among ICU nurses. It was carried out in Hilla City, Iraq where 200 nurses participated, but utilized a 55-item checklist to collect the data. The results demonstrated that 81 percent of the nurses had poor infection control practice. The statistical analysis showed that such factors as age, education, experience, and training were positively correlated with improved adherence to protocols. The paper emphasizes the need of specific training and education to enhance infection control in ICUs (Najm & Yasir, 2024).

Besides, the article "Practices and adherence of nurses with standard precautions of infection control in intensive care units of public sector hospital in Lahore" aimed to determine the level of compliance of the ICU nurses to infection control precautions. It was conducted in two Lahore public hospitals during the period between March and September 2022 and included 150 nurses. The survey administered by researchers on 619 nurses indicated that 84.7% of them followed standard precautions, and 52.7% displayed appropriate practices. Nevertheless, adherence and practice were not associated with each other significantly (p-value: 0.95), which also shows a lapse in implementation. The authors concluded that the practice of infection control is not followed by the ICU nurses in Lahore (Aftab et al., 2023).

One more descriptive cross-sectional study aimed to determine the knowledge, practices, and challenges of nurses to prevent hospital-acquired infections (HAIs) in Punjab, Pakistan. The research was carried out with 78 nurses in public and private hospitals and the questionnaire was of a structured type, refers to CDC and WHO guidelines. Findings demonstrated that there was a good understanding of IPC measures such as face masks, hand hygiene, but the understanding of alcohol-based hand rubs as a handwashing alternative was lacking. Issues such as unavailability of PPE, inadequate training, and workloads were witnessed. The researchers came to the conclusion that although nurses have the basic knowledge of IPC, there are systematic problems and inconsistent practice that should be improved (Riaz et al., 2025).

Another study, "Knowledge and Attitude Towards Preventing Hospital-Acquired Infections Among Nurses: a Cross Sectional Study in Lahore, Pakistan"; evaluated the knowledge and attitudes about the prevention of hospital-acquired infections by nurses. The descriptive cross-sectional design was employed using which a total of 108 nurses were chosen with 100% response rate. Data collection was done by use of a 15-item survey. The results revealed that the average score of knowledge was 53% and the attitude score was 57 and there was no significant difference ($p>0.05$). The research found out that nurses were poorly knowledgeable and that there was need to enhance education and training (Ahmad et al., 2025).

The article, "Evidence-Based Practices of Nurses Regarding Nosocomial Infection in ICU", was intended to determine the conformity of the evidence-based practices of the ICU nurses in preventing nosocomial infections in a tertiary care hospital in Lahore. It included 72 nurses who were chosen through the convenient sampling technique using a 31-item questionnaire. The research revealed that the majority of the nurses (98.6) were women of the ages 26-35 years old (76.4), and their diploma (69.4). Findings revealed that 59.7% of them always practiced hand hygiene and 77.8% of them always wore personal protective gear. The researchers were able to conclude that evidence-based knowledge was satisfactory, whereas hand hygiene practices were at international standards (Riaz et al., 2023).

2.2 Gap Analysis:

Majority of the studies about infection control in ICUs are centered on the physical

activity, such as handwashing and use of protective equipment, but does not pay much attention to emotional and mental aspects that influence staff conduct. Such challenges as stress and burnout can influence the adherence of the staff to the protocols; however, such emotional issues are not frequently addressed in the studies, such as (Ahmadipour et al., 2022). The psychological habits such as getting complacent with routine are also seldom taken into account. These mental and emotional aspects need to be understood particularly in the high-pressure ICU setting.

Moreover, the research also highlights such issues as training and equipment shortage ((Najm & Yasir, 2024); (Riaz et al., 2025)), but it is not detailed enough. Peculiar cultural and organizational specifics of such hospitals as Sir Ganga Ram Hospital Lahore are not examined thoroughly as well. Our research addresses these gaps as it will consider not only about physical actions but also the impact of stress, mental challenges, and the environment of the hospital on the infection control in the given setting.

