Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2019, 8(7): 134-141

Knowledge, Attitude, and Practice of Hand Hygiene among Clinical Year Medical Students at Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia

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ABSTRACT

Background: *Healthcare-associated infection (HCAI) is defined as any infection that the patient gets during hospitalization or after discharge, which was not present at the time of admission. Several factors contribute to HCAIs such as inappropriate hand hygiene, which is considered the most important and simplest precautionary measure to reduce the prevalence and control infection. This study aimed to assess the knowledge, attitude, and practices of hand hygiene among clinical year medical students of Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia.* ***Methods:*** *A cross-sectional survey of 240 clinical year medical students (4th and 5th year) at IMSIU was conducted using a validated self-administered questionnaire. It was cross-sectionally distributed to our participants.* ***Results:*** *Total 196 male students (n=196/240) participated in the questionnaire with a response rate of 81.7%. All participants were male students with the mean age of 23 years old. Overall, the level of knowledge, attitude and practices of hand hygiene among clinical year medical students at IMSIU, Riyadh, Saudi Arabia was found to be moderate (50%-75%).* ***Conclusion:*** *The present study warrants for systematic educational programs for students' awareness regarding the knowledge, attitude and practice towards hand hygiene use and implementation of strict guidelines to regulate nosocomial infection.*

Keywords: Hand hygiene, Healthcare-associated infection, Alcohol-based hand rub, Medical students

INTRODUCTION

Healthcare-associated infection (HCAI), which is also known as a nosocomial infection, is defined as any infection that the patient gets during hospitalization or even after discharge, which was not present at the time of admission [1]. It also includes the occupational infections which affect hospital staff. It not only causes increased morbidity and mortality, but it also poses a significant financial burden of the healthcare system. In the USA, the financial loss due to HCAIs in 2013 was significant in which about $6.5 billion is spent per year [2]. Several factors can contribute to causing HCAIs such as inappropriate hand hygiene, complicated procedures, inappropriate use of devices, and being an immunocompromised patient [3]. Based on the World Health Organization's (WHO) data, it is estimated that hundreds of millions of patients get affected by HCAIs each year [1]. Low and middle-income countries are more affected by HCAIs than high-income countries [2]. At any given time, the occurrence of HCAIs is estimated to be 15.5 per 100 patients in developing countries, whereas it is 9 per 100 patients in developed countries [2]. Reduction of HCAIs is effectively cost-saving and can be achieved by simple and low-cost control measures such as appropriate hand hygiene and proper application of basic precautions [3].

Hand hygiene is considered to be the most important and simplest precautionary measure to reduce the prevalence of HCAIs and control infection [4-6]. Some studies have shown that the compliance with hand hygiene is significantly reduced among health care providers which will lead to an increase in the prevalence of HCAIs [7-10]. There are 2 recognized techniques for performing hand hygiene which is alcohol-based hand rub and hand-washing with water and soap [11-15]. The concept of "My five moments for hand hygiene" is now an evidence-based concept of hand hygiene by WHO [7]. This concept requires cleaning the hands before touching the patient, before performing the aseptic and clean procedure, after being at risk of exposure, after touching a patient and after touching patient surroundings [6,7]. Following these 5 moments will contribute to increasing the compliance of and encourage health care workers to clean their hands [6].

Clinical year medical students are part of the healthcare teams and are significantly involved in inpatient care. Moreover, during their clinical training, they rotate in infection-sensitive floors, such as labor and delivery, intensive care units, neonatal intensive care units, and operating rooms where they are exposed to many different surfaces which are likely to be contaminated by many different organisms. Frequently touched surfaces can spread the infections among healthcare workers as well as patients as HCAIs. The students may touch the bed rails, doorknobs, push plates, and intravenous fluid poles which are susceptible reservoirs for many pathogenic microbes [4,5].

To address this, few studies have been done in the recent past in the different regions/cities of the Saudi kingdom to draw the actual picture of the prevalence of knowledge, attitude and practice towards hand hygiene during clinical rounds of medical students but failed to receive substantial scientific applaud [16-19]. In Qassim University, 29% of medical students were aware of hand hygiene's knowledge, attitude and practice [16]. In King Faisal University, 28% of medical students had good knowledge about hand hygiene [17].

Keeping the aforesaid facts in view, the present study was aimed to assess to identify the gaps in knowledge in order to enhance the awareness and compliance of hand hygiene among clinical year medical students.

