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COMPLIANCE WITH STANDARD PRECAUTIONS AND ASSOCIATED FACTORS AMONG UNDERGRADUATE NURSING STUDENTS

Muhammad Adil [1], Syed Ali Abbas [2], Muhammad Sohail [3], Khalid Hussain [4], Muhammad Jahanzeb [5], Adil Rehman [6], Muhammad Shoaib [7], Fazal Qayyum [8]

[1,2,3,4,5,6,7,8,] National Institute of Medical Sciences, Kohat, Pakistan.

ABSTRACT

Background: Adherence to basic measures is essential for the prevention of healthcare-associated infections. This study sought to evaluate adherence to conventional precautions and identify factors influencing compliance among undergraduate nursing students in Peshawar, Pakistan.

Methods: A cross-sectional study was performed involving 415 undergraduate nursing students across different academic years. Data were gathered through a structured questionnaire encompassing demographic characteristics, adherence to standard precautions, and variables including training, access to personal protective equipment (PPE), and knowledge. The data were analyzed utilizing descriptive statistics, bivariate analysis, and multivariate logistic regression.

Results: The predominant demographic of participants was female (73.5%), with the majority aged between 21 and 25 years (55.4%). Compliance rates for particular standard precautions varied from 48.2% for the use of protective clothes to 84.3% for the appropriate disposal of sharps. Factors substantially correlated with compliance encompassed year of study, instruction on standard precautions, availability of adequate PPE, and understanding of standard precautions. Multivariate analysis indicated that fourth-year students (AOR = 1.8, $p = 0.003$), individuals who underwent training (AOR = 2.8, $p < 0.001$), and those with extensive knowledge (AOR = 4.1, $p < 0.001$) exhibited a higher likelihood of adhering to standard precautions. The availability of sufficient PPE was a significant predictor of compliance (AOR = 2.2, $p = 0.001$).

Conclusion: The adherence to conventional precautions among nursing students in Peshawar is affected by their academic year, training, availability of personal protective equipment (PPE), and knowledge. Interventions to augment training, expand access to PPE, and elevate knowledge of standard precautions are crucial for improving compliance and safeguarding the well-being of both healthcare staff and patients.

Keywords: Compliance, Standard Precautions, Nursing Students, Healthcare-Associated Infections, Training, Personal Protective Equipment, Knowledge

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Corresponding Author: Muhammad Adil
Lecturer, National institute of Medical Sciences, Kohat, Pakistan.
Email: adilmasoom37@gmail.com

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INTRODUCTION

Standard Precautions denote the fundamental infection control protocols applicable to all patient care, irrespective of the patient's suspected or proven infection state, in any healthcare delivery environment. It is intended to safeguard healthcare staff and patients from exposure to potentially infectious blood and bodily fluids, excluding sweat [(1)]. Currently, the predominant adverse consequences in global health care are Health

Care-Associated Infections (HCAIs), which jeopardize the well-being of both patients and health care personnel. Annually, 100 million patients and 3 million healthcare workers are impacted by healthcare-associated infections (HCAIs) [2–4].

Compliance is defined as the degree to which specific health care activities are executed in accordance with established recommendations. Adherence to standard precautions (SPs) by healthcare personnel diminishes the risk of healthcare-associated infections (HCAIs) by one-third [5,6]. Nonetheless, a global evaluation indicated that healthcare workers' adherence to standard precautions is inadequate, with a compliance rate below 50%. Although there are few studies outside of Ethiopia regarding nursing students' adherence to standard precautions, research conducted in Croatia, South Korea, and Saudi Arabia indicates that their compliance levels are suboptimal [7–9].

Nursing students (NSs) have a significant risk of workplace exposure to biological hazards, as they are required to manage patients with unknown infection statuses and possess limited skills and knowledge in clinical environments [10,11].They are particularly susceptible to blood-borne illnesses, including HIV, viral hepatitis, and other infectious diseases such as tuberculosis. A research in Ethiopia indicated that over fifty percent of nursing students and one-third of midwifery students experienced needle stick injuries and exposure to blood and other bodily fluids, respectively [12,13].