METHODOLOGY

3.1 Study Design:

A descriptive cross-sectional design was used in this study.

3.2 Study Site and Setting:

The study was carried out at the Intensive Care Unit (or ICU) of the Sir Ganga Ram Hospital, Jinnah Hospital, and General Hospital in Lahore, Pakistan.

3.3 Study Variables:

Knowledge of Infection Control Practices among ICU staff.

3.3.1 Dependent Variable:

Adherence to Infection Control Practices

3.3.2 Independent Variables:

- **Demographic Characteristics:**
  - Age
  - Gender
  - Qualification (e.g., Diploma in Nursing, Generic BSN, Post RN BSN)
  - ICU experience (e.g. 1-5 years, 5-10 years, over 10 years)
- Infection Control Practices Knowledge
- Institutional Support
- Psychological Factors
- Organizational Barriers

3.4 Study Duration:

The research was conducted in the span of six (06) months after the approval of proposal.

3.5 Study Population:

The population of the study comprised all ICU medical personnel at Sir Ganga Ram Hospital, Jinnah Hospital and General Hospital Lahore. This involved the ICU nurses, physicians and other medical staff that handle direct patient care in the ICU.

3.6 Sampling Technique:

The convenience sampling technique was applied to identify the members of the ICU staff.

3.7 Sample Selection Criteria:

3.7.1 Inclusion Criteria:

ICU employees directly engaged with patients (nurses, doctors, and other medical workers). Members of staff, working in; Sir Ganga Ram Hospital, Jinnah Hospital and General Hospital, Lahore, willing to took part in the study. The participants with at least six months of working experience in the ICU. Participants above the age of 18 years.

3.7.2 Exclusion Criteria:

Those personnel in healthcare who are not directly involved in patient care like the administrative staff. ICU Staff of other hospitals. ICU employees with less than six months of employment in the ICU. Unwilling and incapable participants. Participants under the age of 18 years.

3.8 Sample Size:

The sample size for this study was estimated as 278 assuming a population of 1000 ICU staff members, a confidence level of 95% and a margin of error of 5%. The sample size of 300 was finalized as a way of considerating non-respondent and unanswered questionnaires by using Cochran's formula, which is appropriate for proportions in large populations.

Sample Size Distribution:

The participants had a balanced distribution in the three hospitals where the study was done: a total of 300 participants.

1. Sir Ganga Ram Hospital – 40% of the entire sample = 120 participants
2. Jinnah Hospital – 35% of the entire sample = 105 participants
3. General Hospital Lahore – 25% of the entire sample = 75 participants

3.9 Data Collection:

3.9.1 Study Tool:

The Standard Precaution Adherence and Practice Questionnaire was used as the main data collection tool.

3.9.2 Validity and Reliability of Study Tool:

The validity and reliability of the study instrument was established with Cronbach alpha of 0.84, which has good internal consistency (Yasmeen et al., 2022).

3.9.3 Data Collection Procedure:

Participants were notified of the purpose of the study, rights and voluntariness in participation. The Standard Precaution Adherence and Practice Questionnaire gave to the ICU personnel at shifts. Time of staff to responded to the questionnaire was be 15-20 min. The research team immediately collected the completed questionnaires and stored them in a secure way to maintain the confidentiality.

3.10 Ethical Considerations:

The Ethical Review Board Fatima Jinnah Medical University Lahore reviewed and approval of the study was sought from Supervisor. Data collection permission was obtained from Hospital Administration. Informed consent was sought among all the participants, who must fully understand what the study is about and whether their participation is voluntary or not and that they have the right to withdraw at any point without any adverse repercussions. There was anonymity of the questions by coding them instead of using personal identifiers. All data kept in a secure location and the collected data shall be accessible to the research team only.

3.11 Data Analysis:

Analysis was done through SPSS (version 26.0) software. The demographic features of the participants were summarized using descriptive statistics. This contained frequencies and percentages to explain the distribution of the participants and their infection control practices. Frequency and Percentage analysis was conducted to interpret the results. The data was visually represented in the form of tables to demonstrate the distribution of the responses.

