Hand Hygiene Knowledge, Attitudes, and Practices Among Healthcare Staff at a Tertiary Cardiac Care Center

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ARTICLE INFO	ABSTRACT

Effective hand hygiene (HH) is a cornerstone of infection prevention in healthcare settings, particularly in tertiary cardiac care centers where healthcare-associated infections (HAIs) pose significant risks. This cross-sectional study evaluated the knowledge, attitudes, and self-reported practices of HH among 661 nursing staff (98.3% of 661 respondents; response rate 65.4% of 1,010 total staff), at a tertiary cardiac care center in Ahmedabad, India. The survey, conducted via an online questionnaire (Google Forms), used an instrument with high internal consistency (Cronbach's $\alpha = 0.89$), revealed a mean knowledge score of 84.1%, an attitude score of 88.8%, and a practice score of 87.6%. Critical care nurses and staff with over 5 years of experience exhibited significantly higher knowledge scores compared to their counterparts ($P < 0.001$), while less experienced staff reported lower practice adherence. Positive attitudes were prevalent, with 94.4% willing to promote HH, though workload was cited by 64.9% of respondents as a major barrier to compliance. These findings highlight the need for targeted education for novice staff, workload management strategies, and continuous monitoring to sustain optimal HH compliance and mitigate HAI-related pathogen transmission.

INTRODUCTION

Healthcare-associated infections (HAIs) represent a persistent global health challenge, particularly in tertiary cardiac care settings where invasive procedures and immunocompromised patients increase infection risk. The incidence of HAIs following cardiac surgery ranges from 6% to 24%, with surgical site infections, pneumonia, and urinary tract infections being the most common complications [1, 2]. These infections contribute to prolonged hospital stays, increased antimicrobial resistance, and higher morbidity and mortality rates, imposing significant clinical and economic burdens on healthcare systems and patients [3, 4]. Hand hygiene (HH) stands as one of the most effective, evidence-based interventions to interrupt pathogen transmission by healthcare workers (HCWs). This is particularly critical given that HCWs play a central role in the transmission of HAIs, including those caused by multidrug-resistant organisms (MDROs) such as methicillin-resistant *Staphylococcus aureus* (MRSA) [3, 5].

Historical evidence underscores the transformative impact of HH. In 1847, Ignaz Semmelweis demonstrated that handwashing with chlorinated lime solutions reduced puerperal fever mortality, laying the foundation for modern infection control [6]. Contemporary global efforts, such as the World Health Organization (WHO) "SAVE LIVES: Clean Your Hands" campaign, reinforce HH as central to patient safety [7]. Despite these initiatives, compliance remains inconsistent, influenced by factors such as workload, training, and institutional culture, among others [8]. In high-stakes environments such as cardiac care, HAIs can exacerbate underlying conditions. Thus, understanding the HH knowledge, attitudes, and practices of HCWs is critical for tailoring interventions.

Nursing staff, as primary bedside care providers, play a pivotal role in HH adherence. Studies widely report variable compliance rates worldwide, ranging from low to optimal levels, often linked to knowledge gaps or attitudinal barriers [9, 10]. In India, where healthcare

Maradia et al.

resources and infection control practices vary widely across institutions and regions, assessing HH among nursing staff in specialized settings is particularly urgent given the high burden of HAIs in the country [11]. We therefore conducted this study to evaluate HH knowledge, attitudes, and practices among healthcare (predominantly nursing) staff at a tertiary cardiac care center in Ahmedabad, India, aiming to identify strengths and gaps to inform targeted educational and behavioral strategies for enhancing infection prevention.

METHODS

Study design and setting. A cross-sectional survey was conducted from May 1–6, 2023, during Hand Hygiene Awareness Week (coinciding with the WHO's annual May 5 campaign) at U. N. Mehta Institute of Cardiology and Research Centre, a high-volume tertiary cardiac care center in Ahmedabad, India.

Participants. Using a total population sampling approach, the questionnaire was distributed to all 1,010 nursing and medical staff who were employed at the institution during the study period via an online platform (Google Forms). We obtained a total of 661 completed responses (65.4% response rate), consisting of 650 nurses (98.3%) and 11 doctors (1.7%). Given that nurses comprised the vast majority of respondents, the analysis focuses primarily on nursing personnel, though hereafter, the entire cohort is collectively referred to as staff.

