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#### Received

15, 10, 25

#### Accepted

18, 11, 2025

#### Authors' Contributions

Concept: YK; Design: S; Data Collection: ZA;  
Analysis: BA; Drafting: AB; Critical Revision: AA

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#### Declarations

No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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# Barriers to Hand Hygiene Compliance Among Nurses at DHQ Hospital Charsadda

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## ABSTRACT

**Background:** Hand hygiene is a cornerstone of infection prevention, yet compliance among healthcare workers remains suboptimal in many low-resource settings. Nurses, as the largest group of frontline providers, are particularly influential in the transmission or prevention of healthcare-associated infections. **Objective:** To identify predominant barriers to hand hygiene and describe knowledge and practice among nurses at District Headquarters (DHQ) Hospital Charsadda. **Methods:** A descriptive cross-sectional study was conducted among 50 registered nurses using a structured, self-administered questionnaire and a brief observation checklist based on World Health Organization guidance. Data on demographics, knowledge, self-reported practice, perceived barriers, and observed behaviour were analysed using descriptive statistics in SPSS version 26. **Results:** Most nurses were older than 30 years and highly experienced, with 64% reporting more than 10 years of service. Only 36% correctly identified the WHO-recommended 40–60 seconds handwashing duration, and recognition of all WHO “key moments” was rare. While 56% reported frequently washing hands before patient contact, only 10% always wore gloves; 58% used reusable cloth towels for drying. Observations showed pre-contact hand hygiene in 76% of encounters and glove use in 44%. The principal barriers were lack of handwashing facilities (52%) and insufficient hand sanitiser (34%). **Conclusion:** Structural constraints, particularly inadequate infrastructure and supplies, coexist with knowledge and practice gaps and likely undermine effective hand hygiene among nurses at DHQ Hospital Charsadda.

## Keywords

Hand hygiene; nurses; infection control; barriers; compliance; WHO guidelines; Pakistan.

## INTRODUCTION

Healthcare-associated infections (HAIs) remain a major cause of preventable morbidity, mortality and financial burden worldwide, particularly in low- and middle-income countries where infection prevention resources are constrained (1,2). Hand hygiene is consistently identified as the single most effective and low-cost intervention to interrupt transmission of pathogens between patients, staff and the healthcare environment, and forms the cornerstone of all infection-prevention and control programmes (3). The World Health Organization (WHO) has operationalised this concept through the “My Five Moments for Hand Hygiene” framework and recommends an effective handwashing duration of 40–60 seconds using soap and water or an alcohol-based hand rub when hands are not visibly soiled (4). Despite the simplicity of these recommendations, reported compliance among healthcare workers, including nurses, frequently remains suboptimal, with rates often below 50% in real-world settings (5,6). Nurses constitute the largest proportion of the clinical workforce and have the most frequent direct contact with patients, invasive procedures and the surrounding environment, placing them at the centre of HAI transmission dynamics (7). Multicountry and regional studies have highlighted a recurring pattern in which nurses demonstrate moderate to high knowledge of hand hygiene principles but translate this into only partial adherence at the bedside (8–10). This “knowledge–practice gap” has been attributed to a complex interaction of individual, organisational and system-level barriers including inadequate infrastructure, lack of conveniently located sinks or dispensers, shortage of hand rub, skin irritation, high workload, unclear policies and weak institutional safety culture (11–13). Evidence from settings such as Saudi Arabia, Jordan, Nigeria, Afghanistan and Kuwait suggests that the relative contribution of these barriers varies markedly across hospitals and countries, underscoring the importance of local data to design context-appropriate interventions (8–10,14,15).

In Pakistan, DHQ-level public hospitals are typically characterised by high patient volumes, chronic resource constraints, limited space and staffing pressures, conditions that may amplify barriers to consistent hand hygiene. Yet empirical studies from such secondary-level facilities remain scarce, and most available work has focused on tertiary teaching hospitals or on general knowledge surveys without systematically examining structural obstacles and real-time behaviour. In particular, DHQ Hospital Charsadda serves as a key referral centre for a large catchment population, but there is no published assessment of hand hygiene barriers or compliance among its nursing staff. Without this information, hospital management and infection-control committees are unable to prioritise investments or tailor quality-improvement programmes to the actual bottlenecks experienced by frontline nurses.

