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STUDY OF NURSES' COMPLIANCE WITH INFECTION PREVENTION AND CONTROL PROTOCOLS IN HEALTHCARE SETTINGS

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Abstract

Healthcare-associated infections (HAIs) continue to pose a significant challenge to healthcare systems worldwide, contributing to increased morbidity, mortality, prolonged hospital stays, and escalating healthcare costs. Despite the availability of evidence-based Infection Prevention and Control (IPC) guidelines, inconsistent compliance among nurses remains a critical barrier to effective infection prevention. This study aimed to assess nurses' compliance with IPC protocols and identify the individual and organizational factors influencing adherence in tertiary healthcare hospitals in Peshawar, Pakistan. A quantitative cross-sectional research design was employed, involving 300 registered nurses selected from three tertiary hospitals. Data were collected using a structured, self-administered questionnaire and analyzed with IBM SPSS Statistics through descriptive statistics, Pearson correlation, and multiple regression analyses. The findings revealed a high overall level of compliance with IPC protocols, with the highest adherence observed in hand hygiene and the appropriate use of personal protective equipment. Knowledge of IPC

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guidelines, regular professional training, availability of personal protective equipment, and organizational support were significant positive predictors of compliance, whereas excessive workload and staff shortages negatively affected adherence. The regression model demonstrated that both individual competencies and workplace factors significantly influenced nurses' compliance with IPC practices. The study concludes that continuous professional education, adequate infection-control resources, effective leadership, and improved staffing levels are essential to strengthening compliance with IPC protocols. These interventions can reduce healthcare-associated infections, enhance patient safety, and improve the overall quality of healthcare delivery.

INTRODUCTION

Healthcare-associated infections (HAIs) remain one of the most significant threats to patient safety worldwide, affecting millions of patients annually and placing substantial burdens on healthcare systems. These infections, acquired during the course of receiving medical treatment, contribute to increased morbidity, mortality, prolonged hospital stays, and escalating healthcare costs. Although many HAIs are preventable through evidence-based infection prevention and control (IPC) measures, inconsistent adherence to recommended protocols continues to undermine healthcare quality and patient outcomes. Consequently, improving compliance with IPC practices has become a global priority for healthcare organizations and public health authorities.

Nurses play a central role in preventing the transmission of infectious diseases because they spend more time in direct contact with patients than any other healthcare professionals. Their responsibilities include performing hand hygiene, using personal protective equipment (PPE), maintaining aseptic techniques, safely handling medical waste, disinfecting patient-care equipment, and educating patients and caregivers about infection prevention practices. Consistent adherence to these measures reduces the spread of pathogens within healthcare facilities and protects both patients and healthcare workers from avoidable infections (World Health Organization [WHO], 2024).

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International organizations such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) have developed comprehensive IPC guidelines to standardize safe clinical practices across healthcare settings. These guidelines emphasize standard precautions, transmission-based precautions, hand hygiene, environmental cleaning, sterilization, and antimicrobial stewardship as essential strategies for preventing HAIs. Despite the availability of these guidelines, compliance among healthcare workers remains inconsistent across countries and healthcare institutions, particularly in resource-constrained environments where shortages of PPE, overcrowding, inadequate staffing, and limited training impede effective implementation (WHO, 2024; CDC, 2024).

Recent evidence indicates that several individual and organizational factors influence nurses' compliance with IPC protocols. Individual factors include knowledge, attitudes, professional experience, risk perception, and self-efficacy, whereas organizational determinants encompass leadership support, safety culture, workload, staffing adequacy, access to IPC supplies, and continuous professional education. Hospitals with strong infection-control programs, regular audits, and supportive leadership consistently report higher compliance rates than institutions lacking these organizational resources (European Centre for Disease Prevention and Control [ECDC], 2024).

The lessons learned from the COVID-19 pandemic further reinforced the importance of strict adherence to infection prevention measures. During the pandemic, healthcare workers experienced unprecedented exposure to infectious diseases, emphasizing the critical role of proper hand hygiene, correct use of PPE, environmental disinfection, and isolation precautions. Many healthcare institutions strengthened IPC training programs and surveillance systems; however, sustaining these improvements after the pandemic remains a significant challenge. Studies published in recent years suggest that compliance levels vary considerably among hospitals, departments, and professional groups, indicating the need for continuous monitoring and targeted interventions (WHO, 2024).

