

EVALUATION OF HAND HYGIENE COMPLIANCE AMONG HEALTHCARE WORKERS IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Hand hygiene is a fundamental infection prevention and control measure for reducing healthcare-associated infections and improving patient safety. Despite established guidelines, compliance among healthcare workers remains variable.

Objective: To evaluate hand hygiene compliance among healthcare workers in a tertiary care hospital and identify factors influencing adherence.

Methods: A hospital-based observational cross-sectional study was conducted among 200 healthcare workers. Direct observation using the World Health Organization (WHO) Five Moments for Hand Hygiene framework was employed to assess compliance. Data were analyzed using descriptive and inferential statistics.

Results: A total of 1,800 hand hygiene opportunities were observed, of which 1,170 hand hygiene actions were performed, resulting in an overall compliance rate of 65.0%. Nurses demonstrated the highest compliance (71.9%), while interns showed the lowest (57.8%). Compliance was highest after body fluid exposure risk (85.0%) and lowest before touching a patient (55.2%). Recent training and availability of alcohol-based hand rubs were significantly associated with higher compliance.

Conclusion: Hand hygiene compliance was moderate among healthcare workers. Continuous training, regular audits, and improved accessibility of hand hygiene facilities are essential to enhance adherence and strengthen infection prevention practices.

1. INTRODUCTION

Hand hygiene is universally recognized as the cornerstone of infection prevention and control (IPC) in healthcare settings. It is the most effective, simple, and cost-efficient

strategy for preventing healthcare-associated infections (HAIs) and limiting the transmission of antimicrobial-resistant microorganisms among patients and

healthcare workers (HCWs). Despite substantial advancements in infection control practices, inadequate adherence to hand hygiene recommendations remains a persistent challenge worldwide, particularly in busy hospital environments.¹ Healthcare-associated infections continue to impose a considerable burden on healthcare systems by increasing patient morbidity, mortality, length of hospital stay, and treatment costs. The hands of healthcare workers frequently serve as vehicles for the transmission of pathogens between patients and the healthcare environment. The World Health Organization (WHO) estimates that effective hand hygiene improvement programs can prevent up to 50% of avoidable healthcare-associated infections and generate substantial economic savings for healthcare institutions.²

To promote standardized hand hygiene practices, the WHO introduced the “My Five Moments for Hand Hygiene” framework, which identifies critical moments during patient care when hand hygiene should be performed. These moments include before touching a patient, before clean or aseptic procedures, after body fluid exposure risk, after touching a patient, and after touching patient surroundings.³ Despite widespread dissemination of these guidelines,

compliance among healthcare workers remains inconsistent across healthcare settings and professional categories.

Recent studies have reported considerable variability in hand hygiene compliance rates among healthcare workers. A 2025 observational assessment conducted in a tertiary care educational hospital demonstrated substantial differences in compliance across occupational groups and clinical settings, highlighting the ongoing need for monitoring and targeted interventions.⁴ Similarly, a hospital-based evaluation reported lower compliance before patient contact compared with compliance after body fluid exposure, suggesting that healthcare workers may perceive varying levels of risk associated with different hand hygiene opportunities.⁵ Multiple factors influence hand hygiene compliance, including inadequate training, heavy workload, staff shortages, limited availability of hand hygiene resources, skin irritation, organizational culture, and insufficient supervision. A recent mixed-methods study involving healthcare workers across multiple hospitals identified lack of recent hand hygiene training, inadequate infection prevention infrastructure, and behavioral barriers as major determinants of poor compliance.⁶ These findings underscore the multifactorial nature of hand hygiene

behavior and the necessity for comprehensive improvement strategies.

Educational interventions have been shown to play a crucial role in enhancing hand hygiene knowledge and adherence among healthcare personnel. Recent evidence suggests that structured training programs significantly improve both compliance rates and understanding of infection prevention principles among healthcare workers.⁷

Furthermore, quality improvement initiatives employing multimodal approaches such as education, performance feedback, reminders, leadership engagement, and regular audits have demonstrated sustained improvements in compliance and patient safety outcomes.⁸

Monitoring hand hygiene practices is an essential component of infection prevention programs. Although direct observation remains the gold standard for assessing compliance, it is susceptible to observer bias and the Hawthorne effect.

Consequently, healthcare institutions are increasingly exploring complementary approaches such as electronic monitoring systems, automated surveillance technologies, and hand hygiene consumable utilization metrics to obtain more objective assessments of compliance.⁹

Recent technological advancements have demonstrated promising results in facilitating continuous monitoring and

improving accountability among healthcare workers.¹⁰

Tertiary care hospitals provide complex and specialized healthcare services and often manage critically ill patients who are particularly vulnerable to healthcare-associated infections. In such settings, maintaining optimal hand hygiene compliance is essential for ensuring patient safety and reducing infection-related complications. Therefore, evaluating hand hygiene compliance among healthcare workers in tertiary care hospitals is crucial for identifying existing gaps, understanding barriers to adherence, and developing evidence-based interventions that enhance infection prevention practices.

