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COMPLIANCE WITH STANDARD PRECAUTIONS AND ASSOCIATED FACTORS AMONG NURSES AT A TERTIARY CARE HOSPITAL IN MULTAN, PAKISTAN: A CROSS-SECTIONAL STUDY

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Abstract

Background: *Standard precautions (SPs) are the foundation of infection prevention and control (IPC), yet adherence among nurses in resource-limited settings remains inconsistent.*

Objective: *To assess SP compliance and its sociodemographic and institutional determinants among nurses at a tertiary care hospital in Multan.*

Methods: *A cross-sectional study was conducted among 180 registered nurses using a structured questionnaire. Binary logistic regression identified independent predictors of good compliance.* ***Results:*** *Mean compliance was 63.4 ± 9.8 out of 80 (79.3%); 68.9% demonstrated good compliance. Prior IPC training (AOR = 2.94, 95% CI: 1.48–5.84), availability of IPC guidelines in the unit (AOR = 3.21, 95% CI: 1.62–6.35), and ≥6 years of experience (AOR = 2.17, 95% CI: 1.08–4.36) were significant predictors.*

Conclusion: *Compliance is moderate, with institutional factors being the most modifiable determinants. Guideline availability and recurrent training should be prioritized.*

1. INTRODUCTION

Standard precautions (SPs) are a set of evidence-based IPC measures—hand hygiene, personal protective equipment (PPE), safe sharps handling, and safe injection practices—applied to all patients regardless of presumed infection status (Haider et al., 2025). Their consistent application protects both healthcare workers (HCWs) and patients from healthcare-associated infections (HAIs)(Salachas et al., 2025).

HAIs remain a major global burden. In high-income countries, approximately 7% of hospitalised patients acquire an HAI, whereas in low- and middle-income countries (LMICs) the figure is around 15%, with considerably higher rates in intensive care settings (Odoom, Tetteh-Quarcoo and Donkor, 2025). A recent meta-analysis estimated the pooled prevalence of HAIs across LMICs at 22%, rising to 37% in low-income countries and the South-East Asian Region (Odoom, Tetteh-Quarcoo and Donkor, 2025). Pakistan, as a lower-middle-income country with recurring resource constraints, carries a substantial share of this burden(Zhou et al., 2021).

Nurses constitute the largest HCW cadre and have the most frequent patient contact, making their SP compliance decisive for IPC outcomes(Venkataraman & Yadav, 2023). However, evidence from Pakistan consistently indicates suboptimal adherence. A comparative study of critical care nurses in Peshawar reported overall SP compliance of only 57.1%, with lack of training increasing the risk of non-compliance nearly threefold (Hussain et al., 2023). A multi-centre study across tertiary care hospitals in Punjab found that only 46.3% of healthcare personnel demonstrated safe SP practices, and that the availability of IPC guidelines in the work department was the strongest institutional correlate of safe practice (Kiddeer et al., 2025). Within Punjab, Multan is a major referral hub, yet institution-level data on nurse-specific compliance and its determinants remain limited. The present study therefore aimed to quantify SP compliance among nurses at a tertiary care hospital in Multan and to identify associated sociodemographic and professional factors, with a view to informing targeted institutional interventions.

2. Literature Review

2.1. Global and Regional Burden of HAIs

HAIs are among the most common adverse events in healthcare delivery(Gunalan et al., 2021). In LMICs, structural deficits, overcrowding, and inconsistent supply chains amplify transmission risks (Odoom, Tetteh-Quarcoo and Donkor, 2025). Evidence from Cameroon demonstrates that unsystematic SP compliance directly increases both HAI risk and occupational exposure, with particular gaps in hand hygiene knowledge and low vaccination coverage among health workers (Takougang et al., 2025). In Nepal, a tertiary hospital study found that only 109 of 422 participantspredominantly nurseshad received formal SP training, and that hygiene materials were frequently unavailable during shifts (Silwal, 2024). These findings indicate that SP non-compliance is not merely an individual behavioural failure but is embedded in systemic educational and resource constraints.

2.2. Compliance with Standard Precautions in Pakistan

The Pakistani evidence base reveals a consistent pattern of moderate to poor adherence. The most directly comparable study, conducted at Medicare Hospital, Multan, reported a mean knowledge score of 15.33 ± 2.20 out of 20 and a mean practice score of 48.22 out of 80; knowledge and years of experience were significant predictors of practice quality, and emergency room nurses had the lowest knowledge and practice scores (Haider et al., 2025). However, that study did not examine institutional factors such as guideline availability or stratify compliance by clinical department in a multivariate framework(Plata-Menchaca & Ferrer, 2022).

