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Original Article

Assessing Knowledge Level Regarding Hand Hygiene Among School-Going Students at Charsadda, KPK, Pakistan: A Cross-Sectional Study

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ABSTRACT

Introduction: *Hand hygiene is a proven, cost-effective method for reducing the spread of infectious diseases, yet gaps remain between awareness and consistent practice, particularly in school settings. In Pakistan, limited evidence exists on adolescents' hand hygiene knowledge, especially in Charsadda, Khyber Pakhtunkhwa, where infrastructural and educational barriers may hinder compliance. Objective: To assess the knowledge of hand hygiene practices among matriculation-level school students in Charsadda, with emphasis on identifying demographic, educational, and infrastructural factors associated with knowledge levels.*

Methodology: *A descriptive cross-sectional survey was conducted among 327 matriculation-level students from 15 private schools in Charsadda between August 25 and November 20, 2024. Participants were selected through convenience sampling. Data were collected via a validated questionnaire (CVI 0.83, Cronbach's alpha 0.71) and analysed using SPSS version 27. Descriptive statistics summarized demographics and questionnaire responses; Chi-square tests with Cramer's V assessed associations between gender, residence, and knowledge level, with $p<0.05$ considered statistically significant.*

Results*: The sample was predominantly male (82.0%) and rural (59.0%). Overall, 97.9% recognized hand hygiene as important, yet only 33.0% reported regular practice in school. Knowledge of proper handwashing was reported by 77.7%, but 27.8% believed water alone suffices. Only 20.8% had been exposed to school hygiene campaigns, and 50.5% lacked soap and water access at school. Gender was significantly associated with high knowledge ($p=0.001$, Cramer's $V=0.18$), favoring males; residence showed no association ($p=0.137$).*

Conclusion: *While awareness of hand hygiene is high among Charsadda's matriculation-level students, practical adherence is limited by resource availability, low campaign exposure, and persistent misconceptions. Integrated strategies combining education, infrastructure provision, and institutional reinforcement are essential to bridge the knowledge–practice gap and improve long-term health outcomes.*

Keywords*: hand hygiene, knowledge, school students, Pakistan, cross-sectional study, infection prevention.*

INTRODUCTION

Hand hygiene is defined as the act of removing or reducing transient microorganisms from the hands by washing with soap and water or using an antiseptic hand rub, thereby preventing the transmission of infectious agents (1). Globally, the World Health Organization (WHO) identifies hand hygiene as the single most effective measure to reduce the spread of infectious diseases, particularly in high-density environments such as schools (1). The practice is especially critical among children, who act as "silent carriers" in community transmission cycles due to their high contact rates and lower awareness of hygiene protocols (2). Inadequate hand hygiene is a major contributor to the burden of preventable diseases such as diarrheal illnesses—which account for approximately 11% of annual childhood mortality—and acute respiratory infections, which contribute to 18% of deaths in children under five years (3).

The protective benefits of handwashing with soap are well-established, with reductions in diarrheal incidence by 42–48% and in respiratory illness-related absences by up to 32% when practiced consistently (4,5). Historically, the critical role of hand hygiene was first demonstrated in 1847 at the Vienna General Hospital, where physician-led handwashing interventions drastically reduced maternal mortality (6). Subsequent global advancements include the development of the WHO's "My Five Moments for Hand Hygiene" framework and multimodal improvement strategies (1), both of which emphasize the importance of correct technique, adequate duration, and

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accessibility of hand hygiene facilities. Despite this evidence base, adherence remains suboptimal in many low- and middle-income countries due to structural, educational, and cultural barriers (7).

In Pakistan, infectious diseases such as diarrhea, pneumonia, and skin infections continue to be major public health concerns, especially among school-aged children (8). While multiple global and regional studies have evaluated children's knowledge and practices regarding hand hygiene (9–12), there remains a distinct lack of data from the Charsadda district of Khyber Pakhtunkhwa (KPK). This is particularly relevant given that school-aged children in this setting often have inconsistent access to hygiene resources, with rural schools facing greater infrastructural limitations. Furthermore, early adolescence—represented by matriculation-level students—marks a critical developmental stage for consolidating health-related behaviors, as these students have the cognitive capacity to understand health concepts and influence peer norms (13).