MATERIALS AND METHODS

Study Design and Population

A community-based cross-sectional study was conducted to assess the knowledge, attitude, and practice of hand hygiene of the clinical year medical students at IMSIU by a self-administered questionnaire. To cover this study a systematized questionnaire was developed by following the previously published reports with needful modifications.

The study was implemented in 2 segments. During the first pre-test segment, 25 survey questionnaires were randomly distributed among medical students to assess the knowledge, attitude, and practice of hand hygiene. The survey questionnaire was checked and revised to overcome all obstacles faced during this pilot study. The questionnaire was validated by 3 experts in the field of infection control to assess content validity. Knowledge assessed using WHO's hand hygiene questionnaire that contains 15 questions which include "yes" or "no" questions and multiple choices. Attitude and practice assessed using another 7 and 6 "yes" or "no" questions respectively [20]. A scoring system was used in which one point will be given for each correct response, so the maximum score for knowledge is 25, a positive attitude is 8 and good practice is 9. Zero was given to incorrect response to knowledge, negative attitude and poor practice. A score of more than 75% was considered significant, 50%-74% moderate and less than 50% poor [12,21]. In the second segment, the self-administered typed survey questionnaire was distributed among 240 participating medical students (4^{th} and 5^{th} year) at the College of Medicine, IMSIU, Riyadh. The study was approved by the ethical research committee of the Institutional Review Board (IRB) Registration in Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia. Verbal and written informed consent was obtained from all participants in the study. The study was conducted for 6 months during the period of September 2018 to January 2019. Informed consent was obtained from every participant.

Survey Questionnaire Structure, Data Collection, and Analysis

The trained study personnel participated in the survey questionnaire distribution and data collection. The pretested survey questionnaire was used to obtain the socio-demographic factors that were related to the knowledge, attitude, and practice of hand hygiene of the clinical year medical students. The socio-demographic variables asked in the survey questionnaire for the present analysis included age, knowledge of health-care workers' hands when not clean is the main route of cross-transmission of potentially harmful germs between patients in health-care workers, hand

rubbing is more effective against germs than hand washing, knowledge of time needed for alcohol-based hand rub to kill most germs on your hands is 20 seconds and also knowledge about wearing jewellery and artificial nails are associated with colonization of harmful germs. The participants were also divided into subgroups according to their level of attitude practice of hand hygiene, it included review the guidelines of WHO and CDC for hand hygiene, wearing gloves reduces the need for hand hygiene, feeling frustration if somebody not practicing hand hygiene. In addition, the survey questionnaire included about following the steps of handwashing and hand wash before and after touching the patient, practicing hand wash before performing the aseptic and cleaning procedure and the study was also about the washing of hands after being at risk of exposure.

Inclusion and Exclusion Criteria

The medical curriculum at IMSIU is composed of 6-years divided into 3 phases. The first phase is one pre-professional year, the second phase is 3 pre-clinical years, and the third phase is 2 clinical years. Only clinical year medical students (4th and 5th year) at the College of Medicine, Riyadh, IMSIU were included as a participant. Those students who were unavailable during the period of questionnaire distribution were excluded straightaway.

Statistical Analysis

The data collection was followed by tabulating in Microsoft Excel and data-extrapolation for meaningful results. All the statistical analysis involved in this study was performed by using the SPSS software program (SPSS version 24, SPSS Inc., Chicago, IL). The data were expressed as frequencies, percentages, and means. Frequencies and percentages were used to present categorical variables. Chi-square test was used for comparison of the level of knowledge, attitude, and practice of hand hygiene among clinical year medical students. Any test was declared significant at $p<0.05$.

RESULTS

A total of 240 questionnaires were distributed among clinical year medical students at IMSIU, of them 196 (81.7%) responded with filled questionnaires. All participants were male students with the mean (SD) age of 23 years. Around 129 (65.8%) and 67 (34.2) were 4th and 5th clinical year medical students respectively.

