Risk Management and Healthcare Policy

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Assessment of Hand Hygiene Knowledge, Attitude, and Practice Among Health Sciences Students in Herat, Afghanistan: A Cross-Sectional Study

Enayatollah Ejaz[1], Mohammad Masudi[1,2], Ali Rahimi[1–3], Khadejah Osmani[4], Nasar Ahmad Shayan[5]

[1]Department of Curative Medicine, Faculty of Medicine, Jami University, Herat, Afghanistan; [2]Department of Pediatrics, Faculty of Medicine, Herat University, Herat, Afghanistan; [3]Department of Public Health and Infectious Diseases, Faculty of Medicine, Herat University, Herat, Afghanistan; [4]Department of Surgery, Faculty of Medicine, Herat University, Herat, Afghanistan; [5]Department of Epidemiology and Biostatistics, Schulich School of Medicine and Dentistry, Western University, London, ON, Canada

Correspondence: Mohammad Masudi, Department of Curative Medicine, Faculty of Medicine, Jami University, Students Street, Herat, Afghanistan, 3001, Tel +0093744131596, Email mhmasoudy313@gmail.com

Background: Hand hygiene (HH) is a fundamental practice in preventing hospital-acquired infections (HAIs), yet compliance among healthcare workers, including students, remains suboptimal. This study assesses the knowledge, attitude, and practice (KAP) related to HH among final-year health sciences students in Herat, Afghanistan.

Methods: A convenience-based cross-sectional study was conducted in October to December 2023 at public and private health sciences institutions in Herat, using a structured questionnaire to assess KAP on HH. A sample of 427 participated. Data analysis in SPSS 27 included descriptive statistics, chi-square tests, and logistic regression.

Results: The overall accuracy of responses was 84.61% (IQR: 76.92, 84.61), reflecting a strong level of awareness. Attitudes toward HH were also largely positive, with a correct rate of 81.25% (IQR: 75.00, 85.41). Additionally, self-reported adherence to proper HH practices was notably high at 92.85% (IQR: 85.71, 98.21). Students assigned to the emergency ward (23.6%) demonstrated significantly higher knowledge compared to those in other wards ($p = 0.016$). Logistic regression further confirmed that work setting played a crucial role, with students in the internal ward exhibiting significantly higher knowledge levels than their peers (95% CI: 1.001–4.448) ($p = 0.050$). The study objectives were met, revealing that final-year students possessed strong knowledge, positive attitudes, and high adherence to HH practices. However, the work environment was a key determinant of knowledge variation across wards.

Conclusion: Despite high awareness and adherence, misconceptions and barriers to compliance exist. Strengthening educational interventions, institutional policies, and real-time monitoring is crucial to ensuring sustained HH practices among future healthcare professionals.

Keywords: hand hygiene, health sciences students, knowledge, attitude, practice, Afghanistan

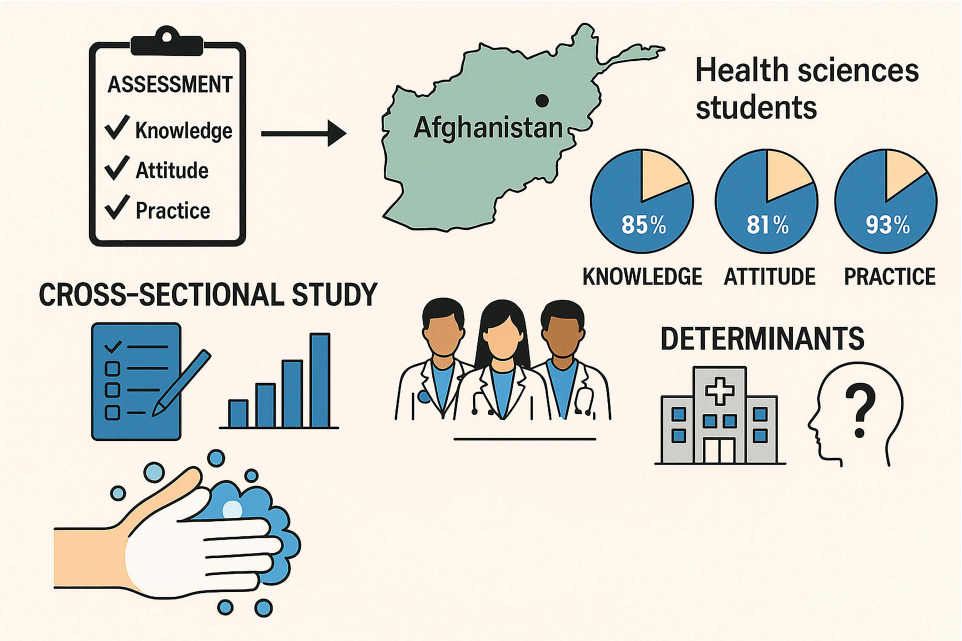
Background

Hospital-acquired infections (HAIs) pose a significant challenge to global healthcare systems, contributing to increased morbidity, mortality, and financial burden.[1,2] The World Health Organization (WHO) defines HAIs as infections that manifest within 48 hours after hospitalization and were not present at the time of admission.[3] These infections reduce the quality of patient care, compromise safety, and escalate healthcare costs. However, research indicates that nearly 30–50% of HAIs can be prevented through effective Hand Hygiene (HH) practices, underscoring the critical role of HH in infection control.[4,5]

Globally, HH compliance among healthcare workers remains suboptimal. Even in high-income countries, adherence rarely exceeds 70%, and systematic reviews report average compliance of only around 40%.[6] In low-resource regions,

Received: 23 February 2025
Accepted: 10 June 2025
Published: 17 June 2025

Graphical Abstract



these numbers drop dramatically. A recent meta-analysis in the WHO Eastern Mediterranean Region, which includes Afghanistan, reported a pooled compliance rate of just ~32%.[7] Additionally, the WHO estimates that one in three health care facilities worldwide lacks hand hygiene stations at points of care, particularly in low-income countries.[8] These infrastructure gaps make routine HH difficult and contribute to the persistence of HAIs.

HH compliance is recognized as one of the most effective methods for preventing HAIs.[9] Studies show that the prevalence of HAIs varies across different regions, with reported rates of 7.6% of patients in high-income countries, 7.1% in European countries, 15.5% in developing countries, and between 5.7% to 45.8% in African countries. In Iran, HAIs range from a minimum prevalence of 1.9% to over 25% in some healthcare settings.[6,10,11] The implications of these infections highlight the necessity for stringent infection prevention and control (IPC) measures, particularly among healthcare workers, including medical and nursing students who will soon enter clinical practice.[12]

In Afghanistan, the challenge is even more profound. Surveys indicate that fewer than half of the healthcare facilities have reliable access to water and soap for handwashing, and only a minority have alcohol-based hand rub (ABHR) available at all points of care. Assessment of hospitals in western Afghanistan revealed that only 2 out of 5 had any supply of ABHR, despite WHO's global push for ABHR use.[13] These limitations are exacerbated in rural and under-resourced regions, where supply chains, funding, and training are often inconsistent.

