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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDES AND PRACTICES OF PROPER HAND HYGIENE TECHNIQUE AMONG FAMILY MEDICINE RESIDENTS IN MAKKAH, SAUDI ARABIA

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ABSTRACT

Background: Hand hygiene (HH) is a general concept of practicing hand washing, either with alcohol-based hand, or with soap and water, and considered the most effective, simple and cost-effective way to prevent transmitting the infections. **Objectives:** To assess the knowledge, attitudes and practices of proper hand hygiene technique among family medicine residents working in Makkah, Saudi Arabia. **Methods:** Analytical cross-sectional study was carried out among Family medicine residents working at joint program of family medicine in Makkah city, Saudi Arabia, during 2020. A valid self-administered questionnaire in English consisted of 4 parts (demographic data, questions to assess knowledge, attitude and practice of hand hygiene) was used. Chi-square and Student t-test were used in analysis utilizing Statistical Package for the Social sciences (SPSS) version 26.0. **Results:** A total of 163 family medicine residents were included in the study. Overall, 87.1% and 92.6% of the family medicine residents had good level of knowledge and positive attitude, respectively towards hand hygiene. Most of them (81%) had good practice-related to hand hygiene. Older physicians were more likely to have good level of practice. Age of family medicine residents who expressed good level of practice –related to hand hygiene was significantly higher than that of those with poor level of practice (28.0±2.1 vs. 27.2±1.3), p=0.005. **Conclusion:** Majority of the family medicine residents had good knowledge and practice as well as positive attitude towards hand hygiene. However, knowledge and attitude towards hand hygiene were not related to its practice among them.

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INTRODUCTION

Healthcare workers are considered the vehicle that acquiring infection from their surrounding healthcare setting and transmits the infections from patients to another, known as healthcare-associated infection (HCAI) (1). Healthcare workers' hands are always contaminated with pathogenic microorganisms, that assist in the propagation of the microorganisms within the hospital environment and finally to patients (1). HCAI could be received from direct contact between health care workers and patients, and from intact patients' skin (colonized areas), bedside furniture and bed linen, infected wounds, and HCAI could be received through any other objectives in the surrounding environment of the patients (2). HCAI could be life-threatening, increases the rate of morbidity and mortality, so it resembles a health burden and effect economically on the healthcare workers and patients (3). It was reported that the incidence of HCAI ranged from 1.7 to

23.6/100 patients in the hospital with expenses ranged from 28.4 to 33.8 billion \$ (4). Therefore, washing the hand is very urgent among healthcare workers, Hand hygiene (HH) is a general concept of practicing hand washing, either with alcohol-based hand, or with soap and water, and considered the most effective way to prevent transmitting the infections (4). Hand hygiene (HH) is simple and cost-effective could decrease the HCAI and decrease the rate of morbidity and mortality from 5% to 1% and from 30% to 2% after a proper practicing of handwashing policy with antiseptic by Semmelweis (5). Unfortunately, in 2007 there was a limited observation on practicing HH, and there was a lack of awareness among healthcare workers towards the techniques of hand hygiene (6). In 2010, there was poor compliance of HH among healthcare workers that exceeded 50% in healthcare settings (7), and 60% in 2013 (8). Enhancing the practicing of hand hygiene (HH) reduced the spread of HCAI (9). Improving HH practicing was suggested by world health organization (WHO) to increase HH compliance among healthcare workers through solving the behavioral barriers and obstacles (9).

This improvement will be applied through education or training programs, self-reporting by healthcare workers, monitoring and reminder in the workplace, and evaluation, and measurement of hand hygiene product usage, through a safety climate at the hospital (9). In Saudi Arabia, several studies were conducted to assess the effectiveness of HH compliance (10), and it was reported that there was a lack of knowledge regarding HH practicing (11). Therefore, the current study aimed to evaluate the awareness, attitude and practices of proper hand hygiene technique among family medicine residents working at joint program of family medicine in Makkah City, Saudi Arabia.