Within this context, the present study was designed to focus explicitly on barriers to hand hygiene compliance among nurses at DHQ Hospital Charsadda, while also describing their knowledge and reported and observed practices. Using a cross-sectional survey complemented by direct observation, the study aimed to quantify the prevalence of infrastructural, supply-related and workload-related constraints and to characterise how

these coexist with everyday handwashing, glove use and use of alcohol-based hand rub. The overarching objective was to generate actionable, locally relevant evidence to inform institutional policies and educational strategies. The specific research question guiding this work was: What are the predominant barriers to hand hygiene among nurses at DHQ Hospital Charsadda, and how do these coexist with their knowledge and self-reported and observed compliance?

## MATERIALS AND METHODS

This study employed a quantitative, descriptive cross-sectional design to assess barriers to hand hygiene compliance, alongside knowledge and practice, among nurses working at District Headquarters (DHQ) Hospital Charsadda. A cross-sectional approach was selected because it allows efficient estimation of the prevalence of behaviours and perceived obstacles at a single point in time and is widely used in infection prevention research among healthcare workers (8,10,14). The study was conducted in DHQ Hospital Charsadda, a secondary-level public hospital in Khyber Pakhtunkhwa province, Pakistan, which provides inpatient and outpatient services across major clinical specialties. Data collection took place over a six-month period from August to November 2025, during routine service delivery without any concurrent institutional hand hygiene campaign. The target population comprised all registered nurses employed at DHQ Hospital Charsadda and providing direct patient care in clinical units. Inclusion criteria were being a registered nurse (male or female), currently posted in any inpatient or emergency unit of the hospital, having at least three months of work experience at the facility to ensure familiarity with existing infrastructure and protocols, and willingness to participate with signed informed consent. Nurses who were on long leave during the data collection period or who reported medical or dermatological conditions preventing them from performing hand hygiene were excluded. A convenience sampling strategy was used because of logistical constraints and the need to enroll nurses who were available during the data collection shifts. Fifty nurses meeting the eligibility criteria were approached and all agreed to participate, yielding a final sample size of 50.

Recruitment was coordinated with hospital nursing administration to minimise disruption to services. After obtaining institutional permission, the researchers visited each clinical unit, briefly explained the study objectives and procedures, and invited eligible nurses to participate. Interested nurses were given an information sheet and an informed consent form. Those who signed consent completed a structured, self-administered questionnaire in a quiet corner of the ward or staff room. The research team remained available to clarify any item but avoided influencing responses. To enhance data quality, questionnaires were checked immediately for completeness and obvious inconsistencies before the nurse left. In addition to the questionnaire, a brief structured observation of hand hygiene behaviour was conducted during routine patient care encounters for each participating nurse on the same shift.

Data were collected using an adapted questionnaire and an observation checklist developed from WHO hand hygiene guidelines and previously published instruments used in similar studies among nurses (4,8,10,14). The questionnaire comprised five sections. The first captured demographic and professional characteristics, including age group, gender, highest nursing qualification, current designation, years of experience, clinical unit and work shift. The second section assessed knowledge of handwashing protocols, with items on WHO-recommended handwashing duration, key moments for hand hygiene and recognised consequences of poor hand hygiene. The third section addressed self-reported practice using Likert-type items (always, most of the time, sometimes, rarely) covering frequency of using alcohol-based hand rub instead of handwashing, washing hands before patient contact, methods of hand drying and glove use during patient interaction. The fourth section focused on barriers, asking nurses to indicate whether they experienced lack of handwashing facilities, insufficient hand sanitiser, heavy workload or lack of awareness as main obstacles. The fifth section collected observational data using yes/no items on whether hand sanitiser was used instead of washing, whether the nurse washed hands before patient contact and whether gloves were worn during interaction.

