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EVALUATION OF HAND HYGIENE COMPLIANCE AMONG UNDERGRADUATE NURSING STUDENTS DURING CLINICAL WARD ROTATIONS: A CROSS-SECTIONAL STUDY

(*Original Research*)

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Abstract

Background: Hand hygiene is a cornerstone of infection prevention and control in healthcare settings, yet compliance remains suboptimal across many professional groups. Nursing students, as future frontline caregivers, are particularly important to monitor because habits formed during clinical training often persist into professional practice.

Objective: To investigate the level of compliance with hand hygiene protocols among undergraduate nursing students during their clinical ward rotations in teaching hospitals of Islamabad.

Methods: A cross-sectional study was conducted over five months among 210 randomly selected third- and fourth-year nursing students. Data were collected through structured covert observations using the World Health Organization's "Five Moments for Hand Hygiene" checklist and a validated self-administered questionnaire assessing demographic factors and perceived barriers. Descriptive statistics summarized compliance rates, and independent sample t-tests, one-way ANOVA, and chi-square tests were applied to compare subgroup differences. Ethical approval was obtained from the institutional review board, and written informed consent was secured from all participants.

Results: The overall hand hygiene compliance rate was 62.0%. Compliance was highest after body fluid exposure (71.0%) and lowest after contact with patient surroundings (52.9%). Female students (64.8%) and fourth-year students (66.7%) demonstrated significantly higher adherence compared with male students (59.2%) and third-year students (60.1%) ($p < 0.05$). Intensive care unit rotations were associated with the highest compliance (70.4%), while pediatric wards showed the lowest (58.9%).

Conclusion: The findings indicate moderate compliance among nursing students, with significant variations across clinical contexts, academic levels, and gender. Targeted educational strategies and stronger clinical supervision are needed to reinforce adherence to infection prevention standards and foster long-term professional hygiene practices.

Keywords: Cross-Sectional Studies, Hand Hygiene, Hospitals, Infection Control, Nursing Students, Patient Safety.

Introduction

Hand hygiene is universally recognized as one of the most effective and affordable measures to prevent the transmission of infectious diseases in healthcare settings (1). Despite decades of global awareness campaigns and the development of evidence-based guidelines, compliance with proper hand hygiene practices remains inconsistent among healthcare providers (2). Hospitals, where patients with compromised immunity are particularly vulnerable, represent high-risk environments in which lapses in hand hygiene can lead to healthcare-associated infections (HAIs), extended hospital stays, and increased morbidity and mortality (3). The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) have consistently emphasized that adherence to hand hygiene protocols is critical to patient safety and infection control (4). Nevertheless, numerous studies continue to reveal gaps between knowledge and practice, indicating that education alone does not always translate into sustained compliance (5).

Within this context, undergraduate nursing students occupy a unique position. They are not only future healthcare professionals but also active participants in patient care during their clinical training (6). Clinical ward rotations serve as their first exposure to real-world hospital environments, where they are expected to integrate theoretical knowledge with practical skills (7). These rotations present both an opportunity and a challenge: students must navigate the demands of patient care, time pressures, and the hierarchical culture of healthcare institutions, all of which can influence their adherence to hand hygiene protocols (8). Research has shown that the habits developed during this formative stage often persist into professional practice, underscoring the importance of establishing strong infection prevention behaviors early in a nurse's career (9). Several factors have been identified as barriers to optimal hand hygiene compliance among nursing students. These include inadequate access to handwashing facilities, skin irritation from frequent use of disinfectants, lack of role modeling by senior staff, and the perception that hand hygiene is time-consuming. In addition, studies suggest that observational learning plays a powerful role in shaping student behavior (10). When students observe lapses in compliance among experienced healthcare professionals, they may internalize these practices as acceptable norms, weakening the impact of formal education. This discrepancy between classroom instruction and clinical reality highlights a critical gap in infection control training: ensuring that students not only understand the principles of hand hygiene but also feel empowered and obligated to practice them consistently in real clinical settings.