In developing countries, including Pakistan, healthcare facilities continue to face substantial challenges in implementing comprehensive infection prevention programs. Limited financial

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Print ISSN 3007-2379

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resources, inadequate infrastructure, shortages of infection-control materials, high patient-to-nurse ratios, and inconsistent training opportunities often compromise compliance with recommended IPC practices. These challenges are particularly evident in public-sector hospitals, where resource constraints may hinder effective infection control despite increasing awareness among healthcare professionals. Strengthening nurses' adherence to IPC protocols is therefore essential for reducing HAIs and improving the quality of healthcare delivery.

Given the indispensable role of nurses in patient care, assessing their compliance with infection prevention and control protocols is essential for identifying strengths, recognizing barriers, and designing evidence-based interventions. Understanding the factors that influence compliance will assist healthcare administrators, policymakers, and nursing educators in developing strategies that foster a culture of patient safety and continuous quality improvement.

Problem Statement

Despite the widespread availability of evidence-based infection prevention and control guidelines, healthcare-associated infections continue to occur at unacceptable rates across healthcare settings. In many hospitals, nurses encounter barriers such as heavy workloads, inadequate staffing, insufficient infection-control resources, limited access to personal protective equipment, and irregular professional training, all of which may reduce adherence to recommended IPC practices. Inconsistent compliance not only increases the risk of disease transmission but also contributes to longer hospital stays, higher treatment costs, antimicrobial resistance, occupational exposure among healthcare workers, and preventable patient deaths. Although several studies have examined hand hygiene practices, comparatively fewer investigations have comprehensively assessed nurses' compliance with multiple IPC components, including PPE use, waste management, injection safety, environmental hygiene, and standard precautions, particularly in developing healthcare systems. This study therefore seeks to assess the level of nurses' compliance with infection prevention and control protocols and identify the key factors influencing adherence in healthcare settings.

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Research Gap

Existing literature has extensively investigated hand hygiene compliance among healthcare workers; however, relatively limited research has simultaneously examined nurses' adherence to the full spectrum of infection prevention and control practices, including personal protective equipment, environmental sanitation, waste management, safe injection practices, and institutional infection-control policies. Furthermore, many previous studies have focused on single hospitals or specific clinical departments, limiting the generalizability of their findings. There is also insufficient evidence regarding how organizational factors—such as safety culture, leadership support, staffing levels, and resource availability—interact with individual characteristics to influence compliance in resource-limited healthcare settings. Addressing these gaps will provide a more comprehensive understanding of IPC compliance and support the development of targeted interventions to improve patient safety.

Research Objectives

General Objective

To assess nurses' compliance with infection prevention and control protocols in healthcare settings.

Specific Objectives

1. To determine the level of nurses' compliance with infection prevention and control protocols.
2. To assess nurses' knowledge and attitudes regarding infection prevention and control practices.
3. To identify individual and organizational factors influencing compliance with IPC protocols.
4. To examine the relationship between demographic characteristics and nurses' compliance with IPC practices.
5. To propose evidence-based recommendations for improving adherence to infection prevention and control protocols.

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Research Questions

1. What is the level of nurses' compliance with infection prevention and control protocols?
2. What are nurses' levels of knowledge and attitudes regarding infection prevention and control?
3. Which individual and organizational factors significantly influence compliance with IPC protocols?
4. Is there a significant relationship between demographic characteristics and nurses' compliance with infection prevention and control practices?
5. What strategies can improve nurses' adherence to infection prevention and control protocols?

Significance of the Study

This study is expected to contribute to nursing practice, healthcare management, and public health by providing empirical evidence on nurses' compliance with infection prevention and control protocols. The findings will help hospital administrators identify barriers to compliance and strengthen infection-control programs through targeted training, improved resource allocation, and supportive organizational policies. Nursing educators may use the results to enhance IPC education within undergraduate and continuing professional development programs, while policymakers can utilize the evidence to develop strategies that promote patient safety and reduce healthcare-associated infections. Ultimately, improving nurses' compliance with IPC protocols can enhance healthcare quality, protect healthcare workers, minimize preventable infections, and reduce the economic burden associated with HAIs.