SUBJECTS AND METHODS

Analytical cross-sectional study was conducted in Makkah city, Saudi Arabia among all family medicine residents working at joint program of family medicine during 2020 (n=163). Self-administered questionnaire in English consisted of 4 parts was applied. Part 1 included demographic data of the participants (age, gender, level of training), Part 2 assessed the knowledge of HH derived from the World Health Organization (WHO) which included total of 10 questions combination from multiple choice questions and binary type questions requiring yes or no. Part 3 and 4 assessed the attitude and practice comprised of 10 and 6 questions, respectively in form of statements of Likert type. The statements were derived and modified from previous hand hygiene studies (12-15). A four (4) Likert scale (Strongly agree, agree, disagree, strongly agree) was used. The total score of knowledge, attitudes and practices were equated to 100%. For knowledge assessment, a score of more than 60% was considered good, and less than 60% poor. An attitude score of 60% and above was positive, and a score less than 60% was considered negative. For practices, a score of 60% and above was good, and a score less than 60% was considered as poor. The cut-off values to determine levels were taken from a previous study carried on medical students (16). The respondents were given a brief description of the study and its objectives, and written consent was obtained from every participant in this study before collecting the data. In addition, approval from the joint program of family medicine in Makkah was obtained. Data were entered to a personal computer and were analyzed by using Statistical Package for the Social sciences (SPSS) version 26.0. Chi-square and Student t-test were used. A p-value of less than 0.05 was adopted for statistical significance.

RESULTS

A total of 163 family medicine residents were included in the study. More than half (51.5%) of them were females. Their age ranged between 25 and 35 years with an arithmetic mean of 27.9 and standard deviation of 2 years. More than half of them (54.6%) were singles. They were almost equally distributed on the four residency levels. Majority of them (92%) received formal training in hand hygiene in the last three years. History of routine use of an alcohol-based hand rub for hand hygiene was reported by majority of the participants (96.3%).

Knowledge about hand hygiene: Table 1 shows that most of the participants (76.7%) could recognize that health care workers' hands when not clean are the main route of transmission of potentially harmful germs between patients. Majority of them knew that hand hygiene prevents

transmission of germs to the patient when done before touching a patient (97.5%), immediately after risk of body fluid exposure (89%), and immediately before a clean/aseptic procedure (95.7%) whereas only 10.4% knew that hand hygiene prevents transmission of germs to the patient when done after exposure to immediate surroundings of a patient. Similarly, majority of them knew that hand hygiene prevents transmission of germs to the healthcare worker when done before touching a patient (96.3%), immediately after risk of body fluid exposure (91.4%), and immediately before a clean/aseptic procedure (92%) whereas only 11% knew that hand hygiene prevents transmission of germs to the healthcare worker when done after exposure to immediate surroundings of a patient. Regarding alcohol-based hand rub and hand washing with soap and water, 74.2% of them knew that hand rubbing is more rapid for hand cleansing than hand washing while 37.4% knew that hand rubbing doesn't cause skin dryness more than hand washing. Most of the participants (71.2%) knew the minimal time needed for alcohol-based hand rub to kill most germs on hands. Majority of the family medicine residents knew that hand rubbing/washing is the method to be applied after removing examination glove whereas only 41.7% knew that hand rubbing is the method applied after making a patient's bed. Majority of them could recognize that wearing jewellery (90.8%) and damaged skin (92%) should be avoided, as associated with increased likelihood of colonization of hands with harmful germs. Overall, 87.1% of the family medicine residents had good level of knowledge about hand hygiene. None of the studies factors (age, gender, residency level, marital status, receiving formal training in hand hygiene in the last three years and routine use of an alcohol-based hand rub) was significantly associated with residents' knowledge regarding hand hygiene and health care-associated infections.