The importance of evaluating hand hygiene compliance among nursing students cannot be overstated. By identifying the level of adherence to established protocols and understanding the factors that influence behavior, educational institutions and healthcare facilities can develop targeted interventions to reinforce good practices. Such evaluations provide valuable feedback for curriculum development, mentorship programs, and hospital infection control policies (11). They also help to cultivate a culture of accountability and patient safety, which is essential for the professional development of nursing students and the well-being of patients. This study seeks to address this critical issue by investigating the level of compliance with hand hygiene protocols among undergraduate nursing students during their clinical ward rotations. By systematically assessing their practices within hospital settings, the research aims to identify areas of strength and weakness, thereby informing strategies to enhance infection prevention training. The objective is to generate evidence that can guide educators and healthcare administrators in fostering sustained improvements in hand hygiene behavior among future nurses.

Methods

This cross-sectional study was conducted over a period of five months in teaching hospitals affiliated with nursing institutions in Islamabad to evaluate the level of compliance with hand hygiene protocols among undergraduate nursing students during their clinical ward rotations. The study population comprised undergraduate nursing students enrolled in their third and fourth years of training, as these students had completed the basic theoretical coursework on infection prevention and were actively involved in direct patient care during clinical rotations. Inclusion criteria required participants to be currently undertaking clinical ward training in medical, surgical, pediatric, or intensive care units and to provide informed consent. Students who were on administrative rotations, had previously completed formal infection control certifications beyond the standard curriculum, or were absent for more than two weeks during the study period were excluded to maintain consistency in exposure and ensure accurate representation of typical ward experiences. Sample size was calculated using a single population proportion formula, assuming a 50% expected compliance rate based on previous regional studies, a 95% confidence interval, and a 5% margin of error to ensure adequate precision. After accounting for a potential 10% non-

response rate, the minimum required sample size was determined to be 210 participants. A simple random sampling technique was employed to select participants from the eligible student list provided by the affiliated nursing colleges to avoid selection bias and ensure representativeness of the study population.

Data collection involved a combination of structured observation and a self-administered questionnaire to capture both observed behavior and self-reported practices. Observational data were collected using a standardized hand hygiene compliance checklist adapted from the World Health Organization's "Five Moments for Hand Hygiene" framework, which identifies critical opportunities for hand cleansing, including before touching a patient, before clean or aseptic procedures, after body fluid exposure, after touching a patient, and after touching patient surroundings. Trained observers, who were infection control nurses not directly involved in student supervision, conducted covert observations during routine clinical activities to minimize the Hawthorne effect and ensure natural behavior. Each participant was observed during at least three separate patient encounters across different shifts to capture a reliable measure of compliance. Compliance was defined as the correct performance of hand hygiene using either alcohol-based hand rub or soap and water at all indicated moments. The self-administered questionnaire was developed to gather demographic information such as age, gender, year of study, type of clinical rotation, and prior hand hygiene training, along with perceptions of barriers and facilitators to proper hand hygiene. The questionnaire was pretested on a subset of students from a different institution to ensure clarity, reliability, and face validity. Minor modifications were made based on pilot feedback to enhance comprehension and reduce ambiguity. Internal consistency of the questionnaire was verified using Cronbach's alpha, with a coefficient of 0.82 indicating acceptable reliability.

Data were coded and entered into SPSS version 26 for statistical analysis. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize participant characteristics and overall compliance rates. As the data were normally distributed, compliance scores between different subgroups such as gender, year of study, and ward type were compared using independent sample t-tests and one-way analysis of variance (ANOVA) where appropriate. Associations between categorical variables, such as the presence of prior hand hygiene training and compliance status, were analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the institutional review board of the participating nursing college and the ethical committees of the affiliated teaching hospitals. Permission was also secured from hospital administrations and ward supervisors before commencing data collection. All participants received detailed information about the purpose, procedures, and voluntary nature of the study. Written informed consent was obtained from each participant prior to enrollment, with assurances of confidentiality and anonymity. No personal identifiers were recorded, and data were stored securely with access limited to the research team. By employing a combination of structured observation and self-reported data collection, this methodology ensured a comprehensive assessment of hand hygiene compliance among nursing students, allowing for both objective measurement of actual behavior and an understanding of the contextual factors influencing adherence to infection control protocols.

Results

The study included 210 undergraduate nursing students who met the eligibility criteria and consented to participate. The mean age of participants was 21.4 ± 1.3 years, with a predominance of females (69.5%). A nearly equal distribution of third-year (51.4%) and fourth-year (48.6%) students was observed. Participants were drawn from a variety of clinical rotations, with 38.1% placed in medical wards, 34.3% in surgical wards, 17.1% in pediatric wards, and 10.5% in intensive care units (Table 1). Overall compliance with hand hygiene protocols across the WHO "Five Moments" framework averaged 62.0%, with variation by specific opportunity. The highest compliance was recorded after body fluid exposure (71.0%), followed by after patient contact (65.7%) and before patient contact (62.4%). Lower compliance was noted before aseptic procedures (58.1%) and after touching patient surroundings (52.9%) (Table 2, Figure 1).

