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Original Research Article

Specialty-specific hand hygiene compliance: 5-year study from a large public sector teaching hospital, South India

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ABSTRACT

Background: Hand hygiene (HH) is essential for preventing healthcare-associated infections (HAIs), especially in ICUs and cancer care centers. These settings often involve immunocompromised patients and invasive devices, making HH critical for patient safety. Despite its recognized importance, consistent adherence to HH practices by healthcare workers (HCWs) remains a significant challenge.
Aim and Objective: This study aimed to evaluate HH compliance in a tertiary care hospital in South India using a customized Android application aligned with WHO guidelines.
Materials and Methods: This observational study was conducted across high-risk areas of a tertiary care hospital from June 2019 to May 2024. The hospital's high-risk units, under medical, surgical, and pediatric alliances, were included. An Android application based on the Ibhar platform and WHO hand hygiene audit guidelines was used for data collection. The study recorded HH opportunities, Complete HH Adherence (HHCAR), Partial HH Adherence (HHPAR), and Total HH Adherence (HHTAR). The data were analyzed for location-specific, profession-specific, and moment-specific compliance rates.
Results: A total of 196,252 HH opportunities were recorded, with the surgical alliance accounting for the highest number. Pediatric units had the highest compliance, with an HHTAR of 89% and an HHCAR of 66%. Nurses demonstrated the highest compliance among professions, with an HHTAR of 82.8%. Compliance was higher after patient care moments compared to before. Statistically significant differences were noted across different specialties and moments.
Conclusion: This large-scale study highlights the variation in HH compliance across different specialties and the need for targeted training sessions. Given the resource constraints in many tertiary care centers, focusing audits on high-risk areas is practical. The use of software-based applications like Ibhar enhances data collection and analysis, making the audit process more efficient. Regular HH audits and behavioral changes are essential to improve and sustain high standards of HH compliance, ultimately contributing to better infection control practices.

1. Introduction

Hand hygiene (HH) is universally recognized as one of the most effective strategies to prevent healthcare-associated infections (HAIs), a significant concern in medical facilities

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worldwide.[1–4] By reducing the transmission of pathogens, proper HH practices are critical to patient safety, particularly in high-risk environments such as Intensive Care Units (ICUs) and cancer care centers, where patients are immunocompromised and often require invasive devices like ventilators, urinary catheters, and central lines. Despite the well-documented importance of HH, ensuring consistent adherence among healthcare workers (HCWs) remains a persistent challenge, even with extensive education and training, especially highlighted during the COVID-19 pandemic.[5,6]

Regular hand hygiene audits play a crucial role in monitoring and improving compliance with HH practices. Audits provide a structured approach to assess adherence, identify gaps, and offer timely feedback, which is essential for fostering a culture of safety and accountability.[3,4] However, for these efforts to be effective on a national scale, it is imperative to establish standardized benchmarks for HH compliance. These benchmarks would serve as a reference point for both public and private healthcare sectors, driving improvements in infection control practices across diverse healthcare settings in India.

The integration of technology in conducting and analyzing HH audits offers a significant advantage in overcoming traditional challenges, such as observer bias. Tools like the Ibhar software, used in this study, enhance the accuracy and efficiency of data collection and analysis, allowing for more objective and reliable monitoring.[6–8] This technological approach not only streamlines the audit process but also enables comprehensive feedback mechanisms, which are vital for sustaining improvements in HH adherence.

This study, conducted at a government sector institute of national importance in South India, stands out due to its extensive dataset and detailed focus on location-specific and profession-specific audits. By including assessments based on the WHO's five moments for hand hygiene, the study provides a nuanced understanding of compliance patterns. The findings from this large-scale study will contribute to establishing a national baseline for HH compliance, offering valuable insights that can inform targeted interventions aimed at enhancing infection control practices across India.

2. Materials and Methods

This study is a observational analysis conducted in high-risk areas of a tertiary care hospital, which has a bed capacity of 188 in the intensive care of medical alliance, 127 in the intensive care of pediatric alliance, and 266 in the intensive care of surgical alliance. The analysis covered a study period from June 2019 to May 2024. For the hand hygiene audit, an Android application based on the Ibhar platform was utilized. This application was designed in accordance with the World Health Organization (WHO) hand hygiene audit guidelines, ensuring standardized and accurate data collection across the various hospital units.