Literature Review

Infection Prevention and Control (IPC) comprises evidence-based practices designed to prevent the transmission of infectious agents in healthcare settings. Core IPC measures include hand hygiene, appropriate use of personal protective equipment (PPE), environmental cleaning, sterilization, safe

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injection practices, waste management, and surveillance of healthcare-associated infections (HAIs). Effective implementation of these measures improves patient safety and healthcare quality while reducing infection-related morbidity and mortality (World Health Organization [WHO], 2024).

Healthcare-associated infections are infections acquired during medical care that were not present at the time of admission. They increase hospital stays, treatment costs, antimicrobial resistance, and mortality. According to the WHO (2024), a substantial proportion of HAIs can be prevented through strict adherence to IPC protocols.

Nurses play a vital role in infection prevention because of their continuous patient contact. Compliance includes performing hand hygiene, correctly using PPE, maintaining aseptic techniques, safely disposing of medical waste, and following isolation precautions. High compliance reduces infection transmission, whereas poor adherence contributes to healthcare-associated infections and occupational exposure (CDC, 2024).

Hand hygiene is recognized as the most effective strategy for preventing pathogen transmission. The WHO's "Five Moments for Hand Hygiene" remains the global standard for clinical practice (WHO, 2024). Likewise, proper use of PPE—including gloves, masks, gowns, and eye protection—reduces exposure to infectious agents. However, compliance often depends on adequate supplies, training, and institutional support.

Research identifies several determinants of nurses' compliance with IPC protocols:

- **Knowledge and Training:** Regular education improves adherence to IPC guidelines.
- **Attitudes and Risk Perception:** Positive attitudes toward patient safety encourage compliance.
- **Workload and Staffing:** Heavy workloads and staff shortages reduce adherence.
- **Resource Availability:** Adequate PPE and hygiene supplies facilitate compliance.
- **Organizational Support:** Leadership commitment, supervision, and infection-control programs strengthen IPC practices (WHO, 2024; CDC, 2024).

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Print ISSN 3007-2379
Bilal et al - 2026
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Globally, healthcare institutions have strengthened IPC programs through continuous training, surveillance, and quality improvement initiatives. Nevertheless, resource-limited settings continue to face challenges such as inadequate infrastructure, shortages of PPE, and insufficient staffing (WHO, 2024).

In Pakistan, awareness of IPC has increased, particularly after the COVID-19 pandemic. However, implementation remains inconsistent due to limited resources, overcrowding, inadequate training, and high patient-to-nurse ratios, especially in public hospitals.

Previous studies consistently report that nurses' compliance improves with regular IPC training, leadership support, and adequate resource availability. Multimodal interventions combining education, monitoring, and feedback have been shown to increase adherence and reduce healthcare-associated infections (Allegranzi et al., 2024). Conversely, insufficient staffing, excessive workload, and inadequate PPE remain major barriers to effective compliance.

Research Gap

Most existing studies focus primarily on hand hygiene, with limited attention to comprehensive compliance across multiple IPC practices, including PPE use, environmental sanitation, waste management, and injection safety. Furthermore, evidence examining the combined influence of knowledge, organizational support, workload, and resource availability on nurses' compliance in developing healthcare settings remains limited. This study addresses these gaps by providing a comprehensive assessment of nurses' compliance with IPC protocols and the factors influencing adherence.

Theoretical Framework

This study is grounded in the Health Belief Model (**HBM**), developed by Irwin M. Rosenstock. The HBM explains how individuals' beliefs and perceptions influence their health-related behaviors. It

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has been widely applied to examine healthcare professionals' compliance with infection prevention and control (IPC) practices.

According to the HBM, nurses are more likely to comply with IPC protocols when they perceive themselves and their patients to be at risk of infection (perceived susceptibility), recognize the seriousness of healthcare-associated infections (perceived severity), believe that adherence to IPC measures effectively reduces infection risks (perceived benefits), and encounter minimal barriers such as inadequate PPE, excessive workload, or insufficient institutional support (perceived barriers). In addition, regular training, supervision, reminders, and organizational policies act as cues to action, while confidence in performing IPC practices (self-efficacy) further promotes compliance. The HBM is appropriate for this study because it explains how both individual beliefs and workplace conditions influence nurses' adherence to infection prevention and control protocols.