Data collection and instrument. We developed a structured questionnaire comprising four sections: demographics, knowledge (10 items), attitudes (9 items), and self-reported practices (10 items). The knowledge and practice items were adapted from the WHO "Hand Hygiene Knowledge Questionnaire for Health-Care Workers" (2009) [4], with minor modifications to ensure relevance to the cardiac care setting. Content validity was established through expert review, and the instrument was pilot-tested prior to distribution. The questionnaire's internal consistency was high, with a Cronbach's α of 0.89. The questionnaire was administered in English.

The knowledge section contained 10 multiple-choice questions, with each correct answer awarded 1 point (maximum score: 10). Scores were converted to percentages for reporting purposes. A score of ≥ 8 (80%) was categorized as "good," while scores < 8 were categorized as "inadequate". The attitude section used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) for 9 statements, and a mean score of ≥ 4 out of 5 was considered "positive," indicating favorable attitudes toward HH; scores < 4 indicated neutral or negative attitudes. For the 10 practice items, responses of "always" were scored as 2, "sometimes" as 1, and "never" as 0 (maximum score: 20). We calculated the total practice score for each participant by summing item scores and converting to a percentage of the maximum possible score.

Statistical analysis. Data were analyzed using IBM SPSS Statistics version 21 (IBM Corp., Armonk, NY, USA). Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize data. Independent-samples *t*-tests were used to compare mean knowledge scores between two groups, while one-way analysis of variance (ANOVA) was used to compare mean knowledge scores among groups with more than two categories. A *P*-value < 0.05 was considered statistically significant.

RESULTS

Of the 661 participants, 650 were nurses (98.3%) and 11 were doctors (1.7%), with 67.6% working in ICUs. The overall mean knowledge score was 84.1%. Furthermore, 99.9% of respondents recognized the role of HH in reducing infections. Critical care nurses ($P < 0.001$) and staff with > 5 years of experience ($P < 0.001$) scored significantly higher than their counterparts on knowledge of HH moments and steps (Table 1). Attitudes were highly positive (mean score of 88.8%), with 98.1% considering HH, a routine practice and 94.4% expressing willingness to promote HH. However, 64.9% cited workload as a barrier to compliance. The mean self-reported practice score was 87.6%, with 36.4% using alcohol-based hand rub (ABHR) 10–20 times per day and more than 90% reporting adherence to key HH moments (Table 2).

Table 1. Knowledge scores by experience and work area

Variable	Category	n (%)	Mean knowledge score (%)	P-value
Years of professional experience	<1 year	173 (26.2)	77.46	<0.001[a]
	1–5 years	158 (23.9)	81.00	
	6–10 years	223 (33.7)	85.00	
	>10 years	107 (16.2)	89.00	
Work area	ICU	447 (67.6)	87.00	<0.001[b]
	Ward	214 (32.4)	79.00	

[a]One-way analysis of variance (ANOVA). [b]Independent-samples t-test (comparing ICU vs. Ward).

Table 2. Self-reported hand hygiene practices

Practice	Always (%)	Sometimes (%)	Never (%)
Before touching a patient	92.7	6.1	1.2
Before a clean or aseptic procedure	96.5	2.7	0.7
After risk of body fluid exposure	93.6	1.3	4.9
After touching a patient	96.8	2.7	0.4
After using the restroom[a]	98.9	0.7	0.3

ᵃ This practice relates to personal hygiene rather than the WHO "My Five Moments for Hand Hygiene" framework.

DISCUSSION

This study demonstrated robust HH knowledge (84.1%) and self-reported practices (87.6%) among nursing staff, exceeding rates reported in some prior studies (*e.g.*, Kudavidanage *et al.*, 2011, who reported < 50% awareness in ICU staff) [12]. These high scores likely reflect intensive training and monitoring at the present cardiac care center, particularly given that 67.6% of the staff worked in ICUs, where infection risks are elevated due to the critical nature of patient care [1]. Years of professional experience significantly influenced knowledge (Table 1). Knowledge scores were significantly higher among staff with > 5 years of experience than among those with less experience ($P < 0.001$), consistent with the findings of Goyal *et al.* (2020), who reported that seniority enhances HH competence [13]. Similarly, critical care nurses demonstrated superior knowledge (mean score: 87%) compared with ward staff (mean score: 79%), consistent with Abd Rahim *et al.* (2022), who reported that working in intensive care settings was associated with better HH understanding [14].