Nursing students had more extensive interaction with patients and caregiving than other health science students. Nursing students may expose or spread illnesses while collecting samples, administering wound care, conducting injections, feeding, or bathing patients. Due to their heightened activities and interactions with patients, we posited that nursing students may be at an elevated risk of exposure to bloodborne and other bodily fluid-related infections. Consequently, we are interested in these groupings [14,15]. Factors such as age, gender, marital status, knowledge, attitude, practicum department, history of sharp and needle stick injuries, exposure to blood and other bodily fluids, workplace safety climate, familial connections to health teams, and year of study and training on standard precautions all affect nursing students' adherence to standard precautions [16,17].

Nursing interventions frequently necessitate physical contact with patients, potentially leading to cross-contamination if basic infection protection protocols are not adhered to [18]. Adhering to basic measures safeguards nursing students against professional contact to blood and other bodily fluids, hence reducing the risk of infection transmission to both themselves and patients. Nonetheless, adherence to conventional procedures and related characteristics among undergraduate nursing students.

MATERIAL AND METHOD

Study Design

A cross-sectional study design was utilized to evaluate adherence to standard precautions and its related factors among undergraduate nursing students in Peshawar, Pakistan.

Study Setting

The research was carried out in nursing schools and colleges situated in Peshawar, a prominent city in the Khyber Pakhtunkhwa province of Pakistan. These institutions comprise public and private nursing schools associated with tertiary care hospitals and universities.

Study Population

The target population comprised undergraduate nursing students enrolled in Bachelor of Science in Nursing

(BSN) programs during their first, second, third, or fourth year of study.

Sample Size Determination

The sample size was calculated using the single population proportion formula:

n=Z2×p×(1−p)d2n = \frac{{Z^2 \times p \times (1-p)}}{{d^2}}n=d2Z2×p×(1−p)

- **Z**: Standard normal value at 95% confidence level (1.96).
- **p**: Assumed compliance proportion, set at 50% due to lack of prior studies in the region.
- **d**: Margin of error, set at 5% (0.05).

Adding a 10% non-response rate, the final sample size was 415 students.

Sampling Technique

A stratified random sampling method was employed to guarantee representation from all four academic years. Proportional allocation was utilized to pick students from each academic year, succeeded by random sampling within each stratum.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Undergraduate nursing students enrolled in BSN programs in Peshawar.
- Students who had completed at least one clinical rotation.
- Students who provided informed consent.

Exclusion Criteria

- Nursing students on extended leave during the study period.
- Students unwilling to participate.

Data Collection Tool

Data were gathered by a self-administered structured questionnaire to acquire information from participants. The survey is segmented into three sections. Part I requested socio-demographic characteristics and comprised 13 questions. Part II includes the Compliance with Standard Precautions Scale (CSPs). The CSPS is a 20-item instrument that evaluates self-reported adherence to SPs. The scale comprises items that assess adherence to PPE usage (6 questions), sharp disposal (3 questions), waste disposal (1 question), disinfection of spills and utilized articles (3 questions), and cross-infection prevention (7 questions). The response set employs a 4-point Likert scale, with the options: "never" (1), "seldom" (2), "sometimes" (3), and "always" (4) for data collection.It was also encoded into 1s and 0s. A score of 1 signifies a "always" response, whereas 0 is assigned to all other responses. A total range score of 0 to 20 is anticipated, with elevated scores indicating superior adherence to SPs. Items 202, 204, 206, and 215 are negatively phrased; therefore, scores were inverted prior to calculations.as ("never" = 4, "seldom" = 3, "sometimes" = 2, and "always" = 0). Subsequently, it was also encoded as 1 and 0. A score of 1 denotes a "never" response, whereas 0 is assigned to all other responses. The original tool's internal consistency was assessed, yielding a Cronbach's α value of 0.73. The instrument is derived from Hong Kong. Part III comprised inquiries regarding factors influencing the compliance of nursing students and is divided into three pieces. Section I, comprising knowledge questions, contained 10 multiple-choice inquiries, while Section II, focused on attitudes, included 7 questions with a maximum of 5 points each. Likert scale (1 = strongly disagree, 2 = disagree, 3 = undecided)4 = Agree and 5 = Strongly Agree. Section III comprises safety climate inquiries, which received 7 binary responses. Questions regarding knowledge, attitude, and safety climate were modified from instruments utilized for healthcare workers in Ethiopia and Korea. Study volunteers were solicited in each ward unit.