The observer underwent baseline training on the WHO Five Moments for Hand Hygiene, including instructions on auditing hand hygiene practices and evaluations with case scenarios and video demonstrations to ensure competence. During the observation period, the observer recorded key metrics to assess hand hygiene compliance: Hand Hygiene Opportunities (instances where HH was indicated for HCWs), Complete Hand Hygiene Adherence (when HCWs performed all steps of hand rub or hand wash with the recommended duration as per WHO guidelines), Partial Hand Hygiene Adherence (when HCWs followed fewer steps or used a shorter duration), and Hand Hygiene Total Adherence (the sum of Complete and Partial Hand Hygiene actions). To ensure audit reliability and minimize biases associated with direct observation, the auditor's training standardized the assessment approach, audits were conducted at random times to mitigate work pressure effects, and an Android application used during other infection control activities helped reduce observer bias and enhanced data objectivity. The data collected were used to calculate the Hand Hygiene Complete Adherence Rate (HHCAR), Hand Hygiene Partial Adherence Rate (HHPAR), and Hand Hygiene Total Adherence Rate (HHTAR) using standard formulas provided by the WHO.[2,4] Location-specific hand hygiene compliance was analyzed across various medical, surgical, and pediatric alliances within the hospital. Profession-specific rates were determined by calculating HHCAR, HHPAR and HHTAR for different professional groups, including physicians, nurses, Group D staff (support staff), and others such as nursing interns and physiotherapists. Additionally, the Moment-Specific HHTAR was computed for each of the five WHO-recommended hand hygiene moments.

2.1. Statistical analysis

All the data sets generated were entered into MS Excel and inferential statistical analysis was done using SPSS Software version 29. Odds ratio and P value was calculated. Odds ratio defines the association between exposure and outcome through which P value has been derived to determine the significance of the results. P Value <0.05 typically indicates that the results are statistically significant, suggesting strong evidence against the null hypothesis.

3. Results

3.1. Hand hygiene opportunities and overall compliance

A total of 196,252 opportunities were recorded during the study period. As shown in the Table 1, maximum number of opportunities was recorded in Surgical alliance (86962) during the study period compared to medical (69962) and

pediatric alliance (39328) and the finding was statistically significant (p value <0.05). However, as shown in the Table 1, adherence rates such as HHTAR and HHCAR were higher in pediatric alliance (89% and 66%) and HHPAR was higher in medical and surgical alliance (29%).

3.2. Speciality specific compliance

In the medical alliance, the MICU had the most recorded hand hygiene opportunities (13,895), followed by the COVID ICU (13,063). The Medical oncology ICU achieved the highest HHTAR at 83.6%. In the Pulmonary ICU, the Total Adherence Rate and Complete Adherence Rate were 82.5% and 56.6% (highest) respectively. The HHPAR was particularly more in the Dialysis Unit (33.2%) and the Medical oncology ICU (32.0%).

In the surgical alliance, the clean labor room had the largest number of hand hygiene opportunities (13,464). The Neurosurgery department demonstrated the highest compliance, with an HHTAR of 82.6% and an HHCAR of 56.2%.

In the pediatric alliance, the Pediatric Medical ICU and the Neonatal ICU recorded the greatest number of hand hygiene opportunities, with 15,012 and 14,972, respectively. Among all medical, surgical, and pediatric units, the Pediatric Medical ICU had the best HHTAR at 92.5%, closely followed by the Neonatal ICU at 91.9%.

3.3. Profession specific compliance

Overall, nurses demonstrated the highest hand hygiene compliance, with an HHTAR of 82.8%, an HHCAR of 54.6%, and an HHPAR of 28.2% and the finding was statistically significant (p value <0.05). This was followed by the "others" category and doctors, with HHTARs of 69.3% and 66.5%, respectively. Among all high-risk locations, nurses and doctors in the pediatric alliance exhibited the best hand hygiene compliance, with HHTARs of 91.6% and 87.6%, respectively. In the medical and surgical alliances, nurses again showed the highest compliance, with HHTARs of 77.7% and 82.8%, respectively (statistically significant p value <0.05).