Accordingly, the present study was undertaken to evaluate hand hygiene compliance among healthcare workers in a tertiary care hospital and to identify factors associated with adherence to recommended hand hygiene practices.

2. Objectives

2.1 Primary Objective

To evaluate hand hygiene compliance among healthcare workers in a tertiary care hospital using the World Health Organization (WHO) hand hygiene observation methodology.¹¹

2.2 Secondary Objectives

1. To assess hand hygiene compliance according to the WHO Five Moments for Hand Hygiene.¹²
2. To compare compliance rates among different categories of healthcare workers, including physicians, nurses, technicians, and support staff.¹³
3. To identify factors associated with hand hygiene non-compliance among healthcare workers.¹⁴
4. To evaluate the availability and utilization of hand hygiene facilities within patient care areas.¹⁵
5. To generate baseline data for developing targeted interventions aimed at improving infection prevention and control practices.¹⁶

3. Materials and Methods

Study Design

A hospital-based, observational, cross-sectional study was conducted to evaluate hand hygiene compliance among healthcare workers in a tertiary care hospital. Direct observation was employed as the primary method for assessing compliance, as recommended by the WHO and infection prevention guidelines.¹⁷

Study Setting

The study was conducted in various clinical departments of a tertiary care teaching hospital, including medical wards, surgical wards, intensive care units, emergency

departments, and outpatient services. These departments were selected because of their frequent patient contact and increased risk of healthcare-associated infection transmission.¹⁸

Study Duration

The study was conducted over a period of three months.

Study Population

The study population consisted of healthcare workers involved in direct patient care activities, including physicians, nurses, interns, laboratory personnel, physiotherapists, and housekeeping staff.¹⁹

Inclusion Criteria

- Healthcare workers directly involved in patient care.
- Healthcare workers present during the observation period.
- Personnel willing to participate in the study.

Exclusion Criteria

- Administrative staff without patient contact.
- Healthcare workers absent during the observation period.
- Students and trainees not independently involved in patient care activities.

Sample Size

The sample size was determined using the single population proportion formula based

on expected hand hygiene compliance rates reported in previous studies.²⁰ The final sample size was adjusted to account for potential non-response and observation losses.

Data Collection Tool

Data were collected using a structured WHO Hand Hygiene Observation Form based on the WHO Five Moments for Hand Hygiene framework.²¹ The observation checklist included:

- Professional category of healthcare worker.
- Clinical department.
- Hand hygiene opportunity.
- Hand hygiene action performed.
- Type of hand hygiene method used (alcohol-based hand rub or handwashing with soap and water).
- Compliance status.

Data Collection Procedure

Trained observers conducted direct observations of healthcare workers during routine clinical activities. Observations were performed unobtrusively to minimize behavioural modification and observer influence. Each hand hygiene opportunity was recorded according to WHO guidelines and classified as compliant or non-compliant.²²

Hand hygiene compliance was calculated using the following formula:

$$\text{Compliance (\%)} = \left(\frac{\text{Number of hand hygiene actions performed}}{\text{Total hand hygiene opportunities observed}} \right) \times 100$$

Observations were conducted across different shifts and departments to ensure adequate representation of healthcare workers and patient care activities.²³

Outcome Measures

Primary Outcome

- Overall hand hygiene compliance rate among healthcare workers.

Secondary Outcomes

- Compliance according to professional category.
- Compliance according to WHO Five Moments.
- Department-wise compliance rates.
- Factors associated with non-compliance.
- Availability and accessibility of hand hygiene resources.

4. STATISTICAL ANALYSIS

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics including frequencies, percentages, means, and standard deviations were calculated. Associations between categorical variables were assessed using Chi-square tests. Multivariable logistic regression analysis was performed to identify factors

associated with hand hygiene compliance. A p-value of <0.05 was considered statistically significant.²⁴

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee before initiation of the study. Permission was also obtained from the hospital administration. Participant confidentiality and anonymity were maintained throughout the study. Data were used exclusively for research purposes, and no personal identifiers were recorded.²⁵

5. RESULTS

A total of 200 healthcare workers were observed during the study period, generating 1,800 hand hygiene opportunities according to the WHO Five Moments for Hand Hygiene framework. Of these opportunities, hand hygiene actions were performed on 1,170 occasions,

yielding an overall compliance rate of 65.0%.