Operational definitions were specified a priori. Hand hygiene referred to handwashing with soap and water or the use of alcohol-based hand rub according to WHO recommendations (4). Knowledge of hand hygiene protocol was evaluated item-wise based on correct identification of the recommended 40–60 seconds duration and selection of WHO “moments” and consequences. Self-reported compliance was interpreted descriptively across the four response categories for each behaviour. Structural barriers were defined as affirmative responses to lack of handwashing facilities and insufficient sanitiser, while workload-related barriers corresponded to the option “heavy workload”. Because the primary aim was descriptive, no composite knowledge or compliance scores were used for inferential modelling in this analysis.

To enhance content validity, the draft questionnaire and checklist were reviewed by infection-control and nursing experts from the institution, who assessed clarity, relevance and alignment with WHO guidance. A pilot test involving approximately 10% of the intended sample (five nurses) was then conducted in units not included in the final analysis. Feedback from the pilot led to minor wording refinements without altering the conceptual content of items. Data from the pilot were excluded from the main dataset. During data collection, all members of the research team were trained in standardised administration and observation procedures to improve reliability and reduce observer bias. Observations were discreet and non-participatory to minimise behavioural reactivity.

Completed questionnaires and observation forms were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 26.0 for analysis. Data were first screened for completeness, range errors and obvious inconsistencies, which were resolved by checking against the original forms. Descriptive statistics were generated for all variables. Categorical variables were summarised as frequencies and percentages. Age and experience were analysed in predefined categories consistent with the questionnaire. Because the study was not powered for hypothesis testing and no stratified sampling was undertaken, the analysis focused on descriptive patterns rather than formal inferential comparisons between subgroups. Missing data were minimal and handled using complete-case analysis for each item; denominators are reported where they deviate from the full sample of 50. All analytical decisions were documented to support reproducibility.

Ethical approval for the study was obtained from the institutional review board of the college affiliated with the nursing students’ training programme before initiation of fieldwork. Written permission to collect data in DHQ Hospital Charsadda was granted by the hospital administration. All participants provided written informed consent after being assured that their responses and observational data would be anonymised, used only for research purposes and reported in aggregate form without individual identifiers. Participation was voluntary, with the option to decline or withdraw at any time without penalty. Completed forms were stored in a locked cabinet accessible only to the research team, and electronic data were password-protected to safeguard confidentiality.

## RESULTS

The study enrolled 50 nurses, most of whom were in middle to late adulthood and highly experienced in clinical practice (Table 1). More than half of the participants were older than 35 years (26/50, 52.0%), while a further 34.0% (17/50) were aged 31–35 years, indicating that 86.0% of the sample was above 30 years. Consistent with this age structure, nearly two-thirds of nurses (32/50, 64.0%) reported more than 10 years of professional experience, and only 16.0% (8/50) had 1–5 years of service, suggesting a predominantly senior workforce with longstanding exposure to hospital routines and infection-control policies.

Multiple responses allowed for barriers; percentages do not sum to 100%.†One observational record was missing; percentages are expressed using N = 50 to facilitate descriptive comparison.

Knowledge of hand hygiene protocols was mixed (Table 2). When asked about the WHO-recommended duration for handwashing, 18 nurses (36.0%) correctly selected 40–60 seconds, but an equal proportion (18/50, 36.0%) believed that 20–40 seconds was sufficient and 14 (28.0%) chose 10–20 seconds, collectively indicating that almost two-thirds of the sample underestimated the recommended duration. Awareness of WHO “key moments” was even more limited. While over half of nurses (28/50, 56.0%) recognized the need for hand hygiene before patient contact, only 26.0% (13/50) selected after patient contact, 10.0% (5/50) chose before aseptic procedures and 8.0% (4/50) identified after exposure to bodily fluids. These frequencies imply that only a small subset of nurses understood the full set of critical moments, with many focusing primarily on pre-contact hygiene. By contrast, awareness of consequences was high: 46 nurses (92.0%) identified spread of infections as a consequence of poor hand hygiene, although far fewer mentioned increased morbidity (2/50, 4.0%) or mortality (1/50, 2.0%), suggesting that the theoretical link to severe outcomes was less salient.