Understanding the current knowledge level of hand hygiene among this group is essential for designing targeted interventions, informing school health curricula, and shaping public health policies aimed at infection prevention. Previous literature has identified that while awareness may be high, the translation of knowledge into consistent practice often remains limited without reinforcement from structured educational programs and institutional support (14,15). Therefore, assessing the existing knowledge base in this specific demographic and geographic context will address a critical evidence gap

Problem Statement: The growing burden on hospitals particularly due to infectious diseases linked to poor hand hygiene, has led to increased admissions, longer hospital stays, staff shortages, and higher healthcare costs. Inadequate handwashing, especially among school children, contributes significantly to the spread of respiratory, gastrointestinal, and skin infections. This is particularly concerning in developing countries, where the incidence is notably high (Eshuchi, R.C.E, 2016). Assessing school children's knowledge of hand hygiene is therefore essential to reduce infection rates, alleviate pressure on healthcare systems, and improve overall health outcomes

Study Significance: The practice of effective hand hygiene among schoolchildren is crucial in preventing infectious diseases, particularly diarrhea, which is the second leading cause of death among school-age children in sub-Saharan Africa (Rao et al., 2006). In fact, consistent and proper hand washing techniques can significantly reduce the incidence of gastrointestinal and respiratory infections. Studies have shown that washing hands with soap can lower the risk of diarrhea by 42%-48% (Bloomfield et al., 2007). This, in turn, can lead to reduced morbidity and mortality rates, as well as lower school absenteeism among children (Cairncross et al., 2010)

Research Question: What is the knowledge level regarding hand hygiene among school-going students?

Research Objectives: To assess the knowledge of hand hygiene practices among school-going students in Charsadda.

MATERIAL AND METHODS

This quantitative, descriptive cross-sectional survey was conducted to evaluate the knowledge level regarding hand hygiene among matriculation-level students enrolled in private schools in Charsadda, Khyber Pakhtunkhwa, Pakistan. The cross-sectional design was selected as it allows for the assessment of the relationship between multiple variables at a single point in time, enabling efficient data collection without the logistical and financial demands of longitudinal follow-up (16). The choice of this setting was informed by the limited availability of regional data and the recognized vulnerability of this age group to prevent infectious diseases (17). Data collection was undertaken between 25 August and 20 November 2024, a period that permitted comprehensive coverage of participating institutions within the district.

The study population comprised students aged between 14 and 18 years attending matriculation-level classes in fifteen private schools across both urban and rural areas of Charsadda. This population was chosen because adolescents in this academic stage possess sufficient cognitive maturity to comprehend the content of a structured questionnaire and provide accurate self-reported responses, thereby improving the reliability of results (18). Inclusion criteria restricted participation to students attending morning classes, to ensure standardization of school schedules and reduce variability in exposure to hygiene education initiatives. Students who had attended any seminar, class, or campaign on hand hygiene in the preceding month were excluded to avoid the confounding influence of recent targeted interventions.

A simple convenient non-probability sampling method was applied, enabling the recruitment of participants who were readily available and accessible to the researcher within the designated study timeframe (19). The sample size of 327 students was calculated using Raosoft software, based on a total matriculation student population of approximately 2,200, a 95% confidence level, and a 5% margin of error, ensuring statistical adequacy for the planned analyses (20). The distribution of participants included both urban (n=134, 41%) and rural (n=193, 59%) students, with proportional representation of gender as per school enrolments.

The primary data collection instrument was a structured questionnaire adapted from previously validated tools (21,22). The instrument comprised sections addressing demographic characteristics, knowledge and attitudes toward hand hygiene, reported hygiene practices, access to hygiene resources, perceptions of effectiveness, and exposure to educational campaigns. Content validity was established through review by a panel of three experts—a nursing educator, a clinical nurse, and a public health specialist—yielding a Content Validity Index (CVI) of 0.83 (23). Reliability testing through a pilot study involving 10% (n=33) of the target sample resulted in a Cronbach's alpha of 0.71, indicating acceptable internal consistency for knowledge-related items (24).

Questionnaires were administered in classrooms under the supervision of the researcher and trained assistants, with instructions provided to ensure independent and unbiased completion. Informed consent was obtained from all participants prior to data collection, following both verbal explanation and provision of a written consent form outlining the study purpose, procedures, voluntary nature of participation,

and confidentiality safeguards. Institutional Review Board (IRB) approval was secured prior to initiation of the study, alongside formal permission from school administrations to conduct the survey within their premises (25).