RESULTS

The responses were analyzed according to answers obtained among ICU employees in three tertiary care hospitals in Lahore. This stage of the research was aimed at defining the compliance of the subjects to the infection control measures. The Standard Precaution Adherence and Practice Questionnaire was used to collect data, and 300 completed forms were returned to the researcher expressing a great overall response of eligible study participants.

Table 4.1: Socio-Demographic Characteristics of Nurses (n=300)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age	21–30 years	204	68.0
	31–40 years	90	30.0
	>40 years	6	2.0
Gender	Male	30	10.0
	Female	270	90.0
Hospital	Sir Ganga Ram Hospital Lahore	120	40.0
	Jinnah Hospital Lahore	105	35.0
	General Hospital Lahore	75	25.0
Qualification	Diploma in Nursing	60	20.0
	Generic BSN	140	46.7

	Post RN BSN	100	33.3
ICU Experience	1–5 years	144	48.0
	5–10 years	104	34.7
	>10 years	52	17.3

Table 4.1 presents the demographic data and indicates that the vast majority of the respondents are between 21 and 30 years of age. The majority were female. A big proportion of respondents was of Sir Ganga Ram Hospital Lahore and then of the Jinnah Hospital and General Hospital Lahore. The majority had a Generic BSN degree and slightly less than 50% of them indicated 1-5 years of experience in the ICU. These attributes were used to characterize the description of healthcare workers that participated in the research.

Table 4.2: Descriptive statistics of checklist for practice of SPs

S. No.	Infection Control Practice Item	Yes	No
1	Washing hands after contact with different patients	270	30
		90.0%	10.0%
2	Hand hygiene after removing gloves	260	40
		86.7%	13.3%
3	Hand hygiene after contact with blood/body fluids	264	36
		88.0%	12.0%
4	Wearing gloves during blood collection	248	52
		82.7%	17.3%
5	Wearing gloves during disposal of urine and stool	258	42
		86.0%	14.0%
6	Wearing gloves when touching impaired skin	248	52
		82.7%	17.3%
7	Wearing gloves during contact with mucosa	224	76
		74.7%	25.3%
8	Wearing gloves even when not dealing with patients	218	82
		72.7%	27.3%
9	Wearing gloves while giving IM/SC injection	256	44
		85.3%	14.7%
10	Wearing gloves during dressing change	166	134
		55.3%	44.7%
11	Wearing gloves & apron when cleaning blood traces	259	41
		86.3%	13.7%
12	Wearing gloves & apron during venous puncture	262	38
		87.3%	12.7%
13	Wearing apron & gloves when handling blood samples	270	30
		90.0%	10.0%
14	Wearing gloves during recapping/reusing syringes	268	32
		89.3%	10.7%
15	Wearing protective gown when splash risk exists	259	41
		86.3%	13.7%
16	Wearing protective cap or shoe covers when required	266	34
		88.7%	11.3%
17	Wearing face mask during splash-risk procedures	265	35
		88.3%	11.7%
18	Wearing gloves & apron for second-hand sharps	269	31
		89.7%	10.3%

19	Cleaning and dressing skin after sharps injury	263	37
		87.7%	12.3%
20	Wearing gloves during needle encapsulation (one-hand method)	269	31
		89.7%	10.3%

The results of the responses to the 20 items of the infection control practice are provided in Table 4.2. There was high compliance in various practices like washing hands after contact with the patient, exposure to blood or body fluids, and putting on gloves during routine procedures, such as work with blood samples and encapsulation of needles. Reduced compliance to the wearing of gloves was observed when changing dressing and when the staff was not in direct contact with the patient. Table 4.2 provided a distribution that indicated the behaviors that were regularly practiced and those that were more widely varied.