**Table 1. Demographic and Professional Characteristics of Nurses (N = 50)**

| Characteristic      | Category | n  | %    |
|---------------------|----------|----|------|
| Age (years)         | 20–25    | 4  | 8.0  |
|                     | 26–30    | 3  | 6.0  |
|                     | 31–35    | 17 | 34.0 |
|                     | >35      | 26 | 52.0 |
| Years of experience | 1–5      | 8  | 16.0 |
|                     | 6–10     | 10 | 20.0 |
|                     | >10      | 32 | 64.0 |

**Table 2. Knowledge of Hand Hygiene Protocols Among Nurses (N = 50)**

| Knowledge item                                | Response option                      | n  | % (of 50) |
|-----------------------------------------------|--------------------------------------|----|-----------|
| WHO-recommended handwashing duration          | 10–20 seconds                        | 14 | 28.0      |
|                                               | 20–40 seconds                        | 18 | 36.0      |
|                                               | 40–60 seconds (guideline-concordant) | 18 | 36.0      |
| Key moments for hand hygiene*                 | Before patient contact               | 28 | 56.0      |
|                                               | After patient contact                | 13 | 26.0      |
|                                               | Before aseptic procedures            | 5  | 10.0      |
|                                               | After exposure to bodily fluids      | 4  | 8.0       |
| Recognized consequences of poor hand hygiene† | Spread of infections                 | 46 | 92.0      |
|                                               | Increased morbidity                  | 2  | 4.0       |
|                                               | Increased mortality                  | 1  | 2.0       |

Multiple responses allowed. Percentages calculated using N = 50.†One questionnaire had missing responses; counts are presented out of N = 50 for consistency with descriptive interpretation.

**Table 3. Self-Reported Hand Hygiene Practices Among Nurses (N = 50)**

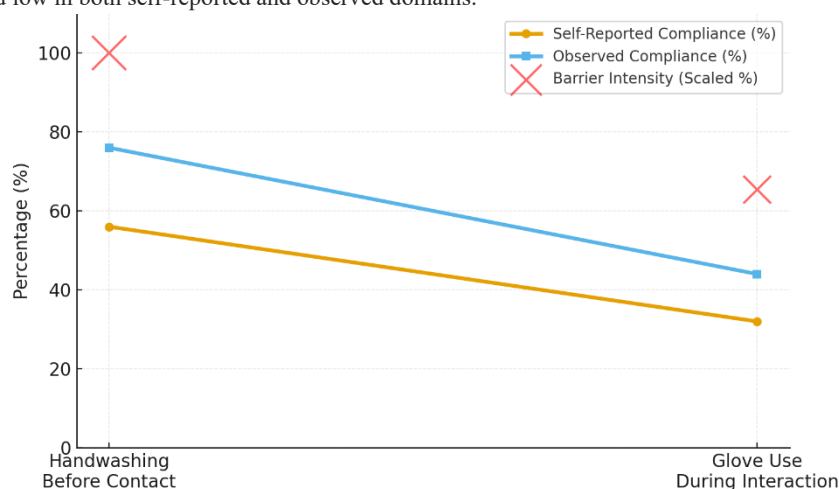
| Practice item                                | Response option  | n  | %    |
|----------------------------------------------|------------------|----|------|
| Use of hand sanitizer instead of handwashing | Always           | 12 | 24.0 |
|                                              | Most of the time | 9  | 18.0 |
|                                              | Sometimes        | 19 | 38.0 |
|                                              | Rarely           | 10 | 20.0 |
| Handwashing before patient contact           | Always           | 16 | 32.0 |
|                                              | Most of the time | 12 | 24.0 |
|                                              | Sometimes        | 15 | 30.0 |
|                                              | Rarely           | 7  | 14.0 |
| Method of hand drying after washing          | Paper towels     | 14 | 28.0 |
|                                              | Cloth towels     | 29 | 58.0 |
|                                              | Air dryer        | 7  | 14.0 |
| Glove use during patient interaction         | Always           | 5  | 10.0 |
|                                              | Most of the time | 11 | 22.0 |
|                                              | Sometimes        | 15 | 30.0 |
|                                              | Rarely           | 19 | 38.0 |