Given the recognized barriers to ABHR access in low-resource settings, some countries have implemented innovative strategies. For instance, in Uganda, a government-supported district-wide ABHR production and distribution initiative successfully improved HH infrastructure in remote clinics. By adopting WHO formulations and centralizing production, they ensured consistent quality and supply, leading to a 4.6-fold increase in proper HH adherence among healthcare workers.[14] Such models underscore how locally tailored, system-level interventions can make HH more feasible and sustainable in fragile health systems—insights that are especially relevant to Afghanistan.

The COVID-19 pandemic has further highlighted the importance of HH and catalyzed changes in both infrastructure and behavior. At the onset of the pandemic, hand hygiene was emphasized as a critical frontline defense against SARS-CoV-2, prompting many healthcare institutions, including in resource-limited settings, to rapidly install handwashing stations and ABHR dispensers.[15] Notably, evidence from rural districts in Uganda demonstrated that expanded access to

ABHR was closely linked to increased HH compliance among healthcare workers both before and during the pandemic. These findings emphasize that improving the availability of ABHR can meaningfully enhance adherence to HH protocols, especially in low-resource environments. Given the persistent challenges in ABHR access and its clear impact on HH behavior, it is essential to evaluate the preparedness and awareness of future healthcare professionals in such settings, particularly as they transition into clinical roles in the post-pandemic era.[16]

Despite the well-documented importance of HH, adherence among healthcare workers, including students, remains inconsistent. Various factors influence HH practices, including knowledge, attitudes, and the type of education received. Previous studies indicate that educational interventions, such as theoretical training and practical demonstrations, can significantly enhance compliance with HH protocols.[17] Therefore, understanding the knowledge, attitudes, and practices (KAP) of health sciences students regarding HH is essential to improving overall healthcare safety and reducing HAIs.

The present study aims to assess the level of knowledge, attitudes, and practices related to HH among final-year health sciences students in Herat, Afghanistan. Given that these students represent the future workforce of the healthcare sector, it is imperative to evaluate their preparedness and compliance with HH guidelines for future pandemics.

Methods

Study Design and Setting

This study utilized a descriptive cross-sectional design to evaluate the practices KAP of HH among health sciences students in Herat, Afghanistan. Data collection took place from October to December 2023 across several public and private health sciences institutions. The study sites included the Herat Institute of Health Sciences (Public) and private institutions such as Atefi, Kahkashan-e-Sharq, Milad Noor, Sana Kowsar, Tolo-e-Saadat, Ferdowsi, Ibn-e-Khaldoon, and Ghalib Institutes of Health Sciences. In addition to academic institutions, students engaged in clinical training at various healthcare centers were also included.

Study Participants

The study population comprised students from the selected institutions during the study period. Participants included medical, nursing, midwifery, and laboratory technician students who were undergoing clinical training at Herat Regional Hospital (Public) and multiple private healthcare facilities, including Aria, Apollo, Asia Mehr, Loqman Hakim, Kimia, Ibn Sina Hakim Specialty, Obaidi, Omid-e-Sabz OPD Clinic, Afghan Salamat, Roshana Specialty Eye, Afghan Aria, Jami, Afghan Kawesh Specialty, Afghan Turkan, Hakim Sanaei, Herat Heart, Ghalib, and Emamul Mottaqin Hospitals, as well as private clinics.

Recruitment Strategy for Target Population

A convenience sampling approach was implemented across various locations to ensure broad representation. Recruitment was coordinated with key institutional figures, including the heads of institutes, general supervisors, and unit leaders, who played a pivotal role in disseminating information about the study to potential participants. To enhance participant engagement and optimize the response rate, a personalized, one-on-one approach was employed.

Sample Size and Justification

Due to the absence of accurate data on the number of health sciences students in the Herat, the minimum required sample size was calculated using Cochran's formula for sample size determination. The sample size was calculated as 424 participants, considering a 5% margin of error, a 95% confidence interval (CI), and an estimated population proportion of 50%. Additionally, a 10% allowance was included to account for nonresponse. In total, 427 completed questionnaires were collected, ensuring the robustness of the data.

Data Collection

Data were collected using a structured, self-administered questionnaire that assessed sociodemographic characteristics and knowledge, attitudes and practices toward HH. Economic status was self-reported by participants and categorized

into five levels (Excellent, Good, Middle, Poor, Very Poor) based on their perceived monthly household income, housing condition, ability to meet basic needs, and financial dependency. These categories were adapted from socioeconomic classifications used in national Afghan surveys and reflect the local economic context. The questionnaire, developed based on previous KAP surveys,[10,18–24] was reviewed by three experienced doctors and validated through a pilot study involving 30 healthcare workers, demonstrating acceptable reliability with Cronbach's alpha coefficients of 0.78 for knowledge, 0.72 for attitude, and 0.86 for practice.

The questionnaire used in this study consisted of four sections: sociodemographic characteristics (11 items), knowledge (13 items), attitude (12 items), and practice (14 items). The knowledge section assessed the participants' factual understanding of proper hand hygiene protocols. Each correct response was awarded 1 point, while incorrect or "I don't know" responses received 0 points, yielding a total possible score ranging from 0 to 13. To enhance clarity, several sample items from this section include: "Hand washing is the most important method of infection control in health centers", "Disinfection of hands is required before wearing gloves and after removing gloves", and "Alcoholic disinfectants are more effective than other detergents to eliminate bacterial infections in the hands".

The attitude section evaluated participants' perceptions and beliefs about the importance of hand hygiene, using a five-point Likert scale: Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, and Strongly Disagree = 1. Total scores for this section ranged from 12 to 60. Examples of attitude items include: "Hand cleaning should become an important habit in the life of health professionals", "I try to be a role model for my colleagues in observing hand hygiene when taking care of the patient", and "Holding training seminars on hand hygiene is mandatory for personnel from time to time in the hospital". These questions aimed to explore internal motivation, personal responsibility, and institutional support perceptions.

The practice section captured the frequency of proper hand hygiene behaviors using a similar five-point scale: Always = 5, Often = 4, Sometimes = 3, Rarely = 2, and Never = 1. Scores ranged from 14 to 70, with higher scores indicating better compliance. Illustrative questions from the practice domain include: "I wash my hands after contact with the patient's blood, discharge, or fluids", "I wash or disinfect my hands both before and after taking care of wounds", and "In the process of working, before washing my hands, I first take off my ring, bracelet, and watch".

