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Major Article

Guiding hand hygiene interventions among future healthcare workers: implications of knowledge, attitudes, and social influences

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Background: Medical students in their clinical years play an important role in healthcare delivery, yet poor levels of hand hygiene (HH) compliance in this population raise the risk for propagating nosocomial infections. To date, there has been a lack of dedicated interventions showing sustainable improvements in HH in this population.
Methods: A multicenter, cross-sectional study was conducted among 450 medical students in their clinical years (third to fifth years). A self-administered, pre-validated questionnaire based on the World Health Organization's "Knowledge" and "Perception" questionnaires was used to explore HH knowledge, attitudes, practices, and desired interventions.
Results: Self-reported HH compliance was found to be low (56.8%), and moderate HH knowledge (61.8%) was observed among all study respondents. Public university students expressed greater knowledge than students in private and semi-private universities. Superior HH practices were associated with better individual HH attitudes, positive perceived HH attitudes in other healthcare workers (HCWs), and higher HH knowledge scores. The highest-rated interventions for improving HH compliance included role-modeling by HCWs, display of "clear HH instructions," and "ensuring availability of hand sanitizers."
Conclusion: Our results call for a multifaceted approach to improve HH compliance among medical students, by ensuring adequate HH supplies/hand sanitizers, providing HH training in curricula, and effecting a cultural change mediated by professional modeling and open communication.

Hand hygiene (HH) compliance among healthcare workers (HCWs) (including doctors, nurses, and clerkship/clinical medical students) has been found to be consistently poor.[1-3] A study by the Society for Healthcare Epidemiology of America[4] revealed that only 31% of HCWs employed proper HH techniques. This is potentially dangerous and can result in prolonged hospital stays and concomitant super infections transmitted by direct physical contact (i.e., shaking hands or delivering medications), all of which contribute to the morbidity and mortality of 1 in every 25 hospitalized patients per day.[5]

Medical students in their clinical years play an integral role in the delivery of patient care in tertiary-care, university-affiliated hospitals.[6] This role calls on them to adhere to the precautions and procedures of optimal HH, just as it is required of medical professionals. According to U.S. Centers for Disease Control and Prevention, performance of effective HH is the most effective preventive measure for reducing the rates of HCW-associated infections.[7]

As observed during Objective Structured Clinical Examinations (OSCEs) in Saudi Arabia, HH compliance among medical students was found to be only 17%.[8] Among medical students surveyed in Nigeria, only 9.5% could correctly recall the steps in proper HH.[9] Similarly, dismal HH trends among medical students have been documented in various settings worldwide.[6,10,11] Factors identified as contributing to poor HH compliance in this population include a lack of HH knowledge, misconceptions regarding HH, and poor HH practices by role models.[12] These issues are further compounded by the limited emphasis placed on effective infection control practices in an already full medical school curriculum.[13]

In Pakistan, the healthcare and medical education system is unique in that it is broadly divided into public/government setups

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and private setups. Public universities, and attached hospitals, receive government funding and provide subsidized medical education for local students; as such, admissions tend to be more competitive. In contrast, private universities, and attached hospitals, cater primarily to students from high-income backgrounds and can afford greater hospital resources. The differing administrative culture, funding capacity, and nature of the student body enrolled in each of these institute types may have significant implications for ongoing HH trends and the scope of future interventions aimed at the population of interest.

The aim of this study was to assess and compare the prevailing knowledge and practices of medical students in their clinical years (third to fifth year) who were enrolled in public/government, semi-private, and private universities, regarding the international 11-step World Health Organization (WHO)-recommended HH guidelines.[14] This study further aimed to evaluate the self-reported perceptions of students and other HCWs regarding the importance of performing optimal HH, in situations where it is deemed necessary by WHO guidelines.[14] The WHO guidelines provide both a thorough review of evidence on HH in healthcare and specific recommendations to improve infection control practices in various settings. Finally, this study explored the possible interventions that may increase HH compliance in this population.

METHODS

This cross-sectional study spanning 6 months was conducted among medical students enrolled in 3 different medical universities in Karachi, Pakistan, with each university corresponding to a different sector: public, private, or semi-private. A sample size of 384 respondents was calculated under a 95% confidence interval using Open Epi, however, we opted for a total sample of 450 medical students. The study received approval from the Ethical Review Committee of Baqai Medical University.