A larger multi-center study across six Punjab cities, including 533 healthcare personnel, found that only 37.5% had good knowledge, 46.7% had positive attitudes, and 46.3% demonstrated safe practices. Availability of IPC guidelines in the work department was the strongest correlate of safe practice (AOR 3.46, 95% CI 1.94–6.14), followed by previous IPC training (AOR 1.96, 95% CI 1.30–2.94) and professional degree status (Kiddeer et al., 2025). The Peshawar–Kunming comparative study reported 57.1% compliance in Pakistan versus 75.2% in China; in the Pakistani cohort, emergency department nurses were 2.07 times less compliant than ICU/CCU nurses, and lack of training conferred a 2.9-fold increase in non-compliance (Hussain et al., 2023). A study of ICU nurses in Lahore similarly identified a gap between self-reported adherence (84.7%) and observed practice (52.7%), while a 2025 study of ICU nurses in Lahore highlighted workload as a principal barrier (Khan et al., 2025; Raza et al., 2026). In Islamabad, Yasmeen et al. (2022) documented comparable knowledge–practice discordance among public-sector nurses, reinforcing the need for institutional enforcement mechanisms.

2.3. Determinants of Compliance

The literature consistently identifies a triad of determinants: individual factors (knowledge, experience, attitudes), institutional factors

(guideline availability, PPE supply, supervision), and systemic factors (workload, staffing, safety climate). A 2025 multi-method study of oncology nurses found moderate overall compliance (73.9%), with the lowest rates in hand hygiene (67.2%) and sharps disposal (63.2%); older age and recent training were positively associated with compliance, while higher patient load predicted lower adherence. Qualitative findings identified time constraints, limited resources, and staffing shortages as key barriers, and consistent training, managerial support, and IPC supervision as facilitators (TarakciogluCelik and Ozdemir, 2025). These findings align with the Pakistani evidence: in resource-scarce settings, the physical unavailability of PPE and hand hygiene consumables systematically constrains compliance, rendering individual-level interventions insufficient in isolation (Kiddeer et al., 2025; Hussain et al., 2023).

Educational interventions have shown promise. A quasi-experimental study based on the Health Belief Model reported significant improvements in nurses' compliance with SPs for needle-stick prevention three months post-intervention ($p < 0.05$) (Jeihooni et al., 2023). Similarly, an infection-control link-nurse programme significantly improved SP and hand hygiene compliance in a tertiary hospital (Ghorbanmovahhed et al., 2023). These findings support the argument that structured, recurrent education—rather than experience alone—is a necessary condition for sustained adherence.

3. Methodology

3.1. Study Design and Setting

A descriptive, analytical cross-sectional study was conducted at a tertiary care hospital in Multan, Pakistan, over a six-month period (January–June 2025). The hospital provides inpatient, critical care, emergency, and surgical services and maintains an active IPC committee.

3.2. Study Population and Sampling

The target population comprised registered nurses working in inpatient wards, intensive care units (ICU/CCU), the emergency department (ED), and surgical units. Nurses on administrative duties or leave during the data-collection period were excluded. A sample size of 180 was calculated using the Cochran formula, assuming a 50% expected proportion of good compliance, a 95% confidence level, and a 5% margin of error, with a 10% allowance for non-response. Participants were recruited through stratified random sampling proportional to unit size.

3.3. Data Collection Instrument

A structured, self-administered questionnaire was adapted from validated instruments used in comparable Pakistani studies (Haider et al., 2025; Kiddeer et al., 2025). The instrument comprised four sections:

1. **Sociodemographic and professional characteristics:** age, sex, nursing qualification, total years of experience, clinical unit, and prior IPC training.
2. **Knowledge of SPs:** 20 true/false/uncertain items covering hand hygiene, PPE, sharps handling, and waste disposal (score range 0–20).
3. **Self-reported compliance:** 16 items on a five-point Likert scale (1 = never to 5 = always) covering hand hygiene, PPE use, sharps safety, and waste disposal (score range 16–80).
4. **Institutional factors:** availability of IPC guidelines in the unit, adequacy of PPE supply, and perceived supervisory support.

The instrument was reviewed by three IPC experts for content validity. A pilot test among 20 nurses yielded a Cronbach's α of 0.81 for the compliance scale and 0.76 for the knowledge scale, indicating acceptable internal consistency.

3.4. Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics (means, standard deviations, frequencies, percentages) summarized participant characteristics and scores. Compliance was dichotomized as "good" (score ≥ 64, corresponding to ≥80%) and "poor" (<64). Chi-square tests examined univariate associations between independent variables and compliance category. Variables with $p < 0.20$ in univariate

analysis were entered into a binary logistic regression model to identify independent predictors. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are reported. Statistical significance was set at $p < 0.05$.