Attitude towards hand hygiene: Majority of the physicians either strongly agreed or agreed that they have sufficient knowledge about hand hygiene (93.8%), adhering to hand hygiene practices is easy in the current setup (87.7%), they adhere to correct hand hygiene practices at all times (86.5%), felt guilty if they omit hand hygiene (77.9%) and felt frustrated when others omit hand hygiene (76.1%). On the other hand, most of them either strongly disagreed or disagreed that sometimes they have more important things to do than hand hygiene (71.2%), wearing gloves reduces the need for hand hygiene (64.5%) and newly qualified staff has not been properly instructed in hand hygiene in their training (60.1%), Table 2. Overall, 92.6% of the family medicine residents had positive attitude towards hand hygiene. None of the studies factors (age, gender, residency level, marital status, receiving formal training in hand hygiene in the last three years and routine use of an alcohol-based hand rub) was significantly associated with residents' attitude towards hand hygiene.

Practice of hand hygiene: From Table 3, it is shown that the majority of the family medicine residents either strongly agreed or agreed that hand hygiene is an essential part of their role (97%), infection prevention team have a positive influence on their hand hygiene (87.6%), and infection prevention notice boards remind them to do hand hygiene (77.3%) while 63.2% either strongly agreed or agreed that it for them to attend hand hygiene courses due to time pressure. Overall, 81% of the family medicine residents had good practice-related to hand hygiene. Age of family medicine residents who expressed good level of practice-related to hand hygiene was significantly

Table 1. Knowledge about hand hygiene and health care- associated infections among family Medicine residents, Joint Program in Makkah

	Right answer		
	Response	Frequency	Percentage
Which of the following is the main route of transmission of potentially harmful germs between patients?	Health care workers hands when not clean	125	76.7
What is the most frequent source of germs responsible for health care	Germs already present on or within the patient	28	17.2
Which of the following hand hygiene actions prevents transmission of germs to the patient?			
Before touching a patient	Yes	159	97.5
Immediately after risk of body fluid exposure	Yes	145	89.0
After exposure to immediate surroundings of a patient	No	17	10.4
Immediately before a clean/aseptic procedure	Yes	156	95.7
Which of the following hand hygiene actions prevents transmission of germs to the health care worker?			
After touching a patient	Yes	157	96.3
Immediately after a risk of body fluid exposure	Yes	149	91.4
Immediately before a clean/aseptic procedure	No	18	11.0
After exposure to the immediate surroundings of a patient	Yes	150	92.0
Which of the following statements on alcohol-based hand rub and hand washing with soap and water is true?			
Hand rubbing is more rapid for hand cleansing than hand washing	True	121	74.2
Hand rubbing causes skin dryness more than hand washing	False	61	37.4
Hand rubbing is more effective against germs than hand washing	False	110	67.5
Hand washing and hand rubbing are recommended to be performed in sequence	False	80	49.1
What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands?	20 seconds	116	71.2
Which type of hand hygiene method is required in the following situations?			
Before palpation of the abdomen	Rubbing	109	66.9
Before giving an injection	Rubbing	93	57.1
After emptying a bed pan	Washing	104	63.8
After removing examination glove	Rubbing/washing	156	95.7
After making a patient's bed	Rubbing	68	41.7
After visible exposure to blood	Washing	140	85.9
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs?			
Wearing jewellery	Yes	148	90.8
Damaged skin	Yes	150	92.0
Artificial fingernails	Yes	107	65.6
Regular use of a hand cream	No	105	64.4

Table 2. Attitude of family medicine resident physicians, Makkah towards hand hygiene

	Strongly agree N (%)	Agree N (%)	Disagree N (%)	Strongly disagree N (%)
I adhere to correct hand hygiene practices at all times	57 (35.0)	84 (51.5)	10 (6.1)	12 (7.4)
I have sufficient knowledge about hand hygiene	45 (27.6)	108 (66.2)	5 (3.1)	5 (3.1)
Sometimes I have more important things to do than hand hygiene	7 (4.3)	40 (24.5)	81 (49.7)	35 (21.5)
Emergencies and other priorities make hygiene more difficult at times	14 (8.6)	65 (39.9)	65 (39.9)	19 (11.6)
Wearing gloves reduces the need for hand hygiene	10 (6.1)	48 (29.4)	81 (49.8)	24 (14.7)
I feel frustrated when others omit hand hygiene	39 (23.9)	85 (52.2)	28 (17.2)	11 (6.7)
I am reluctant to ask others to engage in hand hygiene	12 (7.4)	86 (52.8)	48 (29.4)	17 (10.4)
Newly qualified staff has not been properly instructed in hand hygiene in their training	8 (4.9)	57 (35.0)	79 (48.4)	19 (11.7)
I feel guilty if I omit hand hygiene	43 (26.4)	84 (51.5)	29 (17.8)	7 (4.3)
Adhering to hand hygiene practices is easy in the current setup	46 (28.2)	97 (59.5)	14 (8.6)	6 (3.7)