Knowledge of Hand Hygiene among Students

Table 1 represents the knowledge of the participants about hand hygiene. About 63.8% of 4th year and 76.1% of the students were having knowledge of health-care workers' hands when not clean, it is the main route of cross-transmission of potentially harmful germs between patients in health-care workers. About 24.8% of 4th year and only 6% of 5th-year students stated correctly about germs present on or within the patient is the most frequent source of germs responsible for healthcare-associated infections. Knowledge of hand rubbing is more effective for hand cleansing than hand washing showed 50.4% and 23.9% in 4th and 5th year respectively. The participants' knowledge about the minimal time needed for alcohol-based hand rub to kill most germs on your hands is 20 seconds, which is showed correctly in 49.6% and 58.2% in 4th and 5th year respectively. The study was also conducted about the knowledge about wearing jewellery, and artificial nails are associated with colonization of harmful germs reported that 52.7% and 88.1% in 4th and 5th year.

Table 1 Exhibits the students' knowledge of hand hygiene (expressed as frequencies with percentages of correct and incorrect answers and p-value for each question)

#	Question	Year	Correct Frequency (%)	Incorrect Frequency (%)	P-value
1	Health-care workers' hand when not clean is the main route of cross-transmission of potentially harmful germs between patients in health-care workers	4th	81 (63.8%)	48 (37.2%)	0.025
		5th	51 (76.1%)	16 (23.9%)	
2	Germs already present on or within the patient is the most frequent source of germs responsible for healthcare-associated infections	4th	32 (24.8%)	97 (75.2%)	0.008
		5th	4 (6.0%)	63 (94.0%)	
3	Hand rubbing is more rapid for hand cleansing than hand washing	4th	113 (87.6)	16 (12.4%)	0.006
		5th	48 (71.6)	19 (28.4%)	
4	Hand rubbing causes skin dryness more than hand washing	4th	76 (58.9%)	53 (41.1%)	0.010
		5th	27 (40.3%)	40 (59.7%)	
5	Hand rubbing is more effective against germs than hand washing	4th	65 (50.4%)	64 (49.6%)	0.000
		5th	16 (23.9)	51 (76.1%)	

6	Hand washing and hand rubbing are recommended to be performed in sequence	4th	60 (46.5%)	69 (53.5%)	0.548
		5th	31 (46.3%)	36 (53.7%)	
7	The minimal time needed for alcohol-based hand rub to kill most germs on your hands is 20 seconds	4th	64 (49.6%)	65 (50.4%)	0.004
		5th	39 (58.2%)	28 (41.8%)	
8	Hand rubbing is better than hand washing before palpation of the abdomen	4th	101 (78.3%)	28% (21.7%)	0.338
		5th	55 (82.1%)	12 (17.9%)	
9	Hand rubbing is better than hand washing before giving an injection	4th	85 (65.9%)	44 (34.1%)	0.028
		5th	39 (58.2%)	28 (41.8%)	
10	Hand rubbing is better than hand washing after removing examination gloves	4th	48 (37.2%)	79 (62.8%)	0.100
		5th	24 (35.8%)	43 (64.2%)	
11	Hand washing is better than Hand rubbing after visible exposure to blood	4th	88 (68.2%)	41 (31.8%)	0.339
		5th	43 (64.2%)	24 (35.8%)	
12	Wearing jewellery should be avoided because it is associated with an increased likelihood of colonization of hands with harmful germs	4th	68 (52.7%)	61 (47.3%)	0.000
		5th	59 (88.1)	8 (11.9)	
13	Damaged skin should be avoided because it is associated with an increased likelihood of colonization of hands with harmful germs	4th	117 (90.7%)	12 (9.3%)	0.067
		5th	55 (82.1%)	12 (17.9%)	
14	Artificial fingernails should be avoided because it is associated with an increased likelihood of colonization of hands with harmful germs	4th	100 (77.5%)	29 (22.5%)	0.055
		5th	44 (65.6%)	23 (34.3%)	
15	Regular use of a hand cream should be avoided because it is associated with an increased likelihood of colonization of hands with harmful germs	4th	85 (65.9%)	44 (34.1%)	0.331
		5th	47 (70.1%)	20 (29.9%)	

The Attitude of Hand Hygiene among Students

Table 2 demonstrates the attitude of the participants about hand hygiene. The participants' knowledge score was in the order of 'reviewed the guidelines for hand hygiene by WHO and CDC (52.7% and 88.1% in 4th and 5th year)', 'lack proper hand hygiene practices because no living examples (52.7% and 88.1% in 4th and 5th year)', ' participants think sometimes they have more important things to do rather than hand hygiene (21.7% and 70.1% in 4th and 5th year)', 'wearing gloves reduces the need for hand hygiene (21.7% and 50.7% in 4th and 5th year)', 'feeling frustrated if somebody not practicing hand hygiene (40.3% and 82.1% in 4th and 5th year)'.