To categorize overall performance, total scores for each KAP domain were divided into "Good" and "Poor" based on the sample-based median value specific to each domain. This method was selected to reflect the internal distribution of responses within the study population, rather than applying a universal external benchmark such as WHO criteria. This approach allows for more context-specific interpretation of participants' performance relative to their peers.

Data Analysis

Before analysis, all collected data were reviewed for completeness, and incomplete responses were excluded. The data were then entered into SPSS version 27 for statistical analysis. The normality of continuous variables was assessed, and descriptive statistics, including frequencies, proportions, medians, and interquartile ranges (IQR), were calculated. Bivariate analysis was conducted using the chi-square test, while multivariate analysis involved dichotomizing KAP scores into Good (≥ median) and Poor (< median). Binary logistic regression was performed to identify independent predictors of Good KAP, with odds ratios (OR) and 95% confidence intervals (CI) reported. A p-value < 0.05 was considered statistically significant.

Results

Most of our participants were female (56.2%), aged 18–24 (49.6%), and single (59.3%). The most common economic status is middle (44.3%). The predominant profession is nursing (47.8%), and the most attended Institute of Health Sciences is Herat Institute of Health Sciences (Public) (14.8%). The most common healthcare center is Herat Regional Hospital (Public) (21.5%), and the most frequent ward is the internal ward (29.0%). The most common work shift is changeable (30.2%), with work hours exceeding five hours per day (51.3%). Additionally, the number of patients contacted per day is predominantly more than twelve (51.3%) (Table 1).

Table 1 The Sociodemographic Status of Participants (Herat, Afghanistan, 2023) (N=427)

		%
Gender	Male	43.8
	Female	56.2
Age	18–24	49.6
	25–29	42.4
	30–34	5.2
	>35	2.8
Marital Status	Single	59.3
	Married	40.7
Economic Status	Excellent	5.9
	Good	15.0
	Middle	44.3
	Poor	24.4
	Very poor	10.5
Professions	Nurse	47.8
	Midwives	30.4
	Medical Technologist	21.8
Institute of Health Sciences	Atefi Institute of Health Sciences	10.3
	Kahkashan-e-Sharq Institute of Health Sciences	12.2
	Milad Noor Institute of Health Sciences	12.9
	Sana Kowsar Institute of Health Sciences	8.9
	Tolo-e-Saadat Institute of Health Sciences	13.6
	Herat Institute of Health Sciences (Public)	14.8
	Ferdowsi Institute of Health Sciences	7.7
	Ibn-e-Khaldoon Institute of Health Sciences	11.2
	Ghalib Institute of Health Sciences	8.4
Health Care Center	Herat Regional Hospital (Public)	21.5
	Aria Apollo Hospital	8.9
	Asia Mehr Hospital	7.3
	Loqman Hakim Hospital	3.5
	Kimia Hospital	4.7
	Ibn Sina Hakim Specialty Hospital	3.0
	Obaidi Hospital	1.6
	Omid-e-Sabz OPD Clinic	2.3

(*Continued*)

Table 1 (Continued).

		%
	Afghan Salamat Hospital	1.6
	Roshana Speciality Eye Hospital	3.3
	Afghan Aria Hospital	3.5
	Jami Hospital	3.7
	Afghan Kawesh Speciality Hospital	3.5
	Afghan Turkan Hospital	4.7
	Hakim Sanaei Hospital	4.7
	Herat Heart Hospital	3.5
	Ghalib Hospital	3.7
	Doctor's Office	11.7
	Emamul Mottaqin Hospital	3.0
Ward	Emergency	20.6
	ICU	5.2
	internal	29.0
	Surgery	14.1
	Pediatric	11.2
	Stomatology	5.6
	OPD (Clinics)	4.9
	Others	9.4
Work shift	Morning	26.5
	Afternoon	23.2
	Nightly	20.1
	Changeable	30.2
Work hours (per day)	<=5	48.7
	>5	51.3
Number of Patients Contacting (per day)	<=12	48.7
	>12	51.3
	Total	100.0

Abbreviations: ICU, Intensive Care Unit; OPD, Outpatient Department.

Knowledge

The overall percentage of correct responses was 84.61% (IQR: 76.92–84.61), indicating a generally high level of awareness. Hand washing is considered the most important method of infection control in health centers by 97.4% of participants. Additionally, 96.7% acknowledged that rings, wristbands, and watches should be removed before surgery. However, only 57.8% believed that HH is necessary beyond official work in hospitals and medical centers. A high percentage (95.6%) recognized the importance of washing or disinfecting hands before and after direct patient contact,

while 91.8% agreed that proper drying of hands is as crucial as washing in infection control. Similarly, 91.8% emphasized the need to disinfect hands before wearing and after removing gloves. The necessity of handwashing before performing an ECG was acknowledged by 81.0%, while 94.4% recognized that soap and water should be used before treating and caring for wounds. A significant proportion (89.2%) identified alcoholic disinfectants as more effective than other detergents in eliminating bacterial infections, and 84.3% understood that standard hand disinfection with alcohol requires rubbing hands together for 20 to 30 seconds. Regarding water temperature, 63.0% believed that hot water should be avoided in hospitals as it can cause hand sensitization with disinfectants. However, only 3.3% stated that gloves are still required to protect against infections even if neither the patient nor the healthcare provider is infected. Finally, 75.4% of participants recognized that most hospital infections are transmitted to patients by hospital staff (Figure 1).

Attitude

The overall percentage of correct attitudes was 81.25%, indicating a generally positive attitude. 85.0% of participants strongly agreed that observing hand cleaning in hospital environments and during patient care is mandatory, while 12.9% agreed with this statement. Additionally, 74.7% strongly agreed and 20.4% agreed that they try to be role models for their colleagues in HH adherence. Regarding the impact of hand cleaning on patient safety, 61.6% strongly agreed and 28.8% agreed that proper HH reduces the risk of death in patients, and 59.5% strongly agreed while 33.0% agreed that handwashing helps reduce the medical costs of hospital infections.

However, 37.5% strongly agreed and 34.7% agreed that in urgent cases and under heavy workloads, patient care takes priority over HH, reflecting a potential barrier to compliance. A significant proportion (48.0% disagreed and 7.5% strongly disagreed) that health workers are autonomous in following HH instructions, suggesting that many believe institutional guidelines should dictate hygiene practices. The threat of diseases and infections in hospital settings to personal health was acknowledged by 59.5% strongly agreeing and 26.2% agreeing.