Table 4.3: Summary of Chi-Square Tests for Gender and Infection Control Practices

Item No.	Variable Name	χ^2 Value	p-value	Significant
1	Washing hands when contacting different patients	.412	.521	No
2	Washing hands after taking off gloves	.000	1.000	No
3	Washing hands immediately after blood/body fluid contact	.898	.343	No
4	Wearing gloves during blood collection	.372	.542	No
5	Wearing gloves during urine/stool disposal	1.489	.222	No
6	Wearing gloves when contacting impaired skin	.372	.542	No
7	Wearing gloves when contacting mucosa	.031	.860	No
8	Wearing gloves even when not dealing with patients	2.693	.101	No
9	Wearing gloves for IM or subcutaneous injections	.047	.828	No
10	Wearing gloves during dressing change	.024	.877	No
11	Gloves + apron while cleaning blood traces	.254	.614	No
12	Gloves + apron during venous puncture	1.085	.298	No
13	Gloves + apron when handling blood samples	.412	.521	No
14	Wearing gloves during recapping syringes	.016	.901	No
15	Wearing protective gown during splash-risk procedures	.254	.614	No
16	Wearing protective cap or shoes	.133	.716	No
17	Wearing face mask during splash-risk procedures	.090	.764	No
18	Gloves + apron with second-hand sharps	.484	.487	No
19	Cleaning and taping skin after sharps injury	.031	.861	No
20	Wearing gloves for needle encapsulation (one-hand technique)	.484	.487	No

In order to test the hypothesis that the patterns of adherence vary according to gender; chi-square tests were conducted on all 20 items. As Table 4.3 indicates, all the p-values were above 0.05 (i.e.; all p-values > 0.05). This implied that there were no significant differences in the frequencies of male and female personnel saying Yes and No in all the given standard precaution items. No item showed any gender-based difference in adherence.

Table 4.4: Chi-Square Test Between Hospitals and Infection Control Practices

Item No.	Variable / Practice Item	χ^2 Value	df	p-value	Significant?
Q1	Washing hands when contacting different patients	1.257	2	0.533	No
Q2	Washing hands after taking off gloves	0.188	2	0.911	No
Q3	Washing hands immediately after blood/body fluid contact	2.785	2	0.249	No
Q4	Wearing gloves during blood collection	3.195	2	0.202	No
Q5	Wearing gloves during urine/stool disposal	1.242	2	0.537	No
Q6	Wearing gloves when contacting impaired skin	3.195	2	0.202	No
Q7	Wearing gloves when contacting mucosa	2.209	2	0.331	No
Q8	Wearing gloves even when not dealing with patients	0.291	2	0.864	No
Q9	Wearing gloves for IM or subcutaneous injections	0.904	2	0.636	No
Q10	Wearing gloves during dressing change	0.920	2	0.631	No
Q11	Gloves + apron while cleaning blood traces	0.236	2	0.889	No
Q12	Gloves + apron during venous puncture	2.040	2	0.361	No
Q13	Gloves + apron when handling blood samples	3.323	2	0.190	No
Q14	Wearing gloves during recapping syringes	0.270	2	0.874	No
Q15	Wearing protective gown during splash-risk procedures	0.787	2	0.675	No
Q16	Wearing protective cap or shoes	1.012	2	0.603	No
Q17	Wearing face mask during splash-risk procedures	0.615	2	0.735	No
Q18	Gloves + apron with second-hand sharps	0.116	2	0.944	No
Q19	Cleaning and taping skin after sharps injury	0.628	2	0.731	No
Q20	Wearing gloves for needle encapsulation (one-hand technique)	0.116	2	0.944	No

A second group of chi-square tests investigated the possibility of difference in infection control practices within hospitals. Table 4.4 also indicated no statistically significant correlations of all 20 items. The values of all p-values exceeded 0.05 (i.e.; all p-values > 0.05), which means that the respondents of Sir Ganga Ram Hospital, Jinnah Hospital, and General Hospital provided the same type of compliance results. There was no evidently higher or lower adherence rate in one and the other hospital according to the measured items.