Table 1. Distribution of Healthcare Workers Observed

Professional Category	Number (%)
Doctors	50 (25.0)
Nurses	80 (40.0)
Interns	30 (15.0)
Technicians	20 (10.0)
Housekeeping Staff	20 (10.0)
Total	200 (100.0)

Table 2. Overall Hand Hygiene Compliance

Parameter	Number
Total opportunities observed	1,800
Hand hygiene actions performed	1,170
Missed opportunities	630
Compliance rate (%)	65.0

Table 3. Compliance According to Professional Category

Category	Opportunities Observed	Actions Performed	Compliance (%)
Doctors	450	270	60.0
Nurses	720	518	71.9
Interns	270	156	57.8
Technicians	180	119	66.1
Housekeeping Staff	180	107	59.4

Nurses demonstrated the highest compliance rate (71.9%), whereas interns showed the lowest compliance rate (57.8%).

Table 4. Compliance According to WHO Five Moments

WHO Hand Hygiene Moment	Opportunities	Compliance (%)
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Before touching a patient	420	55.2
Before aseptic procedure	300	61.3
After body fluid exposure risk	180	85.0
After touching a patient	450	74.2
After touching patient surroundings	450	61.8

Compliance was highest after body fluid exposure risk (85.0%) and lowest before touching a patient (55.2%).

Table 5. Factors Associated with Compliance

Variable	Compliance (%)	p-value
Previous hand hygiene training	74.5	<0.001
No recent training	55.8	
Availability of alcohol hand rub	70.2	0.003
Limited availability	58.1	
ICU setting	72.6	0.021
General wards	61.4	

Healthcare workers who had received recent hand hygiene training demonstrated significantly higher compliance than those without recent training ($p < 0.001$). Similarly, adequate availability of alcohol-based hand rub dispensers was significantly associated with improved compliance ($p = 0.003$).

6. DISCUSSION

Hand hygiene remains the cornerstone of infection prevention and control practices in healthcare settings. The present study evaluated hand hygiene compliance among healthcare workers in a tertiary care hospital and demonstrated an overall

compliance rate of 65.0%. Although this compliance level is higher than that reported in many low- and middle-income countries, it remains below the ideal compliance target recommended by international infection prevention guidelines.²⁶

The overall compliance rate observed in the present study is comparable to findings reported in several recent international studies. A systematic review conducted by Price et al. reported that hand hygiene compliance among healthcare workers generally ranges between 40% and 70%, depending on healthcare setting,

professional category, and observation methodology.²⁷ Similarly, Lotfinejad et al. reported moderate compliance levels across healthcare institutions despite widespread implementation of hand hygiene promotion strategies.²⁸ These findings suggest that achieving and sustaining optimal compliance remains a global challenge.

In the present study, nurses demonstrated the highest compliance rate (71.9%), whereas interns exhibited the lowest compliance rate (57.8%). Similar observations have been reported in previous investigations where nurses consistently showed better adherence to hand hygiene practices than physicians and trainees.²⁹ The higher compliance among nurses may be attributed to their continuous patient contact, greater participation in infection control training programs, and stronger adherence to institutional protocols. Conversely, lower compliance among interns may reflect inadequate practical training, heavy workloads, and limited awareness regarding infection prevention practices.³⁰

Assessment according to the WHO Five Moments for Hand Hygiene revealed the highest compliance after body fluid exposure risk (85.0%) and after touching a patient (74.2%). In contrast, compliance was substantially lower before touching a patient (55.2%) and before aseptic

procedures (61.3%). These findings are consistent with previous studies demonstrating that healthcare workers are generally more likely to perform hand hygiene after patient contact than before patient contact.³¹ This behavioral pattern may be influenced by self-protection motives, wherein healthcare workers perceive a greater personal risk following exposure to bodily fluids than before patient interaction.³²

The present study further demonstrated a significant association between hand hygiene training and compliance. Healthcare workers who had received recent hand hygiene training exhibited substantially higher compliance rates than those without recent training (74.5% vs. 55.8%, $p < 0.001$). Similar findings have been reported by numerous investigators who identified continuous education and periodic refresher training as critical determinants of successful hand hygiene improvement programs.³³ Educational interventions enhance awareness, reinforce recommended practices, and contribute to long-term behavioral change among healthcare workers.