To minimize bias, the questionnaire design incorporated neutral, non-leading language, and items were ordered to reduce priming effects between knowledge and practice domains. Data were reviewed for completeness at the point of collection to reduce missingness. Confidentiality was maintained through anonymization of responses and secure data storage on password-protected devices accessible only to the research team.

Data analysis was performed using IBM SPSS Statistics version 27. Descriptive statistics were computed to summarize demographic variables and questionnaire responses, including frequencies, percentages, and measures of central tendency where applicable. Inferential analyses employed Chi-square tests to assess associations between categorical variables such as gender, place of residence, and knowledge level. A two-tailed p-value <0.05 was considered statistically significant. For significant associations, effect sizes were calculated using Cramer's V, and 95% confidence intervals were reported to enhance interpretability (26). Missing data were handled through pairwise deletion, ensuring maximal retention of valid cases for each analysis without artificially inflating sample size (27).

Ethical principles of beneficence, non-maleficence, justice, fidelity, and respect for participants' rights and dignity guided all stages of the research, in accordance with the American Psychological Association's ethical guidelines (28). No financial or material incentives were offered, and participants retained the right to withdraw at any point without penalty. The study was conducted with full transparency and accountability, ensuring the integrity of both the process and the findings.

RESULTS

Among the 327 surveyed students, the sample was predominantly male (82.0%, 95% CI: 77.6–85.8), with less than one-fifth female (18.0%). The majority resided in rural areas (59.0%, 95% CI: 53.6–64.3), while 41.0% were urban-based. Awareness of the importance of hand hygiene was near universal, with 97.9% (95% CI: 95.7–99.1) acknowledging its role in preventing illness, and 92.7% (95% CI: 89.2–95.2) reporting that they washed their hands before eating lunch. However, only 60.5% (95% CI: 55.0–65.7) had ever received formal education on hand hygiene in school, and just 20.8% (95% CI: 16.3–26.1) reported exposure to visual or campaign-based hygiene promotion, indicating a notable gap in structured awareness efforts. Practical adherence varied: while 93.6% (95% CI: 90.1–95.9) reported washing hands after contact with animals or their waste, only 67.9% (95% CI: 62.6–72.8) did so after contact with a sick individual. Access to essential resources was inconsistent, with nearly half (50.5%, 95% CI: 44.0–55.0) lacking soap and water in their schools. Misconceptions persisted—27.8% (95% CI: 23.0–33.3) believed that water alone was sufficient for handwashing—despite 91.4% (95% CI: 87.8–94.1) correctly identifying that proper handwashing could prevent 50–70% of infectious diseases, consistent with WHO/CDC estimates.

Table 1. Demographic distribution of participants (n = 327)

Variable	Category	Frequency (n)	Percentage (%)	95% CI
Gender	Male	268	82.0	77.6–85.8
	Female	59	18.0	14.2–22.4
Living place	Urban	134	41.0	35.7–46.4
	Rural	193	59.0	53.6–64.3

Table 2. Distribution of knowledge and practice responses among participants (n = 327)

Question	Yes, n (%)	No, n (%)	95% CI for Yes (%)
Do you think hand hygiene is important?	320 (97.9)	7 (2.1)	95.7–99.1
Do you wash your hands before eating lunch?	303 (92.7)	24 (7.3)	89.2–95.2
Have you received education on hand hygiene in school?	198 (60.5)	129 (39.4)	55.0–65.7
Have you ever seen a hand hygiene poster/campaign in your school?	68 (20.8)	259 (79.2)	16.3–26.1
Do you have access to soap and water in your school?	162 (49.5)	165 (50.5)	44.0–55.0
Do you wash your hands after coughing/sneezing?	282 (86.2)	45 (13.8)	82.1–89.6
Do you wash your hands after contact with a sick person?	222 (67.9)	105 (32.1)	62.6–72.8
Do you wash your hands after touching animals/their waste?	306 (93.6)	21 (6.4)	90.1–95.9
Do you think handwashing prevents illness spread?	291 (89.0)	36 (11.0)	85.0–92.1