**Table 4. Barriers and Observed Hand Hygiene Behaviours Among Nurses**

| Domain                                            | Response option                | n  | % (of 50) |
|---------------------------------------------------|--------------------------------|----|-----------|
| <b>Main barriers to hand hygiene*</b>             | Lack of handwashing facilities | 26 | 52.0      |
|                                                   | Insufficient hand sanitizer    | 17 | 34.0      |
|                                                   | Heavy workload                 | 6  | 12.0      |
|                                                   | Lack of awareness              | 1  | 2.0       |
| <b>Observation: hand sanitizer vs washing</b>     | Sanitizer used instead of wash | 37 | 74.0      |
|                                                   | No sanitizer used instead      | 13 | 26.0      |
| <b>Observation: handwashing before contact</b>    | Yes                            | 38 | 76.0      |
|                                                   | No                             | 12 | 24.0      |
| <b>Observation: glove use during interaction†</b> | Yes                            | 22 | 44.0      |
|                                                   | No                             | 27 | 54.0      |

Self-reported practices revealed suboptimal but variable compliance (Table 3). Regarding substitution of alcohol-based hand rub for handwashing, 12 nurses (24.0%) reported using hand sanitizer always and 9 (18.0%) most of the time, whereas 19 (38.0%) used it sometimes and 10 (20.0%) rarely. Thus, just over two-fifths (21/50, 42.0%) described frequent sanitizer use. For handwashing before patient contact, 16 nurses (32.0%) stated that they always washed their hands and 12 (24.0%) did so most of the time, while 15 (30.0%) reported sometimes and 7 (14.0%) rarely. These responses indicate that only 28/50 (56.0%) perceived themselves as regularly adhering to pre-contact hand hygiene. Drying methods were dominated by cloth towels, used by 29 nurses (58.0%), whereas paper towels were reported by 14 (28.0%) and air dryers by 7 (14.0%). The extensive reliance on reusable cloth towels may undermine the effectiveness of otherwise adequate handwashing. Glove use during patient interaction showed the lowest self-reported adherence: only 5 nurses (10.0%) indicated always wearing gloves and 11 (22.0%) most of the time, whereas 15 (30.0%) used gloves sometimes and 19 (38.0%) rarely, implying that more than two-thirds of the workforce did not routinely use gloves for patient contact.

The barrier profile underscored prominent structural constraints (Table 4). The most frequently reported obstacle was lack of handwashing facilities, selected by 26 nurses (52.0%), followed by insufficient availability of hand sanitizer, reported by 17 (34.0%). Heavy workload was cited by 6 nurses (12.0%), and only one participant (2.0%) identified lack of awareness as a key barrier, reinforcing the impression that nurses perceived their difficulties as system-driven rather than purely behavioral. Observational data offered complementary insights into real-time behavior. During routine care, hand sanitizer was used instead of handwashing in 37 of 50 observed encounters (74.0%), and nurses washed their hands before patient contact in 38 (76.0%). Gloves were worn in 22 observed interactions (44.0%) and omitted in 27 (54.0%), with one record missing. When contrasted with self-reports, these observations suggest that actual practice may differ from perceived behavior; for example, the proportion of observed pre-contact handwashing (76.0%) exceeded the proportion of nurses who reported always washing hands before patient contact (32.0%), whereas glove use remained low in both self-reported and observed domains.