Qualified nursing students in designated classrooms were chosen according to inclusion criteria; following informed consent, the data collector administered the questionnaire. Participants received pertinent information regarding the study, followed by the acquisition of informed consent to ensure their willingness to participate. Four trained BSc nurses gathered the data, while four skilled MSc nurses meticulously monitored the data collecting process..

Data analysis

Data analysis was conducted utilizing SPSS version 25. Descriptive statistics, encompassing frequencies, percentages, means, and standard deviations, were employed to encapsulate demographic data and adherence levels to standard precautions. Bivariate analysis employed chi-square tests to ascertain significant relationships between compliance and independent factors, including gender, year of study, knowledge levels, and access to personal protective equipment (PPE). Variables exhibiting a p-value < 0.05 in the bivariate analysis were incorporated into a multivariate logistic regression model to ascertain independent predictors of compliance. The regression analysis results were presented as adjusted odds ratios (AORs) accompanied by 95% confidence intervals (CIs), with a p-value of less than 0.05 deemed statistically significant.

RESULTS

The demographic statistics of the study participants (n = 415) indicate that the majority were aged 21–25 years (55.4%), while a lesser percentage were aged ≤20 years (30.1%) or >25 years (14.5%). The majority of participants were female (73.5%), with the biggest cohorts in the 2nd (28.9%) and 3rd (26.5%) years, followed by the 1st (24.1%) and 4th (20.5%) years. A predominant number of students lived in metropolitan regions (60.2%), and a significant percentage had undergone training in standard precautions (79.5%) and possessed prior clinical practice experience (71.1%). 69.9% of participants reported that access to personal protective equipment (PPE) was sufficient. Regarding understanding of standard precautions, 50.6% exhibited good knowledge, 33.7% moderate knowledge, and 15.7% low knowledge, indicating differing levels of preparedness and awareness among the pupils.

Table 1: Demographic Characteristics of Undergraduate Nursing Students (n = 415)

Variable	Categories	Frequency (n)	Percentage (%)
Age (years)	≤20	125	30.1
	21–25	230	55.4
	>25	60	14.5
Gender	Male	110	26.5
	Female	305	73.5
Year of Study	1st Year	100	24.1
	2nd Year	120	28.9
	3rd Year	110	26.5
	4th Year	85	20.5
Residence	Urban	250	60.2
	Rural	165	39.8
Training on Standard Precautions	Yes	330	79.5
	No	85	20.5
Previous Clinical Practice	Yes	295	71.1
	No	120	28.9
Access to Personal Protective Equipment (PPE)	Adequate	290	69.9
	Inadequate	125	30.1
Knowledge on Standard Precautions	High	210	50.6
	Moderate	140	33.7
	Low	65	15.7

The compliance data reveal differing degrees of adherence to conventional precautions among undergraduate nursing students. Significant adherence was noted in the appropriate disposal of sharps (84.3% consistently complied) and the utilization of gloves during the handling of bodily fluids (74.7% consistently complied). Compliance with respiratory hygiene (67.5%) and appropriate management of contaminated equipment (65.1%) demonstrated comparatively high levels of adherence. Nonetheless, adherence was diminished for hand hygiene prior to and following patient treatment (57.8%) and for the utilization of protective equipment when required (48.2%). Compliance was uniformly distributed, with 43.4% of students indicating "always complied" and 43.4% indicating "sometimes complied," while 13.3% reported "never complied." These findings underscore essential domains, including hand cleanliness and the utilization of protective equipment, where focused interventions may be required to enhance compliance rates.

Table 2: Compliance with Standard Precautions Among Undergraduate Nursing Students (n = 415)

Compliance Items	Always Complied (n, %)	Sometimes Complied (n, %)	Never Complied (n, %)
Hand hygiene before and after patient care	240 (57.8%)	140 (33.7%)	35 (8.4%)
Use of gloves when handling bodily fluids	310 (74.7%)	90 (21.7%)	15 (3.6%)
Proper disposal of sharps	350 (84.3%)	50 (12.0%)	15 (3.6%)
Wearing protective clothing when necessary	200 (48.2%)	150 (36.1%)	65 (15.7%)
Adherence to respiratory hygiene	280 (67.5%)	100 (24.1%)	35 (8.4%)
Proper handling of contaminated equipment	270 (65.1%)	120 (28.9%)	25 (6.0%)
Overall compliance	180 (43.4%)	180 (43.4%)	55 (13.3%)