In terms of habits, 73.5% strongly agreed and 21.5% agreed that hand cleaning should become a regular habit for health professionals, while 63.9% strongly agreed and 29.0% agreed that using disinfectants before and after wearing gloves is

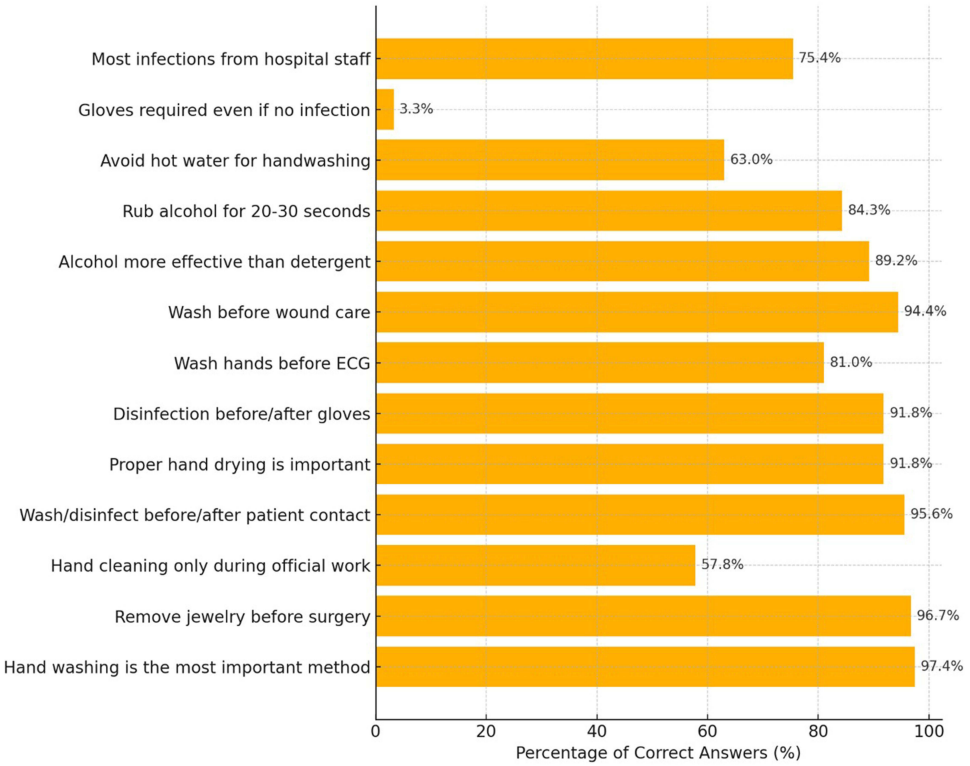


Figure 1 Knowledge towards Hand Hygiene Among Health Sciences Students (Herat, Afghanistan, 2023) (N=427).

https://doi.org/10.2147/RMHP.S524485

essential. Additionally, 69.6% strongly agreed that gloves should be changed when moving between infected and non-infected wards. A strong majority (56.0% disagreed and 18.0% strongly disagreed) with the misconception that wearing gloves eliminates the need for handwashing. Finally, 74.2% strongly agreed and 20.1% agreed that holding training seminars on HH should be mandatory for hospital personnel, reinforcing the importance of continuous education in infection control (Table 2).

Practices

The overall percentage of correct HH practices was 92.85%, indicating a highlight a high level of adherence to proper HH practices among participants. A significant majority (88.3%) always washed their hands after contact with a patient's blood, discharge, or fluids, while 82.9% always followed infection control guidelines in healthcare facilities. Similarly, 79.2% always washed or disinfected their hands before and after wound care, and 75.9% always used soap and water or alcohol-based disinfectants for HH.

Regarding personal protective measures, 68.4% always adhered to proper procedures for using personal protective equipment, while 69.3% always washed their hands before and after invasive care procedures such as Foley catheter placement and NG-tube insertion. Additionally, 72.4% always washed or disinfected their hands after leaving quarantine or an infected patient's room, and 63.9% always ensured proper HH before and after direct contact with a patient's cover.

When it comes to removing accessories before washing hands, 68.6% always removed rings, bracelets, and watches, and 64.9% always disinfected their hands after removing gloves. Furthermore, 71.2% always disinfected their hands after accidental contact with a needle tip, while 61.1% always used hand sanitizers after handling patient papers or belongings.

Table 2 Attitude Towards Hand Hygiene Among Health Sciences Students (Herat, Afghanistan, 2023) (N=427)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	%	%	%	%	%
Observing hand cleaning in hospital environment and during patient care is mandatory	85.0	12.9	1.4	0.5	0.2
I try to be a role model for my colleagues in observing hand hygiene when taking care of the patient	74.7	20.4	4.2	0.5	0.2
Hand cleaning in recommended scenarios reduces the risk of death in patients	61.6	28.8	8.9	0.5	0.2
Hand washing helps reduce the medical costs of hospital infections	59.5	33.0	6.1	0.7	0.7
In urgent cases and large workloads, caring for patients is more important than cleaning hands	37.5	34.7	9.1	15.5	3.3
Health workers are autonomous in observing the hygiene of hands according to the health instructions	9.4	11.5	23.7	48.0	7.5
The presence of diseases and infections in the hospital environment threatens my health and my life	59.5	26.2	10.1	3.5	0.7
Hand cleaning should become an important habit in the life of health professionals	73.5	21.5	3.3	1.4	0.2
It is essential to use disinfectants before and after wearing gloves	63.9	29.0	5.9	0.9	0.2
During the care of the patients, gloves should be changed to non-infected wards	69.6	23.7	5.2	1.4	0.2
If gloves are worn there is no need to wash your hands	8.4	8.9	8.7	56.0	18.0
Holding training seminars on hand hygiene is mandatory for personnel from time to time in the hospital	74.2	20.1	3.3	2.1	0.2

Notes: Overall % correct—median (IQR = Interquartile Range)= 81.25 (75.00, 85.41).

In terms of protective measures, 70.7% always used gloves when in contact with patient body fluids and secretions. Regarding alcohol-based hand sanitization, 61.1% always ensured proper rubbing for at least 15 seconds (Table 3).

Table 4 shows univariate analysis. Among the variables analyzed, ward of work was the only category that showed a statistically significant association with knowledge of HH. Specifically, students working in the emergency ward (23.6%) demonstrated significantly better knowledge compared to other wards (p = 0.016) (Table 4).