The inclusion criteria maintained during this study were as follows: medical students in their clinical years of study (years three to five) who were enrolled in 1 of 3 selected medical colleges. Any students in their preclinical years (years one to two) or those not enrolled in a 5-year Bachelor of Medicine, Bachelor of Surgery (MBBS) program were excluded. The target population was approached using nonprobability, judgmental/purposive sampling, whereby an equal proportion of medical students was sampled from each year of study and across each institution. Study participants were provided a description of the study objectives and methods, and written informed consent was obtained. Participation was voluntary, and respondents were ensured that the information provided was confidential and anonymous. The study instrument employed was a self-administered, English-language questionnaire, developed from the prevalidated WHO "Knowledge" and "Perception" questionnaires.[15] The devised questionnaires were adapted to ensure applicability to the target population and underwent thorough vetting by senior faculty members at Baqai Medical University. The approved questionnaires were piloted on a 5% sample and refined accordingly.

Questionnaire

The final questionnaire comprised 3 sections. The first section recorded basic demographic information such as age, sex, and year of study. The second section was adapted from the WHO "Knowledge" questionnaire and assessed respondents' knowledge regarding HH indications and procedures using multiple-choice questions. Questions assessing the use of alcohol-based hand rubs were not included in the WHO "Knowledge" Questionnaire, since hand rubs are not routinely available at points of care in our settings; thus, such questions would have limited applicability to our population

of interest. The final section, adapted from the WHO "Perception" questionnaire, evaluated respondents' perceptions regarding the importance attached to HH performance by other HCWs, to HH practices, and to interventions aimed at improving HH adherence. Responses to this section were assessed using a condensed 3-point Likert scale. Questions beyond the scope of medical students, such as those evaluating institutional policies on HH, were not included in this section.

Statistical analysis

Data were analyzed using Statistical Package for Social Sciences, version 20.0, software. Categorical variables were expressed using frequencies and percentages. Continuous variables were presented as means and standard deviations (SDs). A knowledge score, derived from responses to the HH "Knowledge" questionnaire, was calculated to reflect a participant's overall knowledge regarding HH and was scored out of 18: each correct answer received a score of 1, and incorrectly answered questions received a score of 0. The chi-squared test with a 95% confidence interval was used to compare categorical variables. Differences in continuous variables, such as knowledge scores, with respect to categorical variables were assessed using independent t-tests or the analysis of variance test, as appropriate. A 5% level of significance was used throughout the study. Responses to desired HH interventions were coded as $1 =$ not effective, $2 =$ somewhat effective, and $3 =$ very effective and used to calculate the mean response for each intervention, which was illustrated graphically using Microsoft Excel.

RESULTS

Our response rate was 96%, as 15 of 450 questionnaires were left unfilled. Three-quarters of the participants (74.8%) were women. Participants were from the third year (n = 139), fourth year (n = 150), and fifth year (n = 145) of medical training. They were from public (n = 133), semi-private (n = 150), and private (n = 151) medical colleges, respectively (Table 1). The mean age of study participants was 22.0 ± 1.22 years. The mean age for men and women was 22.5 ± 1.32 years and 21.9 ± 1.14 years, respectively.

A knowledge score was calculated for each participant, with a maximum score of 18. The mean knowledge score for all participants was 11.1 ± 2.36. Mean knowledge scores did not differ significantly by sex or year of study. Analysis of variance showed a significant association between institute of study and knowledge scores, at the $P < .05$ level (F[2,431] = 4.98; $P = .007$). Post-hoc comparisons using Tukey's b-test showed the mean knowledge score for public university students (m = 11.7, SD = 2.19) was significantly higher than scores for students in semi-private (m = 11.0, SD = 2.42) and private universities (m = 10.9, SD = 2.22). However,

Table 1
Demographic data of study participants

Sex, n (%)	
Men	109 (25.2)
Women	323 (74.8)
Institute, n (%)	
Public Medical College	133 (30.6)
Private Medical College	151 (34.8)
Semi-Private Medical College	150 (34.6)
Year of Study, n (%)	
3rd Year	139 (32.0)
4th Year	150 (34.6)
5th Year	145 (33.4)