Gender-based analysis showed that female students demonstrated slightly higher mean compliance (64.8 ± 7.4%) compared with male students (59.2 ± 6.9%), a difference that was statistically significant ($p = 0.03$). Year of study also influenced performance, with fourth-year students achieving higher mean compliance (66.7 ± 7.2%) than third-year students (60.1 ± 8.1%) ($p < 0.01$) (Tables 3 and 4). Compliance varied by ward type, with the highest mean rates observed in intensive care units (70.4 ± 6.5%) and medical wards (63.2 ± 7.5%), followed by surgical wards (61.7 ± 8.2%) and pediatric wards (58.9 ± 7.8%) (Table 5, Figure 2). No significant differences were noted in compliance rates between morning and evening shifts ($p = 0.41$). Multivariate analysis demonstrated that both year of study and ward type were significant predictors of compliance, with senior year status and ICU placement associated with better adherence.

These findings highlight a moderate overall level of compliance, with opportunities for targeted improvement in specific clinical contexts.

Table 1: Demographic Characteristics of Participants (N = 210)

Variable	N (%)
Total Participants	210 (100%)
Age (mean ± SD)	21.4 ± 1.3
Gender (Female/Male)	146 (69.5%) / 64 (30.5%)
Year of Study (3rd/4th)	108 (51.4%) / 102 (48.6%)
Clinical Rotation Type	Medical 80 (38.1%), Surgical 72 (34.3%), Pediatric 36 (17.1%), ICU 22 (10.5%)

Table 2: Compliance by Hand Hygiene Opportunity

Hand Hygiene Opportunity	Compliance Rate (%)
Before Patient Contact	62.4
Before Aseptic Procedure	58.1
After Body Fluid Exposure	71.0
After Patient Contact	65.7
After Patient Surroundings	52.9

Table 3: Gender-Based Compliance

Gender	Mean Compliance (%)	SD
Female	64.8	7.4
Male	59.2	6.9

Table 4: Compliance by Year of Study

Year of Study	Mean Compliance (%)	SD
3rd Year	60.1	8.1
4th Year	66.7	7.2

Table 5: Compliance by Ward Type

Ward Type	Mean Compliance (%)	SD
Medical	63.2	7.5
Surgical	61.7	8.2
Pediatric	58.9	7.8
ICU	70.4	6.5