Table 2 Exhibits the students' attitude of hand hygiene (expressed as frequencies with percentages of correct and incorrect answers and p-value for each question)

Question	Year	Yes	No	P-value
		Frequency (%)	Frequency (%)	
Before starting my clinical training, I reviewed the respective WHO and CDC guidelines for hand hygiene	4th	93 (72.1%)	36 (27.9%)	0.005
	5th	35 (52.2%)	32 (47.8%)	
I lack proper hand hygiene practices because no living examples (that is, healthcare providers) are performing them	4th	49 (38.0%)	80 (62.0%)	0.167
	5th	31 (46.3%)	36 (53.7%)	
Sometimes I have more important things to do than hand hygiene	4th	28 (21.7%)	101 (78.3%)	0.000
	5th	47 (70.1%)	20 (29.9)	
Wearing gloves reduces the need for hand hygiene	4th	28 (21.7%)	101 (78.3%)	0.000
	5th	34 (50.7%)	33 (49.3%)	
I feel frustrated when others omit hand hygiene	4th	52 (40.3%)	77 (59.7%)	0.000
	5th	55 (82.1%)	12 (17.9%)	
I am reluctant to ask others to engage in hand hygiene	4th	60 (46.5%)	69 (53.5%)	0.271
	5th	35 (52.2%)	32 (47.8%)	
The newly qualified staff has not been properly instructed in hand hygiene in their training	4th	60 (46.5%)	69 (53.5%)	0.014
	5th	43 (64.2%)	24 (35.8%)	

Practice of Hand Hygiene among Students

Practicing hand hygiene among medical students has been shown in Table 3. The awareness about the steps of handwashing reflected in terms of knowledge score was significantly high ($p<0.002$). Practicing habits of hand wash before and after touching the patient was 65.9% and 78.3% in 4th and 91% and 94% 5th year. Practicing hand wash before performing aseptic and clean procedure also showed significant results.

Table 3 exhibits the students' practice of hand hygiene (expressed as frequencies with percentages of correct and incorrect answers and p-value for each question)

Question	Year	Yes	No	p-value
		Frequency (%)	Frequency (%)	
I follow the steps of hand washing	4th	89 (69.0%)	40 (31.0%)	0.002
	5th	59 (88.1%)	8 (11.9%)	
I wash my hand before touching the patient	4th	85 (65.9%)	44 (34.1%)	0.000
	5th	61 (91.0%)	6 (9.0%)	
I wash my hand before performing the aseptic and clean procedure	4th	105 (81.4%)	24 (18.6%)	0.125
	5th	49 (73.1%)	18 (26.9%)	
I wash my hand after being at risk of exposure	4th	113 (87.6%)	16 (12.4%)	0.000
	5th	44 (65.7%)	23 (34.3%)	
I wash my hand after touching a patient	4th	101 (78.3%)	28 (21.7%)	0.003
	5th	63 (94.0%)	4 (6.0%)	
I wash my hand after touching patient surroundings	4th	86 (66.7%)	43 (33.3%)	0.371
	5th	47 (70.1%)	20 (29.9%)	

DISCUSSION

Studies regarding hand hygiene among clinical year medical students in Saudi Arabia is limited [16-18]. Keeping this in view, the present was focused on evaluating the knowledge of hand hygiene of the clinical year medical students at IMSIU, Saudi Arabia, and their attitude towards hand hygiene practice. This study will help increase the production of data regarding the information about knowledge, attitude, and practice among clinical year medical students and further escalate the importance of it. In the present study, the results revealed that the students' knowledge, attitude, and practice about hand hygiene were moderate (62%). The results were marginally better than the other studies done in Saudi Arabia [16-18]. In Sri Lanka, 9% of medical students had good knowledge, 16% had a good attitude and 6% had a good practice about hand hygiene. Several studies state that there is a need for further improvement of clinical year medical students' knowledge, attitude and practice of hand hygiene [12]. Other worldwide studies have shown similar results as in India, China, and Brazil [13-15].

According to WHO guidelines on hand hygiene, the most frequent source of germs responsible for healthcare-associated infections is that germs are already present on or within the patient [3]. In our study, only 36 (18.4%) students answered the question correctly. The majority answered that the hospitals' environment was the leading cause.