3.4. Moment specific compliance

Overall compliance during WHO HH moment 4 (HHTAR-84%) and 3 (HHTAR-81%) were significantly higher and moment 5 (HHTAR- 64%) was significantly lower than other moments and the similar trend was also noted in medical, surgical and pediatric alliance. Statistically significant difference was noted between before and after hand hygiene moments (p<0.05)

4. Discussion

Hand hygiene (HH) is a cornerstone of patient safety and a critical component of effective hospital infection control. Despite its importance, HH compliance remains suboptimal in clinical settings, presenting a persistent challenge in healthcare. HH audits, especially through direct observation, are considered the gold standard for assessing compliance. In our study, we tracked HH opportunities, complete adherence, and partial adherence. While the World Health Organization (WHO) advocates for complete adherence, recognizing that partial compliance may not provide the same level of protection, we included partial adherence metrics to encourage healthcare workers (HCWs) to progress towards full compliance.

This large-scale study, conducted in a 1700-bed tertiary care hospital across 20 high-risk areas, analyzed nearly 1.96 lakh HH opportunities. To our knowledge, this is one of the largest single-center studies of its kind globally. The use of a customized Ibhar application, based on WHO guidelines, was instrumental in streamlining data collection and analysis, reducing the burden on auditors, and ensuring consistency across observations. Given the extensive data collected, this study not only provides valuable insights into HH practices but also contributes to the potential establishment of a national benchmark for HH compliance in India.

In the present study we noted an overall HH compliance of 75%, with best compliance to hand hygiene among pediatric alliance (89%) followed by surgical alliance (72%) and medical alliance (71%). Literature search reveals a varied hand hygiene compliance which emphasizes need for large scale studies. In a study conducted by Gupta S et al,[9] in a tertiary care centre from North India, recorded 16552 HH opportunities and reported overall compliance of 69.3% and in a multicentric study conducted by Harun MG et al,[10] in Bangladesh across 10 hospitals recorded 14,668 HH opportunities and recorded a compliance rate of 25.3%. Other studies done by Rahim VM et al,[11] in 2020, Thomas AM et al,[12] in 2019, Laskar AM et. al,[13] in 2016, and Sastry et al,[14] in 2017 reported an overall HH compliance of 53.74% (total of 4301 recorded opportunities), 65.3% (total of 1056 recorded opportunities), 69.7% (total of 6350 recorded opportunities) and 45.5% (total of 19936 recorded opportunities) respectively. Laskar AM et al[13] and Sastry et al,[14] conducted the study in 2016 and 2017 respectively, in the similar setting as the present study and it clearly demonstrates the change in the trend of HH compliance over years. In a study conducted by Hoffmann M, et al,[15] an observational single-center study conducted in Austria between 2013 and 2017, reported an overall compliance rate of 89.6% and best HH compliance in pediatric ICUs (97.8%) compared to medical (89.5%) and surgical ICUs (82.2%), the similar finding noted in the present study.