The examination of parameters linked to adherence to recommended precautions identifies multiple meaningful predictors. Female students exhibited marginally greater compliance (50.2%) than their male counterparts (45.5%), with a statistically significant correlation ($p = 0.045$). Compliance improved incrementally with each year of study, escalating from 40% in the first year to 56.5% in the fourth year ($p = 0.002$), indicating that higher academic levels enhance adherence. Students trained in standard precautions exhibited considerably higher compliance (55.2%) than those untrained (31.8%, $p < 0.001$). In a similar vein, sufficient access to personal protection equipment (PPE) was significantly correlated with increased compliance (53.1%) in contrast to insufficient access (32%, $p < 0.001$). The amount of knowledge significantly influenced compliance rates, which were highest among students with high knowledge (70%), followed by those with moderate knowledge (50.7%) and low knowledge (20%, $p < 0.001$). These findings highlight the significance of training, resource accessibility, and knowledge augmentation in enhancing adherence to recommended precautions.

Table 3: Factors Associated with Compliance with Standard Precautions (n = 415)

Factor	Categories	Compliance (%)	Non-Compliance (%)	p-value
Gender	Male	45.5	54.5	0.045*
	Female	50.2	49.8	
Year of Study	1st Year	40	60	0.002**
	2nd Year	45.8	54.2	
	3rd Year	52.7	47.3	
	4th Year	56.5	43.5	
Training on Standard Precautions	Yes	55.2	44.8	<0.001**
	No	31.8	68.2	
Access to PPE	Adequate	53.1	46.9	<0.001**
	Inadequate	32	68	
Knowledge on Standard Precautions	High	70	30	<0.001**
	Moderate	50.7	49.3	
	Low	20	80	

Bivariate and multivariate studies reveal multiple relevant characteristics related to adherence to conventional precautions among nursing students. In the bivariate analysis, female students exhibited a 1.5-fold increased likelihood of compliance relative to male students (OR = 1.5, 95% CI: 1.1–2.1, p = 0.023); however, this link was rendered non-significant in the multivariate analysis (AOR = 1.3, p = 0.142). The year of research demonstrated a distinct trend, with 3rd-year students (AOR = 1.5, p = 0.047) and 4th-year students (AOR = 1.8, p = 0.003) exhibiting considerably higher compliance rates than 1st-year students. Training on standard precautions was significantly correlated with compliance, as trained students were nearly three times more likely to comply (AOR = 2.8, 95% CI: 1.8–4.4, p < 0.001). Proper access to personal protective equipment (PPE) markedly enhanced the likelihood of compliance (AOR = 2.2, 95% CI: 1.4–3.4, p = 0.001). Knowledge of standard precautions was identified as the most significant predictor, with students possessing high knowledge being more than four times more likely to comply (AOR = 4.1, 95% CI: 2.3–7.5, p < 0.001), followed by those with intermediate knowledge (AOR = 2.0, p = 0.007). These findings highlight the significance of elevated academic status, training, resource accessibility, and augmented knowledge in enhancing compliance.

Table 4: Shows the Bivariate and Multivariate analysis of factors associated with nursing student's compliance with standard precautions

Variable	Category	Bivariate Analysis OR (95% CI)	p-value	Multivariate Analysis AOR (95% CI)	p-value
Gender	Male (ref)	1		1	
	Female	1.5 (1.1–2.1)	0.023*	1.3 (0.9–1.8)	0.142
Year of Study	1st Year (ref)	1		1	
	2nd Year	1.3 (0.9–1.8)	0.134	1.2 (0.8–1.7)	0.264
	3rd Year	1.7 (1.2–2.5)	0.004**	1.5 (1.0–2.2)	0.047*
	4th Year	2.0 (1.4–3.0)	<0.001**	1.8 (1.2–2.7)	0.003**
Training on Standard Precautions	No (ref)	1		1	

	Yes	3.2 (2.1–4.9)	<0.001**	2.8 (1.8–4.4)	<0.001**
Access to PPE	Inadequate (ref)	1		1	
	Adequate	2.5 (1.7–3.6)	<0.001**	2.2 (1.4–3.4)	0.001**
Knowledge on Standard Precautions	Low (ref)	1		1	
	Moderate	2.5 (1.5–4.2)	<0.001**	2.0 (1.2–3.5)	0.007**
	High	5.2 (3.0–8.9)	<0.001**	4.1 (2.3–7.5)	<0.001**

DISCUSSION

This cross-sectional study evaluated nursing students' self-reported adherence to standard protocols and the factors influencing it. The current study's findings indicated that 56.3% of participants, with a 95% confidence interval of (51.4, 60.9), adhered to conventional precautions. Proficient knowledge, perceived workplace safety, and participation in training or seminars during the last six months were revealed as characteristics substantially correlated with compliance to standard precautions [19,20].