In general, the demographic profile of the participants, the indication of the major trends in the practice, and the demonstration of the fact that the level of adherence did not vary significantly between genders and hospitals were demonstrated in terms of Tables 4.1, 4.2, 4.3, and 4.4. The findings indicate the responses as they were reported by the participants and offer the basis of further explanation in the discussion chapter.

DISCUSSION

This study assessed infection control practices among 300 ICU nurses working in three tertiary hospitals in Lahore. Overall, nurses reported a high level of adherence to standard precautions. Across the 20 practice items, about 84% of responses were "yes," showing that most key infection control behaviors were practiced consistently. Hand hygiene after contact with different patients, after glove removal, and after contact with blood or body fluids was reported by around 86–90% of participants. Use of gloves and protective equipment during blood collection, handling urine and stool, venous puncture, and sharps-related procedures was also high, mostly above 82%. At the same time, a few weak areas were identified. Only 55.3% of nurses reported wearing gloves during dressing changes, and glove use during contact with mucosa (74.7%) and when not directly dealing with patients (72.7%) was lower than other items. These findings suggest that while general adherence is

good, some specific and repetitive tasks (like routine dressing changes or non-obvious risk situations) are more vulnerable to lapses. Chi-square analysis showed that gender was not significantly associated with any of the 20 infection control practice items (all $p > 0.05$). Similarly, there was no statistically significant difference in practices across the three hospitals (all $p > 0.05$). This means that adherence patterns were broadly similar for male and female nurses, and across Sir Ganga Ram Hospital, Jinnah Hospital, and General Hospital. The overall pattern of high, but not perfect, adherence to infection control practices in this study is partly similar and partly different from recent evidence. A Lahore-based ICU study, *"Practices and adherence of nurses with standard precautions of infection control in intensive care units of public sector hospitals in Lahore"* (2023), reported that while 84.7% of nurses showed adequate adherence, only about half consistently applied standard precautions in daily practice, with especially low scores for glove use during dressing changes and some other procedures (Aftab et al., 2023). Compared with that study, our findings show a similar "weak spot" in glove use for dressing changes, but with a somewhat higher proportion (55.3% in this study vs much lower in Aftab et al.). This suggests that, although ICU nurses in Lahore may have benefited from ongoing infection control efforts, some procedure-specific behaviours remain difficult to standardize. In another Pakistani ICU study, *"Evidence-Based Practices of Nurses Regarding Nosocomial Infection in ICU"*, nurses frequently reported following infection prevention measures such as hand hygiene, proper sharps disposal, and environmental cleaning, but their practices were not uniform across all items; some personal protective equipment (PPE) behaviours and environmental measures were less consistent (Riaz et al., 2023). Our results are broadly in line with Riaz et al.: nurses report frequent use of hand hygiene, PPE, and safe handling of sharps, but not every behavior reaches near-universal practice. The relatively high "yes" rates for hand hygiene and sharps-related items in this study support the idea that basic infection control messages have been well-absorbed in ICU settings, while more nuanced behaviours (like always wearing gloves for all dressing changes) still need reinforcement. Outside Pakistan, a Jordanian multi-hospital study, *"The Nurses' Knowledge and Compliance with Standard Precautions to Prevent Healthcare-Associated Infections"* (Da'seh et al., 2023), found good knowledge (mean score 14.09/19) and good compliance (mean 14.46/20), with a strong positive correlation between knowledge and compliance ($r = 0.77$, $p < 0.001$) (Da'seh et al., 2023). Although our study did not measure knowledge scores, the high adherence rates across most items suggest that ICU nurses likely hold adequate knowledge of standard precautions, similar to (Da'seh et al., 2023). However, because knowledge was not directly measured in this study, we cannot claim the same strong knowledge–practice correlation.