Table 1: Location specific HH compliance

		HHCAR %(n/N)	HHPAR %(n/N)	HHTAR %(n/N)
Medical		41.3 (28912/69962)	29.2 (20658/69962)	70.9 (49570/69962)
1.	Medicine ICU	42.2 (5863/13895)	27.9 (3875/13895)	70.1(9738/13895)
2.	Neuromedicine ICU	53.8 (4919/9135)	22.2 (2028/9135)	76.0(6947/9135)
3.	Critical care ICU	38.4 (4595/11978)	30.1 (3602/11978)	68.4(8197/11978)
4.	Pulmonary ICU	56.6 (1252/2212)	25.9 (573/2212)	82.5(1825/2212)
5.	COVID ICU	25.0 (3268/13063)	31.7 (4146/13063)	56.8(7414/13063)
6.	Dialysis unit	41.3 (4556/11032)	33.2 (3665/11032)	74.5(8221/11032)
7.	Medical oncology ICU	51.6 (4459/8647)	32.0 (2769/8647)	83.6(7228/8647)
Surgical		43.4 (37755/86962)	28.9 (25100/86962)	72.3 (62855/86962)
8.	Cardiothoracic ICU	45.2 (5143/11379)	28.0 (3182/11379)	73.2 (8325/11379)
9.	Neurosurgery ICU	56.2 (5769/10265)	26.4 (2709/10265)	82.6 (8478/10265)
10.	Obstetrics ICU	42.8 (2220/5192)	33.7 (1752/5192)	76.5 (3972/5192)
11.	Surgery ICU	35.9 (4243/11805)	27.6 (3257/11805)	63.5 (7500/11805)
12.	Surgical gastroenterology ICU	37.6 (3193/8498)	30.8 (2614/8498)	68.3 (5807/8498)
13.	Trauma care ICU	48.9 (4240/8669)	32.7 (2836/8669)	81.6 (7076/8669)
14.	Plastic surgery ICU	42.3 (2551/6034)	28.2 (1704/6034)	70.5 (4255/6034)
15.	Urology ICU	47.6 (1989/4178)	31.8 (1330/4178)	79.4 (3319/4178)
16.	Clean labour room	38.9 (5235/13464)	25.4 (3425/13464)	64.3 (8660/13464)
17.	Septic labour room	42.4 (3172/7478)	30.6 (2291/7478)	73.1 (5463/7478)
Pediatric		66.4 (26122/39328)	22.7 (8922/39328)	89.1 (35044/39328)
18.	Neonatal ICU	72.0 (10774/14972)	19.9 (2982/14972)	91.9 (13756/14972)
19.	Pediatric ICU (medical)	68.9 (10348/15012)	23.5 (3533/15012)	92.5 (13881/15012)
20.	Pediatric ICU (surgery)	53.5 (5000/9344)	25.8 (2407/9344)	79.3 (7407/9344)