Table 3 Practice Towards Hand Hygiene Among Health Sciences Students (Herat, Afghanistan, 2023) (N=427)

	Always	Often	Sometimes	Rarely	Never
	%	%	%	%	%
I wash my hands after contact with the patient's blood, discharge or fluids	88.3	10.8	0.2	0.2	0.5
I follow all the guidelines for controlling infections and infectious diseases in health care facilities	82.9	13.6	2.8	0.5	0.2
I wash or disinfect my hands both before and after taking care of the wounds and wounds	79.2	16.9	2.6	0.2	1.2
I wash my hands with soap and water or disinfect with alcohol	75.9	19.7	3.3	0.9	0.2
I fully observe the procedures and arrangements for the use of personal protective equipment in the hospital environment	68.4	26.0	4.0	1.2	0.5
I wash my hands before and after invasive care, such as foley matching and NG-tube	69.3	24.8	4.7	0.9	0.2
I wash or disinfect my hands after leaving the quarantine room or the infected patient's room	72.4	23.0	4.4	0.0	0.2
I wash or disinfect my hands before and after direct contact with the patient's cover	63.9	27.4	6.8	1.6	0.2
In the process of working before washing my hands, I first take off my ring, ring, bracelet and watch	68.6	19.0	10.3	1.6	0.5
I wash or disinfect my hands after removing the gloves	64.9	26.5	6.8	1.4	0.5
In case of hand disinfection with the tip of the needle I will disinfect my hands with alcohol	71.2	19.9	7.5	1.2	0.2
I clean my hands with hand sanitizer after contacting the patient's papers or belongings	61.1	26.0	9.1	2.8	0.9
I will use gloves, if possible, contact with the patient's body fluids and secretions	70.7	21.5	7.3	0.0	0.5
Hand sanitizer with alcohol must be rubbed together for at least 15 seconds	61.1	26.0	10.8	0.9	1.2

Notes: Overall % correct—median (IQR)= 92.85 (85.71, 98.21).

Table 4 Univariate Analysis of Hand Hygiene Knowledge, Attitude, and Practice Among Health Sciences Students (Herat, Afghanistan, 2023) (N=427)

		Total	Good Knowledge		Good Attitude		Good Practice	
		%	%	p-value	%	p-value	N %	p-value
Gender	Male	43.8	43.8	0.985	44.5	0.791	52.5	0.145
	Female	56.2	56.2		55.5		47.5	
Age	18–24	49.6	50.2	0.741	48.7	0.922	52.5	0.850
	25–29	42.4	42.9		43.5		39.0	
	>30	8.0	6.9		7.9		8.5	

(*Continued*)

https://doi.org/10.2147/RMHP.S524485

Table 4 (Continued).

		Total	Good Knowledge		Good Attitude		Good Practice	
		%	%	p-value	%	p-value	N %	p-value
Marital Status	Single	59.3	59.1	0.956	59.7	0.869	55.9	0.576
	Married	40.7	40.9		40.3		44.1	
Economic Status	Excellent or Good	20.8	18.2	0.294	21.5	0.667	22.0	0.836
	Average	44.3	47.8		41.9		40.7	
	Poor or Very Poor	34.9	34.0		36.6		37.3	
Professions	Nurse	47.8	47.8	0.367	44.0	0.285	52.5	0.639
	Midwives	30.4	33.0		34.0		25.4	
	Medical Technologist	21.8	19.2		22.0		22.0	
Institute of Health Sciences	Herat Institute of Health Sciences (Public)	14.8	13.3	0.420	16.2	0.439	11.9	0.500
	Private Institutes of Health Sciences	85.2	86.7		83.8		88.1	
Health Care Center	Herat Regional Hospital (Public)	21.5	21.2	0.797	23.6	0.616	28.8	0.341
	Private Hospitals	66.7	66.0		64.4		61.0	
	Doctors' Office	11.7	12.8		12.0		10.2	
Ward	Emergency	20.6	23.6	**0.016***	19.9	0.966	25.4	0.849
	ICU	5.2	3.4		5.2		1.7	
	Internal	29.0	34.5		27.7		25.4	
	Surgery	14.1	12.8		14.1		16.9	
	Pediatric	11.2	11.8		12.0		10.2	
	Stomatology	5.6	3.4		5.8		6.8	
	OPD (Clinics)	4.9	2.5		6.3		5.1	
	Others	9.4	7.9		8.9		8.5	
Work shift	Morning	26.5	26.1	0.911	27.7	0.928	23.7	0.334
	Afternoon	23.2	24.6		22.0		18.6	
	Nightly	20.1	19.2		20.4		28.8	
	Changable	30.2	30.0		29.8		28.8	
Work hours (per day)	<=5	48.7	51.2	0.321	44.0	0.078	47.5	0.836
	>5	51.3	48.8		56.0		52.5	
Number of Patients Contacting (per day)	<=12	48.7	49.8	0.682	47.6	0.691	47.5	0.836
	>12	51.3	50.2		52.4		52.5	

Notes: *Indicates statistical significance at $p < 0.05$. Boldface indicates statistical significance at the $p \leq 0.05$ level. These values represent a statistically significant association between the variable and the corresponding knowledge, attitude, or practice outcome.
Abbreviations: ICU, Intensive Care Unit; OPD, Outpatient Department.

Table 5 Multivariate Analysis of Hand Hygiene Knowledge, Attitude, and Practice Among Health Sciences Students (Herat, Afghanistan, 2023) (N=427)