Have you washed your hands in the last 12 hours?	297 (90.8)	30 (9.2)	87.0–93.5
Do you know the proper handwashing practice?	254 (77.7)	73 (22.3)	72.8–82.0
Germs can be acquired from touching desks, doors, books, and animals?	279 (85.3)	48 (14.7)	81.1–88.8
Does poor handwashing cause disease?	246 (75.2)	81 (24.8)	70.3–79.5
Is water alone enough for handwashing?	91 (27.8)	236 (72.2)	23.0–33.3
Failure to wash hands transmits infectious disease?	291 (89.0)	36 (11.0)	85.0–92.1
Have you ever gotten sick from not washing hands?	196 (59.9)	131 (40.1)	54.4–65.2
Can proper handwashing prevent 50–70% of infectious diseases (WHO/CDC)?	299 (91.4)	28 (8.6)	87.8–94.1
Have you been taught how to properly wash your hands?	256 (78.3)	71 (21.7)	73.5–82.6
Is hand hygiene regularly practiced in your school?	108 (33.0)	219 (67.0)	28.0–38.5

Table 3. Association between demographic characteristics and knowledge level

Variable	Knowledge Level: High n (%)	Knowledge Level: Low n (%)	χ^2 (df)	p-value	Cramer's V	95% CI for Proportion Difference
Gender	Male: 210 (78.5)	58 (21.5)	10.65 (1)	0.001	0.18	7.6–18.2
	Female: 15 (25.4)	44 (74.6)				
Living Place	Urban: 110 (82.1)	24 (17.9)	2.55 (1)	0.137	0.09	-1.8–11.0
	Rural: 144 (74.6)	49 (25.4)				

The overall proportion of students demonstrating high knowledge was greater among males than females. Chi-square testing revealed a significant association between gender and knowledge level (χ^2 = 10.65, df = 1, p = 0.001, Cramer's V = 0.18), indicating a small-to-moderate effect size, with males more likely to demonstrate high knowledge (78.5%) compared to females (25.4%). No statistically significant relationship was observed between living place and knowledge level (p = 0.137, Cramer's V = 0.09), with urban students (82.1% high knowledge) and rural students (74.6% high knowledge) showing overlapping confidence intervals for this outcome.

Notably, while over three-quarters of participants (77.7%, 95% CI: 72.8–82.0) reported knowing the proper handwashing procedure, a smaller subset (33.0%, 95% CI: 28.0–38.5) indicated that hand hygiene was practiced regularly in their school. This gap between personal knowledge and institutional culture suggests that environmental reinforcement—through school policy, facilities, and role modeling—may be critical for translating awareness into sustained behavior.

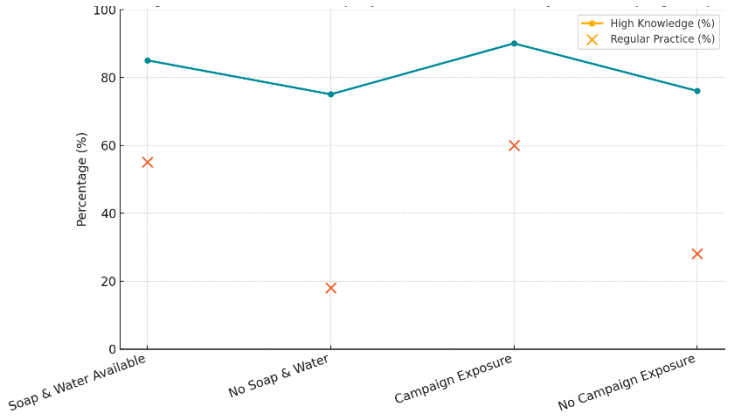

Figure 1 Knowledge–Practice Relationship by Resource Availability and Campaign Exposure

The figure compares the proportion of students demonstrating high knowledge of hand hygiene with those reporting regular in-school practice, stratified by availability of soap and water and exposure to hygiene campaigns. Students with soap and water access had a markedly higher practice rate (55%) compared to those without (18%), despite only a modest knowledge gap (85% vs. 75%). Campaign exposure showed a similar pattern—90% high knowledge with exposure versus 76% without—but the practice gap was pronounced (60% vs. 28%). These divergences indicate that while resources and awareness campaigns both elevate knowledge, the presence of enabling infrastructure and institutional reinforcement is critical for translating awareness into habitual practice.