In contrast, a Brazilian study, *"Adherence to standard precautions by nursing professionals in a public university hospital: a cross-sectional study"*, reported that the average standard precaution adherence score (70.5 points) was considered inadequate overall, with major weaknesses in hand hygiene, PPE use, and needle recapping; only nurses with ≥15 years of experience were more likely to adhere fully (Diniz et al., 2023). Compared to that study, ICU nurses in our sample appear to report better adherence, especially for core behaviours like hand hygiene and sharps handling, where "yes" responses were mostly above 85%. This difference may reflect different settings (ICUs vs mixed wards), stronger infection control culture in intensive care, or local policies in tertiary hospitals in Lahore. A more recent Ethiopian study, *"Adherence to Standard Precautions and Associated Factors Among Healthcare Workers at Public and Private Hospitals in Northeast Ethiopia"*, found overall adherence of 51.6%, with better adherence in private hospitals (60.4%) than in public ones (52.2%). Adherence was strongly linked to availability of written guidelines, PPE, running water, good knowledge, and favorable attitudes (Mohammed et al., 2024). Our higher adherence levels (average ~84% "yes") are better than those reported in Northeast Ethiopia. However, the Ethiopian findings remind us that structural supports, such as supplies, water, and clear guidelines, are crucial for sustaining adherence. We did not measure these institutional factors, so we cannot say whether similar mechanisms were operating in Lahore.

Finally, a 2025 critical-care focused study, *"Determinants of Nurses' Compliance with Infection Prevention and Control Practices in Critical Care Units"*, reported that 71% of nurses had good compliance with infection prevention and control practices, and that critical care experience and institutional support were strong predictors of better compliance (Batran et al., 2025). The present study's high adherence levels in ICUs are consistent with (Batran et al., 2025) in showing that critical care settings can achieve relatively good practice. However, we did not test predictors such as years of ICU experience or institutional support, so our findings complement rather than duplicate that work.

- **Similarities:** Good overall adherence, with persistent gaps in some PPE-related behaviours, are consistent with studies from Lahore, Jordan, Brazil, and Ethiopia.
- **Differences:** Our nurses show better reported hand hygiene and sharps-related practices than some international samples, but still show lower adherence for glove use during dressing changes and some lower-risk situations.
- **Possible outcomes:** If the few weak areas identified in this study are not addressed, they may contribute to preventable healthcare-associated infections, despite otherwise good practice.

The main research question was to assess the adherence of ICU nurses to infection control protocols in three tertiary hospitals in Lahore, and to see whether practices differed by gender or hospital.

1. **Level of adherence to infection control protocols:**

Nurses showed a high level of self-reported adherence, with an average of about 84% "yes" responses across 20 standard precaution items. Hand hygiene, use of gloves for high-risk fluid exposure, and sharps safety behaviors were especially strong. However, adherence for wearing gloves during dressing changes and in some "less obvious" risk situations (mucosa, non-patient contact) was clearly lower.

2. **Hypothesis regarding gender differences:**

The chi-square tests showed no statistically significant association between gender and any of the 20 infection control practice items (all $p > 0.05$). Therefore, the hypothesis that infection control practices differ by gender is not supported by this study.

3. **Hypothesis regarding hospital differences:**

A second set of chi-square tests found no significant association between hospital (Sir Ganga Ram, Jinnah, General) and any of the practice items (all $p > 0.05$). Thus, the hypothesis that infection control practices differ significantly across the three tertiary hospitals is also not supported.

In simple terms, ICU nurses in all three hospitals, regardless of gender, reported similar levels and patterns of adherence to infection control protocols. When seen together with recent local and international studies, the present findings add to a consistent pattern: nurses usually understand and apply the main elements of infection control, but certain actions such as always wearing gloves for dressing changes, consistently using full PPE for splash-risk procedures, or maintaining precautions in lower-risk moments remain challenging. Compared with some international samples where overall adherence is only fair or inadequate, ICU nurses in these Lahore tertiary hospitals appear to be performing comparatively well. However, the repeated observation across different countries that a few specific behaviours lag behind suggests that these are not only local problems but global weak spots in day-to-day infection control practice.

