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A Study on the Effectiveness of Hand Hygiene Practices Among Nursing Students in Preventing Hospital Infections

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Abstract

Hospital-acquired infections (HAIs) remain a critical challenge in healthcare, contributing to increased morbidity, mortality, and healthcare costs. Nursing students, as future healthcare professionals, play a pivotal role in infection prevention through adherence to hand hygiene protocols. This study evaluates the effectiveness of hand hygiene practices among nursing students in preventing HAIs. Using a mixed-methods approach, we assessed compliance rates, knowledge levels, and barriers to hand hygiene among 200 nursing students across three Indian nursing colleges. Findings revealed high knowledge levels (92% awareness of protocols) contrasted by variable compliance rates (45–78%), influenced by barriers such as time constraints, inadequate facilities, and insufficient training. A structured intervention, including training workshops and improved access to hand sanitizers, increased compliance by 25% over six months. The study highlights the need for targeted educational programs and infrastructural enhancements to bolster hand hygiene practices, thereby reducing HAIs.

Keyword: Hand Hygiene, Nursing Students, Hospital-Acquired Infections, Infection Prevention, Compliance

Introduction

Hospital-acquired infections (HAIs) affect millions of patients globally, with an estimated prevalence of 7–10% in developed countries and up to 20% in developing nations (World Health Organization [WHO], 2020). HAIs increase hospital stays, healthcare costs, and mortality rates, making infection prevention a priority in healthcare settings (Pittet *et al*., 2000). Hand hygiene is the most effective and cost-efficient method to reduce pathogen transmission (Allegranzi & Pittet, 2009). Nursing students, who engage in clinical rotations, are critical to implementing these practices but often exhibit suboptimal compliance (Kelcíkova *et al*., 2019). This study investigates the effectiveness of hand hygiene practices among nursing students in preventing HAIs, focusing on compliance rates, knowledge gaps, and barriers to adherence, with the aim of informing targeted interventions.

Materials and Methods

Study Design

A mixed-methods study was conducted from January to June 2025 across three Indian nursing colleges: All India Institute of Medical Sciences (AIIMS), New Delhi; Christian Medical College (CMC), Vellore; and Manipal College of Nursing,

Manipal. The study combined quantitative observational assessments of hand hygiene compliance with qualitative surveys to explore knowledge, attitudes, and barriers.

Participants
A purposive sample of 200 nursing students (100 second-year and 100 third-year students) was selected. Inclusion criteria included enrollment in a Bachelor of Science in Nursing program and active participation in clinical rotations. Students on leave or not engaged in clinical duties were excluded.

Data Collection
Observational Assessment: Hand hygiene compliance was evaluated using the WHO's "Five Moments for Hand Hygiene" framework (WHO, 2009), which includes moments such as before patient contact, before aseptic procedures, and after exposure to bodily fluids. Trained observers recorded compliance during clinical rotations over three months, observing 1,500 hand hygiene opportunities across the three institutions.

Survey: A validated questionnaire adapted from Allegranzi *et al*. (2011) was distributed to assess knowledge of hand hygiene protocols, perceived barriers, and attitudes toward infection prevention. The survey included 20 Likert-scale questions and five open-ended questions to capture qualitative insights.

Intervention
A three-month intervention was implemented post-baseline assessment, comprising:
- Weekly hand hygiene training workshops based on WHO guidelines (WHO, 2009).
- Installation of additional alcohol-based hand sanitizer dispensers in clinical areas.
- Regular feedback sessions to reinforce compliance.

Data Analysis
Quantitative data were analyzed using SPSS version 26. Compliance rates were calculated as the percentage of observed hand hygiene opportunities performed correctly. Descriptive statistics summarized knowledge scores, while chi-square tests assessed differences in compliance by year of study and institution. Qualitative survey responses were analyzed thematically using NVivo software to identify barriers and facilitators.

Ethical Considerations
The study was approved by the Institutional Review Boards of AIIMS, CMC, and Manipal College of Nursing. Informed consent was obtained from all participants, and anonymity was ensured.

Results
Baseline Compliance and Knowledge
Of the 1,500 observed hand hygiene opportunities, the overall compliance rate was 62% (930 instances). Compliance varied significantly across institutions: AIIMS (78%), CMC (60%), and Manipal (45%) ($p < 0.05$). Second-year students exhibited lower compliance (55%) than third-year students (69%) ($p < 0.01$). Survey results indicated high knowledge levels, with 92% of students correctly identifying the WHO's Five Moments for Hand Hygiene. However, only 65% consistently applied this knowledge in practice.

Barriers to Compliance
Thematic analysis of survey responses identified three primary barriers:
1. **Time Constraints**: Students reported insufficient time to perform hand hygiene during busy clinical rotations (68% of respondents).
2. **Inadequate Facilities**: Limited access to handwashing stations or sanitizers was noted, particularly at Manipal (52% of respondents).
3. **Lack of Training**: Second-year students frequently cited insufficient hands-on training (45% of respondents).

Intervention Outcomes
Post-intervention, compliance increased to 87% overall (1,305/1,500 opportunities), a 25% improvement ($p < 0.001$). The most significant improvement was observed at Manipal (from 45% to 75%), attributed to the increased availability of sanitizers. Knowledge scores remained stable, but students reported greater confidence in applying protocols after training. Qualitative feedback highlighted improved awareness and accessibility as key facilitators.

Discussion
The study confirms that while nursing students possess high theoretical knowledge of hand hygiene, practical compliance is hindered by systemic and individual barriers. The baseline compliance rate of 62% aligns with prior studies, such as Kingston *et al*. (2017), who reported rates of 50–70% among healthcare trainees. The variation across institutions suggests that infrastructural differences, such as sanitizer availability, significantly influence adherence (Gould *et al*., 2017).
The intervention's success in improving compliance by 25% underscores the efficacy of combining education with infrastructural support. Training workshops addressed knowledge-application gaps, particularly among second-year students, supporting findings by Labrague *et al*. (2018). The increased availability of sanitizers mitigated access barriers, consistent with Erasmus *et al*. (2010). However, time constraints remain a challenge, as noted by Pittet *et al*. (2000), suggesting a need for workflow optimization in clinical settings.
Limitations include the study's focus on three institutions, which may limit generalizability, and the short intervention duration, which may not reflect long-term sustainability. Future research should explore longitudinal interventions and include diverse healthcare settings.

Conclusion
Effective hand hygiene among nursing students is critical for preventing HAIs. This study demonstrates that while knowledge is high, compliance is suboptimal due to barriers such as time constraints and inadequate facilities. Targeted interventions, including training and improved access to sanitizers, significantly enhance compliance. Nursing curricula should integrate hands-on training, and healthcare facilities must ensure adequate resources to support infection prevention. These measures can empower nursing students to reduce HAIs, enhancing patient safety.

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