		Good Knowledge				Good Attitude				Good Practice			
		Sig.	OR	95% C.I.for OR		Sig.	OR	95% C.I.for OR		Sig.	OR	95% C.I.for OR	
				Lower	Upper			Lower	Upper			Lower	Upper
Gender	Female (Ref)												
	Male	0.181	1.411	0.852	2.338	0.273	1.322	0.803	2.178	0.429	1.345	0.645	2.808
Age	>30 (Ref)	0.716				0.897				0.791			
	18–24	0.455	1.380	0.593	3.208	1.000	1.000	0.438	2.284	0.733	1.226	0.380	3.957
	25–29	0.416	1.404	0.620	3.179	0.815	1.100	0.495	2.446	0.986	0.990	0.317	3.092
Marital Status	Married (Ref)												
	Single	0.822	0.951	0.613	1.475	0.692	1.092	0.707	1.687	0.460	0.791	0.424	1.474
Economic Status	Poor or Very Poor (Ref)	0.392				0.592				0.738			
	Excellent or Good	0.510	0.823	0.462	1.468	0.629	0.869	0.493	1.533	0.714	1.162	0.520	2.597
	Average	0.448	1.194	0.756	1.885	0.306	0.790	0.502	1.241	0.646	0.857	0.443	1.657
Professions	Medical Technologist (Ref)	0.294				0.120				0.778			
	Nurses	0.425	1.244	0.728	2.127	0.652	0.886	0.524	1.499	0.492	1.303	0.613	2.773
	Midwives	0.119	1.667	0.877	3.170	0.164	1.566	0.833	2.942	0.816	1.119	0.434	2.890
Institute of Health Sciences	Private Institutes of Health Sciences (Ref)												
	Herat Institute of Health Sciences (Public)	0.575	0.841	0.459	1.541	0.763	1.096	0.604	1.990	0.297	0.611	0.242	1.541
Health Care Center	Herat Regional Hospital (Ref)	0.863				0.671				0.219			
	Private Hospitals	0.753	0.917	0.535	1.572	0.467	0.821	0.483	1.397	0.088	0.533	0.259	1.098
	Doctors' Office	0.854	1.076	0.495	2.340	0.990	1.005	0.468	2.158	0.242	0.513	0.168	1.567
Ward	Others (Ref)	**0.024***				0.985				0.766			
	Emergency	0.173	1.741	0.785	3.864	0.872	1.067	0.482	2.365	0.419	1.611	0.507	5.123
	ICU	0.648	0.767	0.245	2.400	0.700	1.240	0.416	3.694	0.278	0.287	0.030	2.743
	Internal	0.050	2.110	1.001	4.448	0.838	1.081	0.515	2.265	0.827	0.883	0.290	2.686
	Surgery	0.584	1.265	0.546	2.926	0.842	1.089	0.472	2.510	0.507	1.504	0.451	5.011
	Pediatrics	0.386	1.475	0.612	3.557	0.583	1.278	0.532	3.068	0.930	1.061	0.284	3.971
	Stomatology	0.434	0.639	0.208	1.960	0.635	1.292	0.448	3.722	0.751	1.274	0.286	5.673
	OPD (Clinics)	0.200	0.452	0.134	1.525	0.338	1.713	0.570	5.145	0.807	1.220	0.246	6.044
Work shift	Changeable (Ref)	0.715				0.972				0.270			
	Morning	0.955	0.984	0.564	1.716	0.786	1.079	0.623	1.870	0.564	0.784	0.343	1.792
	Afternoon	0.440	1.248	0.711	2.188	0.839	0.944	0.540	1.649	0.721	0.856	0.365	2.007
	Nightly	0.629	0.863	0.474	1.571	0.878	1.047	0.581	1.887	0.151	1.807	0.806	4.052
Work hours (per day)	>5 (Ref)												
	<=5	0.954	1.012	0.664	1.543	0.167	0.746	0.492	1.131	0.888	0.957	0.523	1.752
Number of Patients Contacting (per day)	>12 (Ref)												
	<=12	0.721	1.082	0.703	1.663	0.914	1.024	0.670	1.564	0.987	1.005	0.539	1.873
Constant		0.076	0.316			0.669	0.762			0.067	0.188		

Notes: *Indicates statistical significance at $p < 0.05$. Values in bold indicate statistically significant results at $p \leq 0.05$, suggesting a meaningful association between the variable and the outcome (Good Knowledge, Good Attitude, or Good Practice). Ref (Reference Category). The baseline group against which other categories are compared.
Abbreviations: p-value, Probability value from statistical tests; OR, Odds Ratio; CI, Confidence Interval (95%); Ref, Reference category; Sig., Significance level.

Table 5 shows multivariate analysis. The logistic regression analysis identified ward of work as a significant factor associated with knowledge of HH. Specifically, participants working in the internal ward had Higher knowledge than others (95% CI: 1.001–4.448) (p = 0.050) (Table 5).

Discussion

Hand hygiene (HH) is a fundamental practice in infection control, playing a crucial role in preventing hospital-acquired infections (HAIs). Despite widespread awareness of its importance, adherence to proper HH remains inconsistent among healthcare professionals and students. The present study conducted in Herat, Afghanistan, reveals a high level of knowledge (84.61%). This aligns with studies reporting a high theoretical level of awareness regarding HH among medical students, with

mean knowledge scores ranging from 6.24/10 to 7.33/10 across various studies.[25,26] Nevertheless, compliance remains below ideal, with multiple studies reporting adherence rates ranging from 25.7% to 58.8%, even after interventions.[27]

The most significant infection control practice for 97.4% of respondents was handwashing, closely aligning with the 99.6% awareness level among clinical-year medical students.[18] Additionally, 96.7% acknowledged the need to remove jewelry, wristbands, and watches before surgery, consistent with previous studies showing a high level of awareness regarding the risks these accessories pose to hand hygiene.[28] However, only 57.8% of participants believed that HH is necessary beyond hospital settings, which is lower than the 75% rate of positive attitudes reported in other studies.[29] This suggests a lack of awareness regarding the importance of HH in community healthcare and personal protection.

The current study found that 95.6% recognized the necessity of washing hands before and after patient contact, aligning with findings from a large observational study where compliance after body fluid exposure reached 76.8%.[27] However, adherence rates tend to drop when the perceived risk is lower, with overall compliance hovering around 50%.[30] Regarding alcohol-based disinfectants, 89.2% of participants identified them as the most effective method for eliminating bacteria, in line with research confirming that alcohol-based hand rubs are significantly more effective than soap in reducing microbial load.[31] However, only 84.3% were aware that proper rubbing requires 20 to 30 seconds, compared to studies indicating that just 61.1% of healthcare professionals adhered to this guideline.[22]

A significant gap in knowledge was noted regarding glove use, with only 3.3% correctly stating that gloves should still be worn even if neither the provider nor the patient is infected. This misconception toward wearing gloves aligns with previous research showing that a considerable proportion of healthcare workers mistakenly believe gloves eliminate the need for HH.[32] Additionally, 75.4% correctly identified hospital staff as the primary vector for nosocomial infections, consistent with literature indicating that HCWs contribute to 40%–80% of hospital-acquired infections.[33]

From an attitudinal perspective, 81.25% of participants demonstrated a positive outlook on HH, supporting research that links attitudes to compliance.[34] However, 37.5% agreed that patient care should take priority over HH in urgent situations, highlighting a persistent challenge in adherence.[35]

In terms of practice, adherence rates were high, with 92.85% correctly performing HH. However, studies indicate that compliance often declines with increased workload, with rates falling below 50% in intensive care settings.[36] Additionally, logistic regression analysis showed that knowledge levels were significantly higher among students working in emergency wards, reinforcing previous findings that high-risk environments foster better compliance.[37]

Although this study demonstrated high levels of knowledge and positive attitudes toward HH among health sciences students, a modest discrepancy was observed between knowledge (84.61%) and practice (92.85%), particularly in emergency contexts. This divergence may stem from real-world constraints such as time pressure, staff shortages, inadequate supervision, and prioritization of immediate patient care over infection control protocols. For instance, 37.5% of participants agreed that patient care should take precedence over HH in urgent situations, suggesting a situational compromise that affects compliance. This is consistent with previous research showing reduced HH adherence under high workload or in fast-paced environments like emergency and intensive care units.[35,36] Addressing these situational barriers requires institutional support and a cultural shift emphasizing that HH is a core component of patient care, not a secondary task.