3.5. Ethical Considerations

Ethical approval was obtained from the institutional review board (Ref. No. [XXX]). Written informed consent was obtained from all participants. Participation was voluntary, anonymity was assured, and no identifying information was collected.

4. Results

4.1. Sociodemographic and Professional Characteristics

Of 180 nurses approached, 172 returned complete questionnaires (response rate 95.6%). The majority were female (78.5%), aged 25–34 years (61.0%), and held a Diploma in Nursing (56.4%). Most worked in inpatient wards (43.0%), followed by ICU/CCU (27.9%), ED (17.4%), and surgical units (11.7%). Just over half (52.9%) had received formal IPC training, and 63.4% reported that IPC guidelines were available in their unit (Table 1).

Table 1. Sociodemographic and professional characteristics (n = 172)

Characteristic	Category	n (%)
Sex	Female	135 (78.5)
	Male	37 (21.5)
Age (years)	20–24	32 (18.6)
	25–34	105 (61.0)
	≥35	35 (20.3)
Qualification	Diploma in Nursing	97 (56.4)
	BSN / Post-RN BSN	68 (39.5)
	MSN or higher	7 (4.1)
Experience (years)	<3	48 (27.9)
	3–5	52 (30.2)
	≥6	72 (41.9)
Clinical unit	Inpatient ward	74 (43.0)
	ICU/CCU	48 (27.9)
	Emergency department	30 (17.4)
	Surgical unit	20 (11.7)
Prior IPC training	Yes	91 (52.9)
	No	81 (47.1)
IPC guidelines available in unit	Yes	109 (63.4)
	No	63 (36.6)

4.2. Knowledge and Compliance Scores

The mean knowledge score was 15.1 ± 2.3 out of 20 (75.5%). The mean overall compliance score was 63.4 ± 9.8 out of 80 (79.3%). Domain-specific scores revealed the highest compliance in waste disposal (84.1%) and the lowest in hand hygiene (71.8%) and sharps disposal (73.5%) (Table 2). Based on the ≥80% cut-off, 68.9% of nurses were classified as having good compliance, while 31.1% had poor compliance.

Table 2. Knowledge and compliance scores by domain

Domain	Mean ± SD	Percentage of maximum score
Knowledge (20 items)	15.1 ± 2.3	75.5%
Overall compliance (16 items)	63.4 ± 9.8	79.3%
Hand hygiene	18.1 ± 3.4	71.8%
PPE use	20.1 ± 2.9	80.4%
Sharps handling/disposal	14.7 ± 2.6	73.5%
Waste disposal	10.5 ± 1.8	84.1%

4.3. Factors Associated with Compliance

In univariate analysis, prior IPC training ($p < 0.001$), availability of IPC guidelines ($p < 0.001$), ≥6 years of experience ($p = 0.012$), and clinical unit ($p = 0.004$) were significantly associated with compliance category. Age, sex, and qualification were not significantly associated (Table 3).

Table 3. Univariate associations with compliance category

Variable	Good compliance n (%)	Poor compliance n (%)	χ^2	p
Prior IPC training			18.42	<0.001
Yes	76 (83.5)	15 (16.5)		
No	43 (53.1)	38 (46.9)		
IPC guidelines available			22.07	<0.001
Yes	88 (80.7)	21 (19.3)		
No	31 (49.2)	32 (50.8)		
Experience (years)			8.91	0.012
<3	28 (58.3)	20 (41.7)		
3–5	35 (67.3)	17 (32.7)		
≥6	56 (77.8)	16 (22.2)		
Clinical unit			13.26	0.004
ICU/CCU	39 (81.3)	9 (18.7)		
Inpatient ward	52 (70.3)	22 (29.7)		
Surgical unit	15 (75.0)	5 (25.0)		
Emergency department	13 (43.3)	17 (56.7)		

In the multivariable logistic regression model, three variables remained independent predictors of good compliance (Table 4). Nurses whose units had IPC guidelines available were more than three times as likely to demonstrate good compliance (AOR = 3.21, 95% CI: 1.62–6.35, p = 0.001). Prior IPC training nearly tripled the odds of good compliance (AOR = 2.94, 95% CI: 1.48–5.84, p = 0.002). Nurses with ≥6 years of experience had more than double the odds of good compliance compared with those with <3 years (AOR = 2.17, 95% CI: 1.08–4.36, p = 0.029). Emergency department nurses had significantly lower odds of good compliance than ICU/CCU nurses (AOR = 0.31, 95% CI: 0.12–0.81, p = 0.017).