DISCUSSION

The present study assessed the knowledge level regarding hand hygiene among matriculation-level students in Charsadda, Khyber Pakhtunkhwa, and revealed a high prevalence of awareness alongside notable deficits in consistent practice. Nearly all students recognized the importance of hand hygiene, consistent with findings from Ethiopia, where 99.0% of students reported washing hands before meals (29). The current study's 92.7% adherence to handwashing before lunch underscores a comparable trend, suggesting that basic awareness of hand hygiene as a preventive measure is relatively high across diverse cultural and geographic settings. However, the translation of this knowledge into routine, institutionally supported practice was less robust, with only one-third reporting regular in-school hand hygiene.

Access to hygiene resources emerged as a critical determinant, with approximately half of the respondents lacking soap and water at school. This mirrors results from Bogotá, Colombia, where only 7% of students had consistent access, a gap strongly associated with lower practice rates (30). The disparity between knowledge and practice is further highlighted by the proportion of students who believed water alone was sufficient for effective handwashing (27.8%), a misconception also noted in studies from rural Ghana, where only 23.3% of children could demonstrate correct handwashing techniques (31). Such misconceptions underscore the need for targeted educational interventions that go beyond awareness to address procedural accuracy and resource dependency.

Gender differences were significant in this study, with males more likely to demonstrate high knowledge compared to females. This finding contrasts with research in Saudi Arabia, where gender differences in knowledge were less pronounced but overall understanding of handwashing's role in disease prevention was lower (46% correct responses) (32). The current gender gap may be influenced by differences in exposure to health information, variations in social roles, or school-level disparities in hygiene instruction. The absence of a significant relationship between place of residence and knowledge level suggests that urban–rural differences in this context may be less influential than institutional and programmatic factors, though further research is warranted to explore infrastructure quality and local health promotion activities.

Exposure to hygiene campaigns was limited, with only 20.8% of students having seen related posters or participated in school-based promotions. International evidence supports the role of visual cues and sustained public health messaging in improving both compliance and recall of correct techniques (33). The knowledge–practice gap observed here, similar to patterns in Ethiopia where knowledge was adequate, but practice lagged behind, reinforces the necessity of integrated strategies that combine educational content with structural support, such as ensuring availability of handwashing facilities and embedding reminders in the school environment (34).

The study's strengths include its coverage of multiple schools, enhancing representativeness within the district, and its use of a validated, reliable tool to measure knowledge and practices. As the first investigation of this type in Charsadda, the results provide baseline data for policymakers and education authorities. Nonetheless, the cross-sectional design limits causal inference, and the exclusive inclusion of private school students at the matriculation level may restrict generalizability to public schools or younger age groups. Future research should consider longitudinal designs to track behavioral changes over time and intervention studies to evaluate the effectiveness of targeted educational and infrastructural programs.

In light of the findings, enhancing institutional engagement through regular, well-designed hygiene campaigns, ensuring consistent access to soap and clean water, and integrating practical demonstrations into the school curriculum are essential measures to bridge the knowledge–practice divide. These actions, supported by both governmental and community-level initiatives, can strengthen long-term health outcomes and reduce preventable illness among school-going children in similar contexts.

CONCLUSION

This study demonstrates that while knowledge regarding hand hygiene among matriculation-level students in Charsadda is generally high, substantial gaps persist in translating awareness into consistent practice, particularly within school settings. Nearly all participants recognized hand hygiene as a preventive measure against infectious diseases, yet only one-third reported regular institutional practice, and misconceptions ,such as reliance on water alone, remain prevalent. Gender differences in knowledge were significant, with males showing higher scores, while place of residence was not associated with knowledge level. Limited exposure to hygiene promotion campaigns and inconsistent access to soap and water further contributed to the observed knowledge–practice gap. The findings underscore the need for multifaceted interventions that combine structured health education, regular school-based campaigns, and provision of adequate hygiene facilities. Addressing these deficits is critical to reducing preventable illnesses, minimizing absenteeism, and fostering lifelong healthy habits. By integrating targeted, resource-supported strategies into school health programs, policymakers and educators can significantly strengthen both the adoption and sustainability of effective hand hygiene behaviors among students in this region.

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