**Figure 1 Integrated Compliance–Barrier Interaction Visualization Among Nurses**

## DISCUSSION

This study provides a focused description of hand hygiene barriers, knowledge and practices among nurses working in a district-level public hospital in Pakistan. Despite a predominantly senior workforce, with almost two-thirds of nurses having more than 10 years of experience, substantial gaps were observed between recommended standards and everyday practice. Knowledge of the WHO-recommended 40–60 seconds duration for handwashing was correct in only a little over one-third of participants, and awareness of the full set of WHO “My Five Moments for Hand Hygiene” was particularly limited. At the same time, nurses overwhelmingly recognized that poor hand hygiene contributes to the spread of infection, although far fewer associated it with morbidity or mortality. These findings align with global evidence that, although the conceptual importance of hand hygiene is widely accepted, detailed procedural knowledge and risk perception often remain incomplete, contributing to a persistent knowledge–practice gap in many settings (3,4,8–10).

Self-reported practice in this study indicated that just over half of nurses perceived themselves as frequently washing hands before patient contact, and fewer than one-third reported always wearing gloves during patient interaction. Observational data suggested somewhat higher compliance for handwashing, with pre-contact hygiene observed in three-quarters of encounters, but glove use remained suboptimal, with more than half of observed contacts occurring without gloves. Similar discrepancies between self-reported and observed behaviour have been described in Kuwait, Saudi Arabia and Iran, where nurses and physicians tend to overestimate or misclassify their consistency with hand hygiene protocols when



compared with structured observation (10,12,13). In the present study, the pattern was more nuanced: observed behavior exceeded self-reported high compliance for both handwashing and glove use, which may reflect either momentary improvement during observation, recall limitations, or the fact that the observation captured a single or few encounters while the questionnaire addressed general habits. Regardless of direction, the divergence underscores the importance of using multiple data sources when assessing hand hygiene performance.

The most salient contribution of this study lies in its detailed profiling of barriers, which were overwhelmingly structural. More than half of nurses reported lack of adequate handwashing facilities, and one-third cited insufficient hand sanitizer, while relatively few identified heavy workload or lack of awareness as major obstacles. These perceptions resonate with earlier work from Turkey, Malawi and Iran, where nurses and clinicians described difficulty complying with hand hygiene recommendations when sinks were distant from patient beds, water supply was intermittent, or soap and towels were scarce (11–13). In Akyol's study from Turkey, nurses explicitly linked dense working conditions and lack of necessary materials with their inability to wash hands as frequently as guidelines recommended (11). In the current context of a busy district hospital, the prominence of infrastructural barriers suggests that nurses view themselves less as resistant to good practice and more as constrained by their working environment.

When the findings are compared with those from neighboring and regional countries, both convergence and divergence emerge. Studies from Saudi Arabia and Jordan reported that approximately two-thirds of nurses demonstrated good hand hygiene practice according to predefined scoring systems, with higher compliance among female nurses and those working in certain departments such as pediatrics (8,9). In contrast, the present study did not compute composite practice scores but found that only about one-third of nurses always washed hands before patient contact and only one in ten consistently wore gloves. The Afghan study from Kandahar, which also relied on WHO's "5 Moments for Hand Hygiene", reported that roughly three-quarters of nurses had good practice, with better compliance among older, more educated and previously trained staff (14). Similarly, South Sulawesi data highlighted specific moments, such as hand hygiene after exposure to body fluids, where adherence was particularly weak (15). Compared with these settings, nurses in DHQ Hospital Charsadda appear to face a more severe combination of resource scarcity and behavioral gaps, particularly in glove use and proper hand drying, where cloth towels predominated.