Importantly, environmental and systemic limitations—such as inconsistent access to alcohol-based hand rubs (ABHR)—may act as structural barriers to compliance, particularly in resource-limited healthcare systems like Afghanistan's. While high levels of knowledge and favorable attitudes were observed, actual adherence is often mediated by the availability of necessary supplies. In this context, findings from other low-resource settings offer valuable insight. For instance, Tusabe et al demonstrated that a district-led initiative to manufacture and distribute WHO-formulated ABHR significantly improved both accessibility and hand hygiene compliance in Ugandan health centers.[14] Likewise, Ishida et al found that even in facilities with high awareness, ABHR availability was the strongest predictor of proper HH behavior among rural healthcare workers.[16] These studies underscore the need to interpret behavioral outcomes not solely as individual failings but as reflections of broader health system infrastructure gaps.

The stark gap between knowledge and behavior was most apparent in responses to glove use. Only 3.3% of participants correctly identified the necessity of wearing gloves regardless of visible infection risk—despite high overall knowledge and attitude scores. This suggests that favorable scores may not automatically translate into sound clinical

judgment. Denijs et al, in a study among Thai nursing students, emphasized the mediating role of attitude and self-efficacy in transforming theoretical knowledge into habitual practice, advocating for experiential, hands-on training over didactic instruction alone.[33] Our findings reinforce this model and suggest that conventional lectures may need to be supplemented with interactive simulations, supervised application, and peer-led feedback.

Moreover, the unusually high self-reported practice score of 92.85% raises the possibility of social desirability bias—a known limitation of KAP surveys that rely on self-reporting. In environments where hand hygiene is emphasized as an ethical imperative, respondents may overstate their compliance to align with expected norms. Future studies should address this limitation through mixed-method designs, including direct observation or digital monitoring systems, to validate self-reported behaviors and triangulate findings more accurately.

While we recommend educational reinforcement and institutional support to enhance HH, these strategies should be rooted in practical, evidence-based interventions. Real-world programs in LMICs have shown that low-cost approaches —such as visual cues (eg, posters at handwashing stations), real-time prompts via mobile apps, ward-based audits, and peer-to-peer accountability structures—can significantly improve HH compliance. These proven strategies should be incorporated into Afghan health education systems and clinical routines to sustain behavioral change.

Conclusion

This study revealed that final-year health sciences students in Herat exhibited high levels of knowledge (84.61%), positive attitudes (81.25%), and strong self-reported HH practices (92.85%). However, critical gaps remain. Notably, only 3.3% of participants correctly understood glove-use protocols, and 57.8% believed that hand hygiene is only necessary during official work in hospitals—highlighting persistent misconceptions that could compromise infection control. Additionally, the exceptionally high practice scores may reflect social desirability bias, as responses were self-reported.

To address these gaps, educational strategies must go beyond theoretical instruction and include hands-on simulations, case-based learning, and peer modeling to reinforce behavior in real clinical contexts. Institutional efforts should also prioritize the consistent availability of alcohol-based hand rub, integrate real-time visual or digital reminders at care points, and implement routine monitoring with feedback loops. These targeted, evidence-based interventions are essential to ensure future healthcare providers translate knowledge and attitude into sustained, high-quality hand hygiene practices, ultimately improving patient safety in Afghanistan's health system.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval Statement

The study received ethical approval from the Institutional Review Board of Jami University on November 2, 2023 (Reference: J.2023.11.2). The study adhered to the Declaration of Helsinki and followed ethical principles to ensure participant confidentiality and privacy throughout the research process.

Participants' Consent Statement

Consent was obtained from participants before heading to fill out the questionnaire.

Acknowledgments

We extend our sincere gratitude to the students who participated in this study and generously shared their insights. We would like to express our appreciation to the hospitals in Herat, Afghanistan, for their invaluable cooperation and support throughout the data collection process. Additionally, we are thankful to Jami University for providing the necessary funding for printing the questionnaires, which facilitated the smooth execution of this research project. Their contributions were instrumental in the successful completion of this study.

Author Contributions

All authors made a significant contribution to the work reported, including conception, study design, execution, data acquisition, analysis, and interpretation. All authors also participated in drafting, revising, and critically reviewing the manuscript. Each author has given final approval of the version to be published, has agreed to the journal to which the article has been submitted, and accepts responsibility for all aspects of the work.