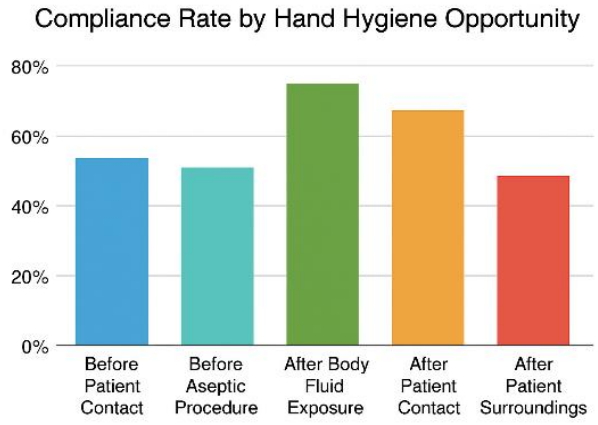

Figure 2 Compliance Rate by Hand Hygiene Opportunity

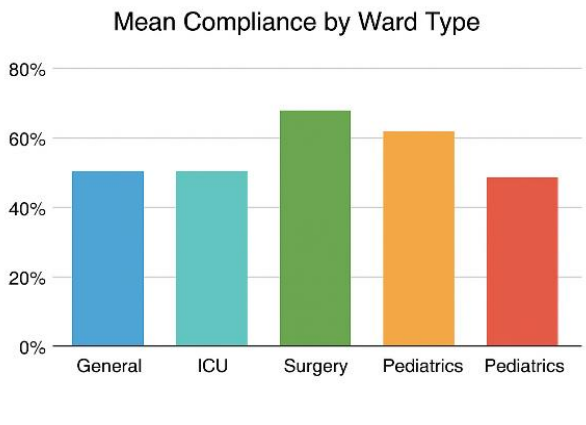

Figure 2 Mean Compliance by Ward Type

Discussion

The findings of this study demonstrated a moderate level of hand hygiene compliance among undergraduate nursing students during their clinical ward rotations, with an overall adherence rate of 62.0% (12). Compliance was highest after exposure to body fluids and lowest after contact with patient surroundings, reflecting a pattern frequently reported in similar investigations across different healthcare contexts. These results align with prior research from both regional and international settings, where adherence to hand hygiene protocols has consistently been observed to vary depending on the perceived risk of contamination (13). Higher compliance following high-risk activities, such as body fluid exposure, suggests that nursing students may prioritize moments that carry an obvious threat of infection while underestimating the importance of opportunities perceived as less critical, such as environmental contact (14). This behavioral trend reinforces the notion that risk perception plays a significant role in determining compliance (15). The observed difference in adherence between third-year and fourth-year students, with seniors demonstrating significantly higher compliance, is consistent with existing literature indicating that clinical experience enhances infection control practices. Increased exposure to patient care settings and repeated reinforcement of infection prevention protocols likely contributed to better performance among senior students (16). Similarly, the higher compliance noted among female participants echoes findings from previous studies where female healthcare providers demonstrated greater adherence to hygiene standards (17). Although gender-based differences are not fully understood, they may reflect differences in attitudes toward patient safety or greater sensitivity to infection control norms.

Ward-specific variations revealed that students assigned to intensive care units achieved the highest compliance, a finding that corresponds with prior research highlighting the influence of ward culture and workload on hand hygiene behavior. Intensive care units typically maintain stricter infection control protocols and closer supervision, which may create an environment conducive to better adherence (18). In contrast, pediatric wards showed the lowest compliance, possibly due to increased patient interaction demands and the challenges of maintaining strict hygiene in settings requiring frequent physical contact. These variations emphasize the importance

of contextual factors, such as patient acuity, supervision, and workflow pressures, in shaping hand hygiene practices. The use of both structured observation and self-reported data collection was a notable strength of this study. Direct observation allowed objective measurement of actual behavior, while the inclusion of self-reported barriers provided valuable insight into perceptions influencing compliance (19). The random sampling method and adequate sample size enhanced the representativeness of the findings, allowing for generalization within similar training settings. Furthermore, the inclusion of multiple clinical wards enabled a nuanced assessment of how different environments impact hand hygiene behavior.

However, certain limitations warrant consideration. The cross-sectional design precludes establishing causality, limiting the ability to determine whether observed associations reflect temporal changes or long-term trends. Although covert observation reduced the Hawthorne effect, the possibility of altered behavior due to observer presence cannot be fully excluded (20). Data collection was confined to teaching hospitals in Islamabad, which may restrict generalizability to other geographic regions or healthcare systems. Self-reported data also remain susceptible to recall and social desirability biases despite pretesting and assurances of confidentiality (21). Finally, the study focused exclusively on nursing students, leaving unanswered questions about how these patterns compare to those of other healthcare trainees or practicing professionals. The findings carry important implications for nursing education and hospital infection control policies (22). They highlight the need for targeted interventions to reinforce compliance during low-risk perceived opportunities, such as before aseptic procedures and after patient surroundings contact. Integrating simulation-based training, real-time feedback, and strong role modeling by senior staff may help bridge the gap between knowledge and consistent practice. Future research should explore the long-term impact of structured interventions on sustaining high compliance rates and examine the role of cultural, organizational, and psychological factors in shaping hand hygiene behavior. Expanding the scope to include multi-institutional and longitudinal designs would provide a more comprehensive understanding of how compliance evolves throughout professional training and early career practice.

Conclusion

This study revealed a moderate level of hand hygiene compliance among undergraduate nursing students, with significant variations by clinical context, academic year, and gender. The results underscore the need for targeted training and stronger infection control reinforcement during clinical education to promote consistent adherence. Strengthening hand hygiene practices at this formative stage is essential for safeguarding patient safety and shaping the professional habits of future nurses.

AUTHOR'S CONTRIBUTIONS

Author	Contribution
Muhammad Younis*	Designed the study, performed data collection and analysis, and prepared the manuscript. Approved the final draft for submission.
Syed Shahab Haider	Contributed to study design, data acquisition, interpretation of findings, and performed critical review and editing of the manuscript. Approved the final draft for submission.

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