Recent evidence from Nigeria and North Cyprus adds further nuance. Nwosu and colleagues found moderately good knowledge but poor execution of key handwashing steps, with specific omissions such as turning off the faucet with a towel and adequately cleaning fingernails and dorsal hand surfaces (16). Bakare and Bayraktar reported relatively high belief and practice scores but noted that practice outstripped belief, suggesting that institutional norms and monitoring may sustain behavior even when cognitive conviction is incomplete (17). The current study did not evaluate detailed technique or beliefs, but the combination of moderate knowledge, incomplete recognition of high-consequence outcomes and frequent use of reusable cloth towels suggests that both training content and environmental enablers require strengthening. The predominance of cloth towel use is particularly concerning, as it may recontaminate hands and negate the benefits of otherwise adequate washing, a risk highlighted in prior infection-prevention literature (3,4,11).

From a health-systems perspective, these findings align with broader work showing that a sizeable proportion of hospital-acquired infections in resource-limited settings are theoretically preventable through rigorous hand hygiene and standard precautions (1,20). HAIs are associated with increased mortality, prolonged length of stay and substantial financial cost, particularly in trauma and surgical patients (2,18,21,22). Interventional studies in China and Indonesia have demonstrated that multimodal strategies combining staff education, infrastructure improvements, reminders and audit-feedback can significantly increase compliance and reduce infection rates, even in lower-resource settings (18,23). However, such interventions are most effective when they explicitly address the barriers identified by local staff, rather than relying solely on didactic training. In DHQ Hospital Charsadda, this implies that any future quality-improvement initiative should prioritize the installation and maintenance of conveniently located sinks, consistent provision of soap, paper towels and alcohol-based hand rub, and clear policies for glove use in routine patient care.

The results must be interpreted considering several limitations. The cross-sectional design precludes causal inference, and the use of convenience sampling limits generalizability beyond the study hospital. The sample size of 50, while adequate for descriptive purposes, is underpowered for robust subgroup analyses by department, shift or qualification, and no multivariable modelling was performed to adjust for potential confounding. Self-reported data are vulnerable to recall and social-desirability biases, and observation of a limited number of encounters per nurse cannot fully capture habitual behavior, especially in different workload conditions or shifts. Nonetheless, the consistency between structural barriers reported by nurses and the observed reliance on cloth towels and low glove use suggests that the main conclusions are credible and clinically relevant.

Despite these constraints, the study has several strengths. It is one of the first to document hand hygiene barriers among nurses at a Pakistani district-level public hospital, a level of care often underrepresented in the literature relative to tertiary institutions. The combined use of questionnaire and observation offers a richer picture of practice than either method alone, or the explicit focus on structural constraints shifts the conversation away from individual blaming toward system-level responsibility. Furthermore, the findings are directly actionable for hospital administrators: targeted investments in infrastructure and supplies, supported by ongoing training and non-punitive monitoring, could reasonably be expected to improve compliance and reduce infection risk.

Future research should build on this descriptive work by employing larger, possibly multicentre samples and incorporating objective outcome measures such as HAI incidence, device-associated infection rates or antibiotic consumption. Cluster randomised or stepped-wedge designs evaluating specific interventions—such as installation of additional sinks, introduction of bedside alcohol-based hand rub, or implementation of electronic or video-based monitoring systems—would provide stronger evidence on causal links between barrier reduction, behaviour change and infection outcomes (18,23–25). Qualitative work exploring nurses' and managers' perspectives in more depth could also illuminate cultural and organisational factors not fully captured by structured questionnaires.

## CONCLUSION

In summary, this study demonstrates that nurses at DHQ Hospital Charsadda work within a context of substantial structural barriers to effective hand hygiene, particularly limited handwashing facilities, inconsistent availability of hand sanitiser and reliance on reusable cloth towels, while also exhibiting important gaps in detailed knowledge of WHO-recommended duration and critical moments for hand hygiene. Although observed pre-contact handwashing was more frequent than nurses' self-reported high compliance, glove use remained low, and the combination of infrastructural constraints and incomplete adherence likely contributes to preventable infection risk. Addressing these challenges will require not

only refresher training but also sustained investment in basic infrastructure, reliable supply chains for hand hygiene materials and supportive institutional policies that prioritise infection prevention as a core component of patient safety.

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