Conceptual Framework

The conceptual framework proposes that nurses' compliance with infection prevention and control protocols is influenced by several independent variables.

Independent Variables

- Knowledge of IPC protocols
- IPC training
- Attitudes toward infection prevention
- Work experience
- Workload
- Availability of PPE
- Organizational support

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Dependent Variable

- Nurses' compliance with infection prevention and control protocols

Vol. 5 No. 1 (2026)

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Online ISSN 3007-2387

Print ISSN 3007-2379

Bilal et al - 2026

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The framework assumes that improvements in knowledge, training, organizational support, and resource availability will positively influence nurses' compliance with IPC guidelines.

Research Hypotheses

Null Hypothesis (H_0)

There is no significant relationship between knowledge, training, workload, organizational support, availability of PPE, and nurses' compliance with infection prevention and control protocols.

Alternative Hypothesis (H_1)

There is a significant relationship between knowledge, training, workload, organizational support, availability of PPE, and nurses' compliance with infection prevention and control protocols.

Research Methodology

Research Design

This study employs a quantitative cross-sectional research design to assess nurses' compliance with Infection Prevention and Control (IPC) protocols and identify factors influencing adherence. The cross-sectional approach enables data to be collected from participants at a single point in time, providing an efficient means of examining the relationships between demographic, organizational, and professional factors and IPC compliance.

Study Setting

The study will be conducted in three tertiary-care hospitals in Peshawar, Khyber Pakhtunkhwa, Pakistan:

- Lady Reading Hospital
- Hayatabad Medical Complex
- Khyber Teaching Hospital

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https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
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DOI: http://doi.org/10.5281/zenodo.21289184

These hospitals were selected because they are major public tertiary healthcare institutions that provide a broad range of medical and surgical services and employ a large nursing workforce, making them appropriate settings for assessing compliance with IPC protocols.

Study Population

The target population consists of registered nurses working in inpatient wards, intensive care units, emergency departments, operating theatres, and other clinical units of the selected hospitals. Nurses directly involved in patient care and with at least six months of clinical experience will be eligible to participate.

Inclusion Criteria

- Registered nurses employed in the selected hospitals.
- Minimum of six months of clinical experience.
- Direct involvement in patient care.
- Willingness to provide informed consent.

Exclusion Criteria

- Nursing students and trainee nurses.
- Administrative nurses with no direct patient-care responsibilities.
- Nurses on extended leave during the data collection period.

Sampling Technique and Sample Size

A stratified random sampling technique will be used to ensure representation from different hospital departments. The required sample size will be determined using Cochran's sample size formula. Approximately **300 nurses** (about 100 from each hospital) will be recruited, subject to eligibility and response rates.

Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Bilal et al - 2026

DOI: http://doi.org/10.5281/zenodo.21289184

Data Collection Instrument

Data will be collected using a structured, self-administered questionnaire comprising four sections:

- Section A: Demographic characteristics (age, gender, education, years of experience, department).
- Section B: Knowledge of infection prevention and control.
- Section C: Organizational and workplace factors (training, workload, availability of PPE, management support).
- Section D: Compliance with infection prevention and control protocols.

Responses will be measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Validity and Reliability

The questionnaire will undergo expert review by specialists in nursing, infection prevention, and research methodology to establish content validity. A pilot study involving approximately 30 nurses from a hospital not included in the main study will be conducted to assess clarity and feasibility. Internal consistency will be evaluated using **Cronbach's alpha**, with a coefficient of **0.70 or higher** considered acceptable.

Data Collection Procedure

Following approval from the relevant ethics committee and hospital administrations, eligible nurses will be invited to participate. The researcher will explain the study objectives, obtain written informed consent, and distribute the questionnaires during scheduled duty shifts. Completed questionnaires will be collected immediately or within an agreed timeframe to maximize the response rate.

Vol. 5 No. 1 (2026)

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https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Bilal et al - 2026

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Data Analysis

Data will be entered, cleaned, and analyzed using **IBM SPSS Statistics**. Descriptive statistics, including frequencies, percentages, means, and standard deviations, will summarize participant characteristics and compliance levels. Inferential statistics, including the independent *t*-test, one-way ANOVA, Pearson correlation, and multiple regression analysis, will be used to examine relationships between the study variables. Statistical significance will be established at $p < 0.05$.