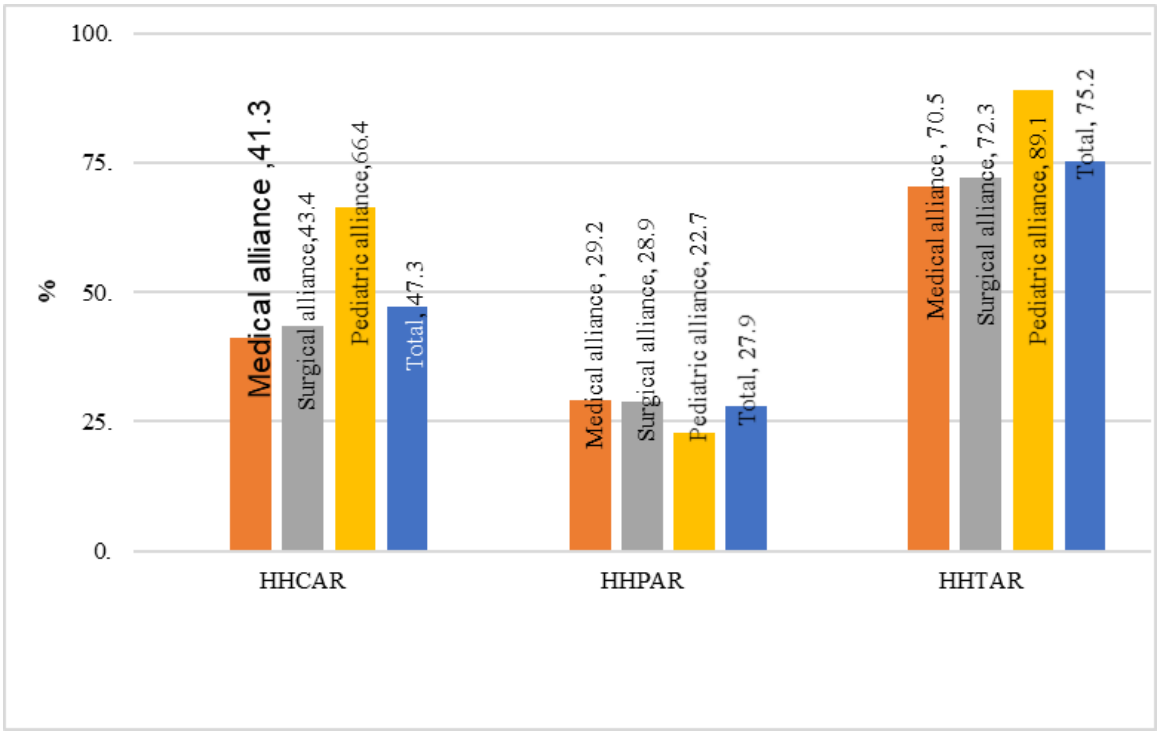

Figure 1: Overall specialty-specific hand hygiene compliance

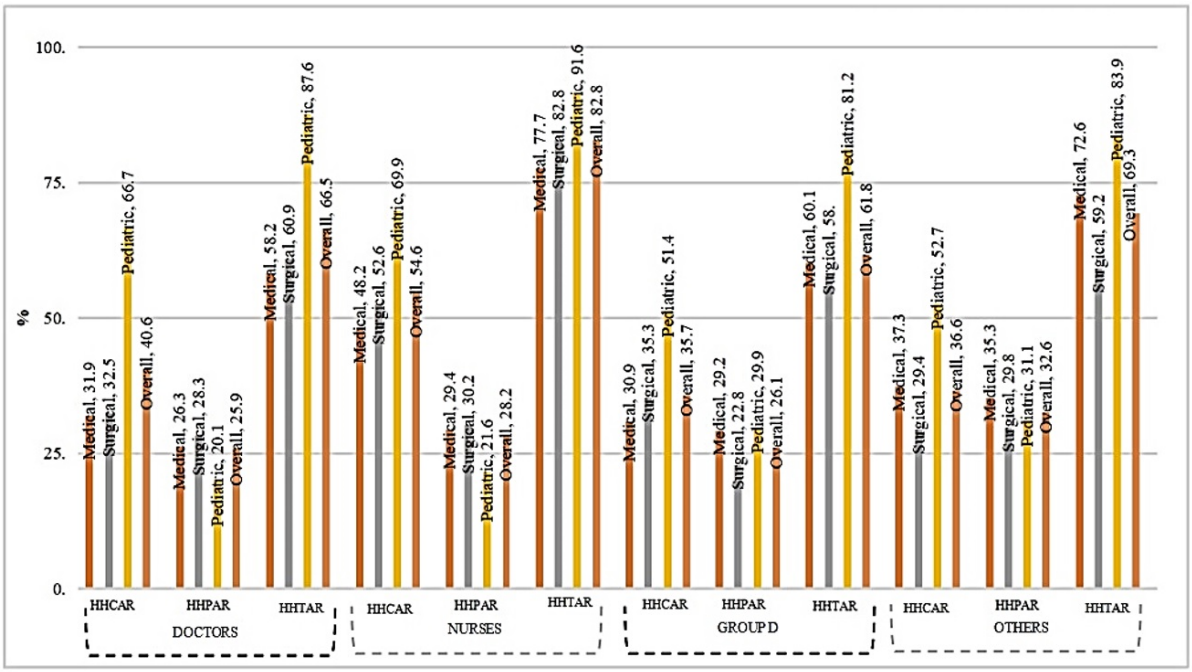

Figure 2: Profession specific hand hygiene compliance

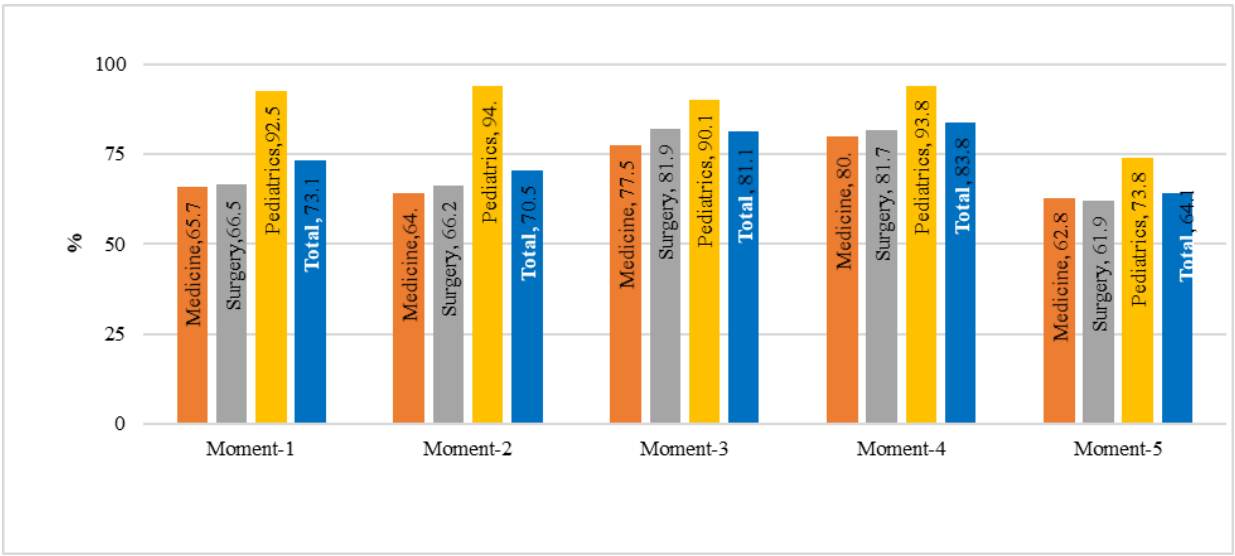

Figure 3: Moment specific HH compliance

As reported by many studies in the literature i.e. by Harun MG et.al, Hoffmann M et al, Thomas AM et al, and Gupta S et al, clearly stated that HH compliances among nurses is higher than that of physicians. In a meta-analysis from 105 studies conducted by Bredin D et al.,[16] also stated the same finding. Nurses tend to exhibit better hand hygiene compliance than doctors, largely due to their consistent and repetitive patient care tasks that incorporate hand hygiene into their routine. In contrast, doctors often face higher cognitive demands and time pressures, which can lead to lapses in hand hygiene, especially in high-stress situations. This discrepancy highlights the need for targeted interventions to support improved compliance among physicians.

It was noted that after moments of hand hygiene had better compliance than before moments. The similar observations were reported by Harun MG et al,[10] Hoffmann M et al,[15] Laskar AM et al,[13] and Sastry et al.[14] The factors which may influence this behavior include greater awareness and adherence to hand hygiene

protocols immediately following critical patient interactions or procedures and also as a response to direct contact with potentially contaminated environments or body fluids during care activities. This pattern underscores the importance of maintaining rigorous hand hygiene practices both before and after patient moments to minimize the risk of infection and enhance overall patient safety.

The limitations of this study include, HH compliance based on shift variation, gender variation, diurnal variation, and experience-specific variation were not examined. Additionally, the observation periods were based on convenience sampling rather than being randomized, which may have introduced bias. Furthermore, the study did not analyse the role of HH in reducing healthcare-associated infections (HAIs). These areas will be the focus of our future research.

5. Conclusion

This study is among the first to conduct a HH audit on such a large scale, with a significant number of HH opportunities recorded. Analyzing compliance on a specialty-wise basis provides valuable insights into variations in practice, helping to tailor hand hygiene training sessions more effectively. Given that many tertiary care centres are burdened with numerous locations to audit and limited manpower, it is practical to focus on high-risk areas for HH audits. We strongly recommend that infection control departments in healthcare facilities regularly conduct HH audits in these critical locations. Additionally, adopting software-based applications can significantly ease data collection and analysis, making the auditing process more efficient. Improving the Hand Hygiene Complete Adherence Rate (HHCAR) by ensuring adherence to all WHO-recommended steps and durations is crucial. Achieving and sustaining high standards of HH compliance will require behavioural changes, especially under increased work pressure.

6. Source of Funding

None.

7. Conflict of Interest

None.

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