Only 103 (52.6%) students, unfortunately, claimed that the newly qualified staff in the hospital have not been properly instructed on hand hygiene in their training. Another study that was done in Taif, 90 healthcare workers (25.9%) have also agreed that newly qualified staff have not been properly instructed in hand hygiene in their training [22]. This might lead the students to think that hand hygiene is not mandatory and important while they are rotating in the hospital. The WHO guidelines on hand hygiene have also stated that the minimum time needed for alcohol-based hand rub to kill most germs on the hands is 20 seconds [3]. Only 103 (52.6%) students have answered this question appropriately. In another study that was also conducted in India [23], only 189 (36.1%) students answered this question correctly. this necessitates the further need for improvement of the existing hand hygiene programs which is of utmost importance in preventing HCAI. According to the respective WHO and CDC guidelines for hand hygiene, wearing jewellery, damaged skin, and artificial fingernails are associated with an increase in the likelihood of colonization of hands with harmful germs [3]. Students were asked about which of them should be avoided and 127 (64.8%) chose to avoid wearing jewellery, 172 (87.8%) chose to avoid damaged skin and 144 (73.5%) chose to

avoid artificial fingernails. We asked the students if they have reviewed respective form of WHO and CDC guidelines for hand hygiene and we found that 128 of the students (65.3%) have reviewed it before starting the clinical years [3]. Clearly, it's very important for the students to understand and review these guidelines as it will help to reduce the likelihood of the HCAI.

In this study, 149 (76%) of the participants reported that they were educating patients and their families about hand hygiene and its importance. However, in another study conducted at Alfaisal University, they reported that only 43 (39%) students were educating their patients and families [18]. By educating the patients about hand hygiene, help in the compliance of the health care worker in applying hand hygiene as it was reported by Awaji's study [24].

The lack of knowledge, attitude, and practice that were found among the participants of this study could be attributed to the missing part of the curriculum regarding the hand hygiene lectures and workshops for the clinical medical students. Additionally, during the clinical years, those students do not receive enough education on how to apply proper hand hygiene. Moreover, the campaign and the extracurricular lectures that are given on the campus do not focus on the hand hygiene topics.

In order to help in improving the lack of knowledge and to increase the practice of hand hygiene, we suggest conducting lectures about how to do the hand hygiene and its importance with having it as part of the curriculum. Doing a campaign for the students and letting them conduct a campaign for the population so that they can feel the responsibility. In Kenya, a study reported that there was a significant improvement in medical students' knowledge about hand hygiene after applying the program to be part of their curriculum [25]. Also, sharing the statistics about the morbidity and mortality caused by hand hygiene malpractice with clinical year medical students will help in improving their compliance with hand hygiene.

Limitation of this Study

This study was conducted only among the students at IMSIU and was not generalize to other different universities in Saudi Arabia. Moreover, it included only male students, and this would be justified as there are no female students at clinical years at IMSIU.

CONCLUSION

The results of this study showed unsatisfactory moderate knowledge, attitude and practice towards hand hygiene among clinical year medical students. Clearly, they had some misconceptions about hand hygiene that were reflected in their knowledge, attitude, and practice. The study shows the further need for improvement of the existing hand hygiene programs which is of utmost importance in preventing HCAI. Adoption of well-structured curricular and extra-curricular training programs and enhancing positive attitudes by healthcare workers is a necessity. Emphasis on the importance of hand hygiene increases the availability and accessibility of its related facilities, in addition to, active involvement of the medical staff in training will help increase the compliance among the intended students.

Recommendations

Based on the findings of this study, the following has been recommended:

- Further research is necessitated to the knowledge of medical students regarding the role of mobile phones in the transmission of microorganism, maybe their devices can harbor various potential pathogens and serves as an exogenous source of nosocomial infection among hospitalized patients
- One major answer, hand rubbing is more effective against germs than hand washing, which was not in details in our questionnaire, hence we recommend more research on its occurrence
- University curriculum must play a major role in educating the students about hygiene practicing and must be included in the survey
- Researchers should continue to investigate the long-term contaminated effects not practicing hand hygiene
- Also, more research is needed to investigate the increased prevalence of hand, computer keyboards, mouse, ballpoint pens, files, books, door handle, lift button and mobile phones contamination in medical college

students' which may help increase awareness of the transmission of pathogenic organisms from colonized areas of healthy individuals to susceptible patients

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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