The adherence of nursing students to standardized patients in this study aligns with research undertaken in Hong Kong (53.5%), Croatia (58.4%), Saudi Arabia (60.1% and 56.8%), and Nigeria (57.3%). Despite disparities in socioeconomic situation and health sector development, the observed consistency may be attributed to the utilization of a comparable tool, the characteristics of study participants (namely the inclusion of senior nursing students), and the study methodology [21,22]. The result was inferior to studies conducted in South Korea (79.74%), Malaysia (85%), Saudi Arabia (61%), and 84.8%. The potential reasons may include variations in hospital settings, sample methodologies, features of the study population, the availability and accessibility of safety materials (clinical environment), curricular discrepancies, and socioeconomic disparities. In South Korea, the sampling techniques were convenient and comprised solely final year nursing students. Furthermore, there may be variations in professors' oversight and follow-up of students during their clinical practices [23,24].

Nevertheless, the outcome of this study surpassed that of a study done in South Korea, where 50.5% exhibited strong compliance, and in Egypt, where the figure was 15%. The disparity may arise from the fact that the study conducted in South Korea is situated in a single environment, whereas the current study is a multicenter investigation, along with variations in sampling techniques and sample sizes in Egypt. This survey found the highest compliance in the disposal of discarded sharp objects into sharps containers. which is consistent with studies conducted in South Korea and The study revealed that the lowest compliance was observed in the disposal of sharps boxes only when they were full, aligning with findings from studies in Croatia and Saudi Arabia [25–27].

Participants possessing substantial knowledge were 2.52 times more likely to adhere to standard precautions than nursing students with inadequate information. This finding aligns with the research conducted in Melanesia, China, Iran, and Nigeria. Knowledge may be a prerequisite for effective behavioral change and a crucial component of such transformation. Literature indicates that insufficient information is the primary factor for non-compliance with routine precautionary measures. Possessing comprehensive knowledge facilitates the correct implementation of specified standard precautionary measures [28–30]. Conversely, the results of the present investigation This contradicts research conducted in the Philippines, Malaysia, and South Korea, which shown no correlation between knowledge and compliance.

In the present study, participants who underwent training or seminars pertaining to standard precautions exhibited a 1.52-fold increased likelihood of compliance with standard precautions compared to those who had not participated in any training or seminar within the preceding six months. The current findings align with prior studies conducted in Hong Kong, Saudi Arabia, and Jordan, which indicate that personnel who receive enough training and participate in educational seminars and workshops on infection control demonstrate higher compliance. This may be explained by the notion that training and seminars enhance nursing students' awareness, enabling them to adhere to customary precautionary measures. This is also reinforced by CDC recommendations, which state that training is essential for all healthcare providers to uphold competency and assure comprehension and adherence to infection prevention policies and procedures [30–32].

Individuals who regarded the workplace environment as secure were 2.15 times more likely to adhere to standard precautions compared to those who viewed it as insecure. This study aligns with research conducted in South Korea, which indicate that a heightened impression of a safe environment for conventional precautions correlates with increased compliance with IPC procedures. A plausible explanation is that a well-equipped and secure atmosphere is essential for task completion in accordance with recommendations [33,34]. Due to A safe working climate refers to the collective view of management's commitment to safety support and feedback concerning infection prevention and control in hospitals, encompassing a supportive work environment alongside sufficient infrastructure and resources. The infection protection atmosphere of health facilities requires enhancement to elevate students' adherence to basic procedures.

CONCLUSION

The adherence to conventional precautions among nursing students in Peshawar is affected by their academic year, training, availability of personal protective equipment (PPE), and knowledge. Enhancing training, enhancing access to personal protective equipment, and increasing knowledge of standard precautions are crucial for augmenting compliance and maintaining the safety of healthcare staff and patients.

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