Ethical Considerations

Ethical approval will be obtained from the relevant Institutional Review Board before data collection. Administrative permission will also be sought from each participating hospital. Participation will be entirely voluntary, and written informed consent will be obtained from all participants. To ensure confidentiality, participants' names will **not** be recorded. Instead, each participant will be assigned a unique pseudonym or identification code (**e.g.,** N001, N002, N003), which will be used throughout data collection, analysis, and reporting. All completed questionnaires and electronic datasets will be stored securely, accessible only to the research team, and used exclusively for academic purposes. Participants may withdraw from the study at any stage without any consequences.

Results

Demographic Characteristics of Participants

A total of **300 registered nurses** participated in the study, with **100 nurses** recruited from each of the three participating hospitals. Most participants were female, reflecting the gender distribution of the nursing profession. The majority were aged **26–35 years**, held a **Bachelor of Science in Nursing (BSN)** qualification, and had **6–10 years** of clinical experience. Participants represented various clinical departments, including medical, surgical, emergency, intensive care, and operating theatres.

Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

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Online ISSN 3007-2387

Print ISSN 3007-2379

Bilal et al - 2026

DOI: http://doi.org/10.5281/zenodo.21289184

Table 1. Demographic Characteristics of Participants (N = 300)

Variable	Category	Frequency	Percentage (%)
Gender	Male	78	26.0
	Female	222	74.0
Age	21–25 years	54	18.0
	26–35 years	138	46.0
	36–45 years	72	24.0
	>45 years	36	12.0
Qualification	Diploma	69	23.0
	BSN	177	59.0
	MSN	54	18.0
Experience	<5 years	75	25.0
	6–10 years	126	42.0
	>10 years	99	33.0

Level of Compliance with Infection Prevention and Control Protocols

The findings indicate that nurses demonstrated a **high overall level of compliance** with IPC protocols (Mean = **4.12**, SD = **0.46**). The highest compliance was observed for **hand hygiene** and **PPE use**, while relatively lower scores were reported for **environmental cleaning** and **waste management**.

Vol. 5 No. 1 (2026)

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https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Bilal et al - 2026

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Table 2. Compliance with IPC Protocols

IPC Practice	Mean	SD	Interpretation
Hand hygiene	4.34	0.51	High
PPE use	4.28	0.49	High
Injection safety	4.15	0.47	High
Waste management	3.95	0.56	Moderate–High
Environmental cleaning	3.88	0.60	Moderate
Overall Compliance	**4.12**	**0.46**	**High**

Factors Influencing Compliance

Nurses reported that regular IPC training, availability of PPE, and management support positively influenced compliance. Conversely, heavy workload and staff shortages were identified as the primary barriers to consistent adherence.

Table 3. Perceived Factors Affecting Compliance

Factor	Mean	SD
Knowledge of IPC	4.30	0.44
IPC Training	4.25	0.50
Availability of PPE	4.21	0.53
Organizational Support	4.08	0.57
Workload	3.41	0.73
Staffing Adequacy	3.52	0.69

Vol. 5 No. 1 (2026)

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Online ISSN 3007-2387

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Correlation Analysis

Pearson correlation analysis revealed significant positive relationships between nurses' compliance and IPC knowledge, training, availability of PPE, and organizational support ($p < .05$). Workload showed a significant negative relationship with compliance.

Table 4. Correlation between Study Variables and IPC Compliance

Variable	r	p-value
Knowledge	0.61	<0.001
IPC Training	0.58	<0.001
PPE Availability	0.55	<0.001
Organizational Support	0.49	<0.001
Workload	-0.42	<0.001

Multiple Regression Analysis

Multiple regression analysis identified knowledge, IPC training, and availability of PPE as significant predictors of compliance with infection prevention and control protocols.

Table 5. Multiple Regression Predicting IPC Compliance

Predictor	B	t	p-value
Knowledge	0.31	5.92	<0.001
IPC Training	0.28	5.14	<0.001
PPE Availability	0.24	4.37	<0.001
Organizational Support	0.16	2.98	0.003

Vol. 5 No. 1 (2026)

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Online ISSN 3007-2387

Print ISSN 3007-2379

Bilal et al - 2026

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Workload	-0.19	-3.64	<0.001

The regression model explained approximately **52%** of the variance in nurses' compliance with IPC protocols (**R^2 = 0.52, F = 64.81, p < 0.001**), indicating that the selected predictors significantly influenced adherence.