Funding

No funding was received for writing and publishing this paper. However, Jami University generously assisted in covering expenses related to data collection, particularly for printing questionnaires.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Barrasa-Villar JI, Aibar-Remón C, Prieto-Andrés P, Mareca-Doñate R, Moliner-Lahoz J. Impact on morbidity, mortality, and length of stay of hospital-acquired infections by resistant microorganisms. *Clin Infect Dis*. 2017;65:644–652. doi:10.1093/cid/cix411
2. Glance L, Stone P, Mukamel D, Dick A. Increases in mortality, length of stay, and cost associated with hospital-acquired infections in trauma patients. *Arch Surg*. 2011;146(7):794–801. doi:10.1001/archsurg.2011.41
3. WHO. *Prevention of Hospital-Acquired Infections*; 2002.
4. Baghaei R, Sharifian E, Kamran A. Can theoretical intervention improve hand hygiene behavior among nurses? *Psychol Res Behav Manag*. 2016;9:133–138. doi:10.2147/PRBM.S91433
5. Korhonen A, Lukkari A, Laitinen A, et al. Increasing nursing students' knowledge of evidence-based hand-hygiene: a quasi-experimental study. *Nurse Educ Pract*. 2019;35:104–110. doi:10.1016/j.nepr.2018.12.009
6. Allegranzi B, Syed S, Ellis B, Pittet D, Pittet D. Health-care-associated infection in Africa: a systematic review. *Bull World Health Organ*. 2011;89:757–765. doi:10.2471/BLT.11.088179
7. Bajunaid RM, Saeed A, Bostaji M, Farsi NJ. Hand hygiene compliance and improvement interventions in the Eastern Mediterranean Region: a systematic review and meta-analysis. *Infect Prev Pract*. 2024;6:100363. doi:10.1016/j.infpip.2024.100363
8. *Progress on WASH in Health Care Facilities 2000-2021: Special Focus on WASH and Infection Prevention and Control*. 1st ed. Geneva: World Health Organization;2023.
9. Tem C, Kong C, Him N, Sann N, Chang SB, Choi J. Hand hygiene of nursing and midwifery students in Cambodia. *Int Nurs Rev*. 2019;66:523–529. doi:10.1111/inr.12547
10. Zimmerman P-AP, Sladdin I, Shaban RZ, Gilbert J, Brown L. Factors influencing hand hygiene practice of nursing students: a descriptive, mixed-methods study. *Nurse Educ Pract*. 2020;44:102746. doi:10.1016/j.nepr.2020.102746
11. Kobra P, Sima L, Fariborz R, Rasouli AS, Neda K. The comparison of the effectiveness of two education methods video and lecture on knowledge, belief and practice of hand hygiene in nursing students: clinical trial. *Int J Med Res Health Sci*. 2016;5:240–248.
12. Sohrabi MB, Khosravi A, Zolfaghari P, Sarrafha J. Evaluation of nosocomial infections in Imam Hossein (as) Hospital of Shahrood, 2005. *J Birjand Univ Med Sci*. 2009;16:33–39.
13. MoPH. Afghanistan service provision assessment (AfSPA) 2018-19 key findings. 2018.
14. Tusabe F, Nanyondo J, Lozier MJ, et al. Improving access to WHO formulations of alcohol-based hand rub in healthcare facilities: a district-wide approach. *Ame J Tropical Med Hygiene*. 2023;109:191–200. doi:10.4269/ajtmh.22-0554
15. Zhang X, Ma Y, Kong L, et al. The impact of COVID-19 pandemic on hand hygiene compliance of healthcare workers in a tertiary hospital in East China. *Front Med*. 2023;10:1160828. doi:10.3389/fmed.2023.1160828
16. Ishida K, Lozier M, Medley AM, et al. Changes in access to alcohol-based hand rub and hand hygiene adherence among healthcare workers after a hand rub production and distribution program in Rural Uganda before and during the COVID-19 Pandemic. *Am J Trop Med Hyg*. 2024;111:1343–1352. doi:10.4269/ajtmh.24-0040
17. Bouchoucha S, Philips NM, Lucas JJ, Kilpatrick M, Hutchinson A. An investigation into nursing students' application of infection prevention and control precautions. *Nurse Educ Today*. 2021;104:104987. doi:10.1016/j.nedt.2021.104987
18. Aziz K, Rus RM, Rahman JA, Nasreen H, Pasi H. Knowledge, attitude and practice on hand hygiene among clinical year medical students in Islamic institution. *Int J Med Res Health Sci*. 2016;8:134–41.
19. Sallami ZA. Assessment of hand hygiene attitude, knowledge and practice among health science students in Aden university. *J Biosci Med*. 2016;04:25–32. doi:10.4236/jbm.2016.49003
20. Sanchis Sánchez E, Sánchez Lorente M, Olmedo Salas A, García Molina P, Balaguer López E, Blasco Igual J. Awareness of hand hygiene in health science students. *Educ Exp RIdEC*. 2021;14:44–49.
21. Taylor JK, Basco R, Zaied A, Ward C. Hand hygiene knowledge of college students. *Am Soc Clin Lab Sci*. 2010;23:89–93. doi:10.29074/ascls.23.2.89
22. Noprianty R, Thahara GKD. Healthcare workers knowledge, attitude, and availability of facilities toward compliance hand hygiene. *Indones J Glob Health Res*. 2019. doi:10.37287/ijghr.v1i1.2
23. Ojulong J, Mitonga KH, Iipinge S. Knowledge and attitudes of infection prevention and control among health sciences students at University of Namibia. *Afr Health Sci*. 2013;13:1071–1078. doi:10.4314/ahs.v13i4.30

24. Nair SS, Hanumantappa R, Hiremath SG, Siraj MA, Knowledge RP. Attitude, and practice of hand hygiene among medical and nursing students at a Tertiary health care centre in Raichur, India. *ISRN Prev Med*. 2014;2014:1–4. doi:10.1155/2014/608927
25. Maria HSY, Ivan WYY, Samson YWS, Amy L, Cherry NCY. Knowledge, practices, compliance and beliefs of university nursing students' toward hand hygiene: a cross-sectional survey. *GSTF J Nurs Health Care*. 2018. doi:10.5176/2345-7198_5.1.21
26. Elsafi SH, Al-Howti SY. Factors influencing hand hygiene compliance of healthcare students. *Int J Infect Control*. 2019;15. doi:10.3396/ijic.v15i4.19118
27. Chegini Z, Kolawole I, Singh PV, Alikhah F, Rasti Y, Motazedi Z. Improving knowledge, attitude, and compliance of hand hygiene of Iranian healthcare workers: a pilot study using Reminder Card. *J Health Res*. 2022. doi:10.56808/2586-940x.1011
28. Bakarman M, Baig M, Malik AA, et al. Hand hygiene knowledge and attitude of medical students in western Saudi Arabia. *PeerJ*. 2019;7:e6823. doi:10.7717/peerj.6823
29. Goyal J, Sharma OP, Kumar U, Sain S, Knowledge GB. Attitude and practice of hand hygiene among nurses at a teaching hospital. *Indian J Appl Res*. 2017;2017:7.
30. Hosseinialhashemi M, Kermani FS, Palenik C, Pourasghari H, Askarian M. Knowledge, attitudes, and practices of health care personnel concerning hand hygiene in Shiraz university of medical sciences hospitals, 2013-2014. *Am J Infect Control*. 2015;43(9):1009–1011. doi:10.1016/j.ajic.2015.05.002
31. Kamara CT. An effect of the world health organization's "my five moments for hand hygiene": an initiative on hand-hygiene knowledge, beliefs, attitudes and compliance among certified nursing assistants working in a health care facility. *Int J Res*. 2020;11:24–32. doi:10.3844/ijrnsp.2020.24.32
32. Jose G, Valsan C. A study to assess the knowledge, attitude and practices of hand hygiene in a health-care setting. *J Acad Clin Microbiol*. 2017;19:93–100. doi:10.4103/jacm.jacm_42_16
33. Denijs N, Sirichokchatchawan W. Exploring the relationship between knowledge and attitudes, adherence and confidence on hand hygiene practices among Thai nursing students. *Int J Nurs Educ*. 2024. doi:10.37506/jscrf411
34. Tien W, Komariah M, Knowledge NFRB. Attitude and supervision hand hygiene compliance. *Poltekita J Ilmu Kesehat*. 2024;18. doi:10.33860/jik.v18i1.3594.
35. Qasmi SA, Shah SMM, Wakil HYI, Pirzada S. Guiding hand hygiene interventions among future healthcare workers: implications of knowledge, attitudes, and social influences. *AJIC Am J Infect Control*. 2018;46:1026–1031. doi:10.1016/j.ajic.2018.02.019
36. Sopjani I. Health care personnel's attitude toward hand hygiene in regard to the prevention of health-care associated infections: a cross sectional study at the university Hospital pristine. *Open J Nurs*. 2016;06:841–852. doi:10.4236/OJN.2016.610083
37. Gluyas H. Understanding non-compliance with hand hygiene practices. *Nurs Stand R Coll Nurs G B*. 2015;29(35):40–46. doi:10.7748/ns.29.35.40.e9929