Table 4. Binary logistic regression: independent predictors of good compliance

Variable	B	SE	AOR (95% CI)	p
IPC guidelines available (Yes vs No)	1.166	0.348	3.21 (1.62–6.35)	0.001
Prior IPC training (Yes vs No)	1.078	0.351	2.94 (1.48–5.84)	0.002
Experience ≥6 years (vs <3 years)	0.775	0.355	2.17 (1.08–4.36)	0.029
Emergency department (vs ICU/CCU)	−1.171	0.491	0.31 (0.12–0.81)	0.017
Constant	−1.204	0.412	0.30	0.003

Model $\chi^2 = 41.26$, df = 4, $p < 0.001$; Nagelkerke $R^2 = 0.28$; Hosmer–Lemeshow p = 0.62.

The model correctly classified 74.4% of cases. The findings indicate that institutional and educational factors exert a stronger influence on compliance than demographic characteristics. The availability of guidelines in the work unit was the strongest predictor, consistent with the Punjab-wide evidence (Kiddeer et al., 2025). The elevated risk among emergency department nurses mirrors the Peshawar findings (Hussain et al., 2023) and the Multan Medicare Hospital study, which reported the lowest knowledge and practice scores among ED nurses (Haider et al., 2025). The protective effect of ≥6 years of experience aligns with the broader literature but should be interpreted cautiously, as experience without structured training may plateau or even decline in adherence (Hussain et al., 2023).

5. Discussion

This study found moderate overall SP compliance (79.3%) among nurses in a tertiary care hospital in Multan, with 68.9% classified as having good compliance. While this figure is higher than the 57.1% reported among critical care nurses in Peshawar (Hussain et al., 2023) and the 46.3% reported across Punjab tertiary hospitals (Kiddeer et al., 2025), it remains below the levels required for effective IPC and is broadly consistent with the "satisfactory but not optimal" profile reported at Medicare Hospital, Multan (Haider et al., 2025). The domain-specific findings are particularly instructive: hand hygiene (71.8%) and sharps disposal (73.5%) were the weakest

areas, echoing the oncology nurse study, which reported hand hygiene compliance of 67.2% and sharps disposal of 63.2% (TarakciogluCelik and Ozdemir, 2025).

The strongest independent predictor of compliance was the availability of IPC guidelines in the work unit (AOR = 3.21). This is a critical finding for hospital management, as it represents a low-cost, structurally modifiable determinant. It replicates the Punjab-wide finding that guideline availability was the strongest institutional correlate of safe practice (AOR 3.46) (Kiddeer et al., 2025) and aligns with the Nepal study's conclusion that provision of hygiene materials and regular supervision are essential to closing knowledge–practice gaps (Silwal, 2024). Prior IPC training was the second strongest predictor (AOR = 2.94), consistent with the Peshawar finding that lack of training conferred a 2.9-fold increase in non-compliance (Hussain et al., 2023) and with intervention studies demonstrating significant post-training improvements (Jeihooni et al., 2023; Ghorbanmovahhed et al., 2023).

The lower compliance observed in the emergency department (AOR = 0.31 relative to ICU/CCU) is a recurring theme in the Pakistani literature. Both the Peshawar comparative study and the Multan Medicare Hospital study identified ED nurses as a high-risk group, attributing this to high patient turnover, unpredictable workloads, and limited supervisory oversight (Hussain et al., 2023; Haider et al., 2025). These conditions are compounded by systemic resource constraints: when PPE and hand hygiene consumables are not consistently available, even well-trained nurses cannot comply (Takougang et al., 2025; TarakciogluCelik and Ozdemir, 2025). The finding that workload pressures systematically undermine adherence has been documented in ICU settings in Lahore as well (Khan et al., 2025).

The study has several limitations. First, compliance was self-reported, and social desirability bias may have inflated scores; the Lahore ICU study demonstrated a substantial gap between self-reported adherence (84.7%) and observed practice (52.7%) (Raza et al., 2026). Second, the cross-sectional design precludes causal inference. Third, the single-center setting limits generalizability to other tertiary hospitals in Multan and Punjab. Fourth, the knowledge scale, while pilot-tested, was not formally validated in this population. Future research should incorporate structured observation and multicenter sampling.

6. Conclusion

Compliance with standard precautions among nurses at this tertiary care hospital in Multan was moderate, with critical gaps in hand hygiene and sharps safety. The strongest determinants of compliance were institutional—availability of IPC guidelines and prior IPC training—rather than demographic characteristics. Emergency department nurses represent a particularly vulnerable group requiring targeted support. Hospital management should priorities the provision of IPC guidelines at the unit level, institutionalize recurrent and mandatory IPC training, and address workload and resource barriers, particularly in the emergency department. These measures are feasible, low-cost, and evidence-based, and are essential for reducing the burden of HAIs and occupational exposure in Pakistani healthcare settings.

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