The positive mean attitude score (88.8%) and the high proportion of staff willing to promote HH (94.4%) were consistent with the findings of Dreidi *et al.* (2016), who reported that experienced HCWs exhibited stronger HH commitment [15]. However, the finding that 64.9% of respondents cited workload as a barrier is consistent with global challenges reported by Pittet *et al.* (1999), who demonstrated that time constraints undermine compliance [5]. Self-reported practices showed high adherence (>90%) to critical HH moments (Table 2), surpassing rates reported by Vikke *et al.* (2019) in emergency settings (70–80%) [16]. Nevertheless, self-reporting may inflate results due to social desirability bias, whereby respondents may overreport favorable behaviors [17]. The finding that less experienced nurses showed lower compliance highlights the need for targeted onboarding education, as supported by Akyol (2007), who found that novices struggled with practical application despite possessing adequate theoretical knowledge [18].

These findings are consistent with the broader literature showing that HH knowledge scores range from 60% to 90% among HCWs, with variations influenced by training, experience, and setting [10, 19]. In India, where HAI prevalence is high (up to 20% in tertiary care settings) [11], the results of the present study are encouraging yet highlight areas for improvement. Compared with the findings of Maheshwari *et al.* (2014), who reported lower HH awareness in central India [20], the performance of our cohort may reflect the effectiveness of localized HH programs. Nonetheless, the integration of direct observation, as recommended by Gould *et al.* (2007) [21], could validate the present self-reports and address potential overestimation of compliance rates. Maintaining optimal HH compliance requires addressing workload, providing enhanced training for novice staff, and ensuring alignment with WHO guidelines [7] to reduce HAIs and the transmission of MDROs in the present high-risk cardiac setting.

CONCLUSION

This study demonstrated high levels of HH knowledge, positive attitudes, and strong self-reported practices among nursing staff at a tertiary cardiac care center. Years of professional experience and work area (ICU *vs.* ward) were significant predictors of higher knowledge. However, perceived workload remains a key barrier to HH compliance. To sustain these positive outcomes in HH compliance and mitigate HAI risks, institutions should prioritize ongoing HH training for novice staff, address systemic barriers such as workload, and implement continuous HH compliance monitoring through direct observation. These measures are essential for reducing HAIs and improving patient safety in high-risk cardiac care settings.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

AI DISCLOSUE

No artificial intelligence tools were used in the preparation, writing, or editing of this manuscript.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

AUTHORS' CONTRIBUTIONS

MM: Concept; Design; Definition of intellectual content; Literature search; Data acquisition; Statistical analysis; Drafting of the manuscript. SG: Definition of intellectual content; Statistical analysis. SB: Concept; Literature search. DP, AC, DP, and IK: Data collection. All authors critically reviewed and approved the final version of the manuscript.

ETHICS STATEMENT

The present study, which explores knowledge, attitudes, and practices (KAP), was conducted in accordance with the institutional policy, thereby

Maradia et al.

exempting it from the requirement for formal ethical approval. Voluntary participation was ensured throughout the study, and the study adhered to the institutional ethical policy as outlined in the institutional ethical declaration. This policy stipulates that participants must be fully informed about the nature, purpose, risks, and benefits of the study and must voluntarily agree to participate without coercion. The researchers committed to protecting the welfare, rights, and privacy of participants throughout the study, which included minimizing risks and ensuring confidentiality. Furthermore, respect for participant autonomy was upheld at every stage of the study. Informed consent was implied through voluntary participation, and all data were collected anonymously.

Studies of this nature, commonly referred to as KAP studies, are typically classified as low-risk research in which participants' identities are kept anonymous, and no invasive procedures or sensitive information is involved.

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