5.1 Strengths and Limitations

5.1.1 Strengths:

- The study included a relatively large sample (n = 300) of ICU nurses from three major tertiary care hospitals, which improves the reliability of the estimates and gives a broader picture of ICU practice in Lahore.
- The focus on ICUs is important, as patients in these units are highly vulnerable to healthcare-associated infections, and infection control practices have a direct impact on morbidity and mortality.
- A structured checklist covering 20 core items of standard precautions was used, allowing a detailed assessment of specific behaviors rather than only a global score.

5.1.2 Limitations:

- The design was cross-sectional and based on self-reported data. Nurses may have over-reported good practices due to social desirability or fear of judgment, so actual adherence might be lower than reported.
- Only nurses working in ICU settings of three tertiary hospitals were included. The findings cannot be generalized to physicians, other healthcare workers, non-ICU wards, or smaller hospitals.
- Important factors such as availability of PPE, workload, staffing levels, prior training in infection control, knowledge scores, and attitudes toward standard precautions were not measured. This limits our ability to explain why some practices are strong and others are weak.
- The study did not measure infection outcomes (such as rates of healthcare-associated infections), so we cannot directly link adherence scores to patient-level outcomes.

5.2 Implications:

5.2.1 For knowledge:

This study provides updated, ICU-specific data on adherence to infection control protocols in tertiary hospitals in Lahore. By breaking down adherence into 20 specific behaviors, it shows exactly where practice is strong and where it is weaker. This can help refine future training content and guide more focused research on "stubborn" behaviors such as glove use during routine dressing changes.

5.2.2 For policy:

The absence of significant differences between hospitals suggests that infection control policies and implementation in these tertiary centers are relatively aligned. Policymakers at hospital and provincial level can build on this foundation by:

Ensuring sustained availability of PPE, color-coded bins, sharps containers, and running water, as highlighted in the Ethiopian study where such structural factors significantly influenced adherence. Integrating regular ICU-specific audits and feedback on key practice gaps like dressing-change glove use and proper PPE for splash risk. Linking adherence to infection control protocols with institutional quality indicators and accreditation standards.

5.2.3 For practice:

Teaching should focus on the specific behaviors where adherence is lower (e.g., gloves during dressing changes, PPE in borderline risk situations) rather than only repeating broad messages about hand hygiene and universal precautions. Because the weak areas are often "routine" tasks, real-time reminders from charge nurses, visual cues at the bedside, and periodic observation can help convert knowledge into habit. Studies in critical care have shown that institutional support and ICU experience predict better compliance. A positive safety culture, where staff feel supported rather than blamed, can encourage honest reporting of lapses and continuous improvement in infection control.

5.3 Recommendations:

Based on the results and limitations, the following directions are suggested for future research: Combine self-reported questionnaires with direct observation of practices in ICUs to reduce social desirability bias and get a more objective picture of adherence. Future studies should measure nurses' knowledge, attitudes, and perceived barriers, along with structural factors like PPE availability, staffing level, and training history. This would help identify which factors most strongly predict adherence in ICU settings. Design and test targeted educational or multimodal interventions (e.g., training, reminders, feedback) focused on the weakest items, and then measure changes in practice over time. Include nurses from non-ICU wards, private hospitals, and district hospitals to compare adherence patterns and identify system-level differences. Where feasible, future work should link adherence scores to ICU infection rates, length of stay, or other clinical outcomes, to show the real-world impact of improved practice.

5.4 Conclusion:

This study shows that ICU nurses in three tertiary hospitals in Lahore report a generally high level of adherence to infection control protocols, particularly in hand hygiene, glove use for high-risk exposures, and sharps safety. However, adherence is lower for certain routine yet important behaviors, especially wearing gloves during dressing changes and in

some less clearly perceived risk situations. No significant differences were found between male and female nurses or across the three hospitals. Taken together with recent local and international evidence, these findings suggest that while ICU infection control practice in tertiary hospitals in Lahore is comparatively strong, there is still room for improvement in a small set of critical behaviors. Addressing these gaps through focused training, supportive supervision, and institutional support can help further reduce the risk of healthcare-associated infections and protect both patients and healthcare workers in intensive care units.

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