Availability of alcohol-based hand rub was also significantly associated with improved compliance (70.2% vs. 58.1%, $p = 0.003$). Easy accessibility of hand hygiene resources is a well-established predictor of

adherence. Studies have shown that strategically placed alcohol-based hand rub dispensers significantly increase hand hygiene performance by reducing the time and effort required to perform hand hygiene.³⁴ The WHO multimodal hand hygiene improvement strategy similarly emphasizes system change and resource availability as essential components of successful compliance improvement initiatives.³⁵

Department-wise analysis indicated significantly higher compliance in intensive care units compared with general wards (72.6% vs. 61.4%, $p=0.021$). This observation is consistent with previous reports suggesting that intensive care settings often demonstrate superior compliance because of increased awareness of infection risks, closer supervision, higher nurse-to-patient ratios, and more rigorous infection control practices.³⁶ However, despite higher compliance rates in critical care units, continuous monitoring remains necessary to ensure sustained adherence and reduce healthcare-associated infection rates.

The findings of the present study highlight the importance of implementing multifaceted interventions to improve hand hygiene compliance. Recent evidence supports the effectiveness of multimodal strategies incorporating education, audit

and feedback, reminders, leadership engagement, and institutional safety culture initiatives.³⁷ Such approaches have demonstrated significant and sustained improvements in compliance rates across diverse healthcare settings. Furthermore, technological innovations including electronic monitoring systems and automated compliance surveillance tools may provide valuable support for continuous quality improvement programs.³⁸

From a patient safety perspective, improved hand hygiene compliance has been consistently associated with reductions in healthcare-associated infections, antimicrobial resistance transmission, and healthcare expenditures.³⁹ Therefore, strengthening hand hygiene programs should remain a priority for healthcare institutions seeking to improve quality of care and patient outcomes.

Strengths of the Study

The study utilized direct observation based on the WHO Five Moments for Hand Hygiene framework, which is considered the gold standard for evaluating hand hygiene compliance. Observations were conducted across multiple professional categories and clinical departments, allowing a comprehensive assessment of hand hygiene practices within the hospital.⁴⁰⁻⁵⁷

Limitations of the Study

The study has certain limitations. First, direct observation may have introduced the Hawthorne effect, whereby healthcare workers modified their behaviour because they were aware of being observed. Second, the study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings. Third, observations were performed over a limited study period and may not fully capture long-term compliance patterns. Future multicenter studies incorporating electronic monitoring systems may provide more robust assessments of hand hygiene behaviour.

Overall, the findings indicate moderate hand hygiene compliance among healthcare workers, with significant variations across professional categories, hand hygiene moments, and clinical settings. Continuous education, resource availability, regular audits, and multimodal intervention strategies are recommended to improve compliance and strengthen infection prevention and control practices.

7. CONCLUSION

The present study evaluated hand hygiene compliance among healthcare workers in a tertiary care hospital and found an overall compliance rate of 65.0%, indicating moderate adherence to recommended hand hygiene practices. Compliance varied

considerably across professional categories, with nurses demonstrating the highest compliance and interns exhibiting the lowest. Similarly, significant differences were observed across the WHO Five Moments for Hand Hygiene, with the highest compliance recorded after body fluid exposure risk and the lowest before patient contact.

The study further identified several factors significantly associated with hand hygiene compliance, including recent hand hygiene training, availability of alcohol-based hand rub dispensers, and clinical work setting. Healthcare workers who had received recent training and those working in environments with readily accessible hand hygiene facilities demonstrated significantly higher compliance rates. These findings highlight the critical role of continuous education, adequate infrastructure, and institutional support in promoting effective hand hygiene practices. Given the well-established relationship between hand hygiene and prevention of healthcare-associated infections, sustained efforts are required to improve compliance among all categories of healthcare workers. Regular training programs, periodic compliance audits, performance feedback, adequate provision of hand hygiene resources, and implementation of the WHO multimodal hand hygiene improvement

strategy should be strengthened to enhance adherence.

In conclusion, although the observed compliance rate was encouraging, further improvements are necessary to achieve optimal hand hygiene performance and ensure patient safety. Strengthening hand hygiene practices through comprehensive infection prevention and control initiatives can contribute significantly to reducing healthcare-associated infections, improving quality of care, and promoting a safer healthcare environment.

8. FUTURE RECOMMENDATIONS

To further improve hand hygiene compliance among healthcare workers, healthcare institutions should implement regular training and refresher programs, ensure continuous availability of hand hygiene resources at points of care, and conduct periodic compliance audits with constructive feedback. Promoting a strong patient safety culture through leadership support and staff engagement can enhance adherence to recommended practices. Additionally, the adoption of electronic monitoring systems may facilitate effective compliance surveillance. Future multicenter studies involving larger sample sizes are recommended to provide more generalizable evidence and to evaluate the long-term impact of improved hand

hygiene practices on healthcare-associated infections and antimicrobial resistance.

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