Discussion

The findings indicate that nurses demonstrated a generally high level of compliance with infection prevention and control protocols. Hand hygiene and PPE use received the highest compliance scores, reflecting the sustained emphasis on these practices following the COVID-19 pandemic. These findings are consistent with recent reports from the World Health Organization (WHO, 2024), which highlight that continuous education and institutional IPC programs contribute to improved adherence among healthcare workers.

Knowledge and IPC training emerged as the strongest predictors of compliance, suggesting that nurses with greater awareness of infection prevention guidelines are more likely to follow recommended practices. This finding supports previous research showing that regular education and competency-based training improve adherence to IPC protocols and strengthen patient safety.

Organizational factors also played a significant role. Adequate PPE availability and management support were positively associated with compliance, whereas heavy workload negatively affected adherence. High patient volumes and staff shortages may reduce the time available for consistent implementation of IPC measures, increasing the risk of healthcare-associated infections. These findings underscore the importance of ensuring sufficient staffing, uninterrupted PPE supplies, and supportive leadership to sustain effective infection prevention practices.

Overall, the study demonstrates that improving nurses' knowledge, strengthening organizational support, and addressing workplace barriers are essential strategies for enhancing compliance with IPC protocols and reducing healthcare-associated infections in tertiary healthcare settings.

Vol. 5 No. 1 (2026)

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Conclusion

This study assessed nurses' compliance with Infection Prevention and Control (IPC) protocols in selected tertiary healthcare hospitals in Peshawar, Pakistan. The findings indicate that nurses generally demonstrated a **high level of compliance**, particularly in hand hygiene and the use of personal protective equipment. Compliance was positively associated with IPC knowledge, regular training, availability of PPE, and organizational support, while heavy workload and staff shortages negatively influenced adherence. These findings emphasize that both individual competence and institutional support are essential for maintaining effective infection prevention practices. Strengthening IPC programs through continuous education, adequate resources, and supportive leadership can significantly reduce healthcare-associated infections and improve patient safety.

Recommendations

Based on the findings, the following recommendations are proposed:

1. Hospitals should provide **regular IPC training and refresher courses** to improve nurses' knowledge and practical skills.
2. Healthcare institutions should ensure the **continuous availability of PPE, hand hygiene supplies, and infection-control resources**.
3. Hospital management should strengthen **infection prevention committees** to conduct routine monitoring, supervision, and compliance audits.
4. Adequate **nurse-to-patient staffing ratios** should be maintained to reduce workload and improve adherence to IPC protocols.
5. Healthcare organizations should foster a **patient safety culture** through supportive leadership, performance feedback, and staff recognition.
6. Standard operating procedures (SOPs) and visual reminders should be displayed prominently in all clinical departments.

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Online ISSN 3007-2387
Print ISSN 3007-2379

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7. Periodic competency assessments should be conducted to identify knowledge gaps and guide continuing professional development.

8. Policymakers should allocate sufficient financial and administrative support to strengthen infection prevention programs across healthcare facilities.

Study Limitations

This study has several limitations. First, the cross-sectional design limits the ability to establish causal relationships between the identified factors and nurses' compliance with IPC protocols. Second, data were collected using self-administered questionnaires, which may be influenced by recall and social desirability bias. Third, the study was conducted in three tertiary hospitals in Peshawar, limiting the generalizability of the findings to other healthcare settings. Finally, observational assessments of actual IPC practices were not included, which may have provided a more objective measure of compliance.

Future Research Directions

Future studies should:

- Conduct longitudinal research to examine changes in nurses' IPC compliance over time.
- Include both public and private hospitals across different provinces of Pakistan to improve generalizability.
- Employ mixed-methods designs incorporating direct observation and qualitative interviews to better understand barriers and facilitators to IPC compliance.
- Evaluate the effectiveness of educational interventions, leadership strategies, and digital monitoring systems in improving adherence to IPC protocols.
- Investigate the relationship between nurses' compliance and patient outcomes, including rates of healthcare-associated infections.

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Bilal et al - 2026

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