Table 3. Practice o-related to hand hygiene among family medicine resident physicians, Makkah

	Strongly agree N (%)	Agree N (%)	Disagree N (%)	Strongly disagree N (%)
Sometimes I miss out hand hygiene simply because I forget it	30 (18.4)	82 (50.3)	38 (23.3)	13 (8.0)
Hand hygiene is an essential part of my role	87 (53.4);	71 (43.6)	2 (1.2)	3 (1.8)
The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	15 (9.2)	82 (50.3)	54 (33.1)	12 (7.4)
Infection prevention team have a positive influence on my hand hygiene	38 (23.3)	90 (55.3)	33 (20.2)	2 (1.2)
Infection prevention notice boards remind me to do hand hygiene	30 (18.4)	96 (58.9)	33 (20.2)	4 (2.5)
It is difficult for me to attend hand hygiene courses due to time pressure	21 (12.9)	82 (50.3)	43 (26.4)	17 (10.4)

higher than that of those with poor level of practice (28.0 ± 2.1 vs. 27.2 ± 1.3), $p=0.005$. Other studies factors (age, gender, residency level, marital status, receiving formal training in hand hygiene in the last three years and routine use of an alcohol-based handrub) were not significantly associated with residents' practice-related to hand hygiene. There was no statistically significant association between knowledge and attitude towards hand hygiene from one side and practice-related to hand hygiene from the other side.

DISCUSSION

Proper hand hygiene is regarded as a simple and most effective technique to prevent cross-transmission of microorganisms and to decrease the rate of infections among healthcare workers (17). Despite its simplicity, knowledge and adherence of health care workers to it are mostly suboptimal (18). The present study was conducted to assess the knowledge, attitudes and practices of proper hand hygiene technique among family medicine residents working at joint program of family medicine in Makkah city to set recommendations to reduce the nosocomial infection rate. In the present study, most of the family medicine residents were knowledgeable about different aspects of hand hygiene, with the exception of the fact that hand hygiene prevents transmission of germs to the patient and/or healthcare worker when done after exposure to immediate surroundings of a patient as only about 10% could recognize that. Overall, majority of physicians in the current study expressed good level of knowledge about hand hygiene (87.1%), which is quite similar to the figure reported among healthcare providers in Nigeria, 2011 (83%) (19). In a similar study carried out in India among medical and nursing students, a moderate overall level of knowledge about HH has been observed (20). Also, in Iran (2014), health care workers (resident physicians, nurses and nursing assistants) had a moderate knowledge of hand hygiene with only 10.6% had a good knowledge score ($\geq 75\%$). (21) In a recent Saudi study carried out by Alhraiwil, et al, the average hand hygiene knowledge score was 65.5% among HCWs (22). In Al-Qassim, the average knowledge score was 63% (23). This difference in the knowledge level about hand hygiene could be explained by different demographic characteristics of the participants as well as using different tools to assess the level of knowledge regarding hand hygiene.

In accordance with others (21), knowledge level of the physicians in this study did not correlate with their age, gender or marital status. However, in another Saudi study carried out in Al-Qassim, health-care workers over the age of 30 had higher knowledge scores than those younger than 30 and also, those working at the tertiary hospital had higher scores than those working at secondary hospitals (23). Majority of family medicine residents in the present study (92.6%) had positive attitude towards hand hygiene. The same high attitude has been observed in a similar study carried out in Nigeria (97.6%) (19). Also, positive attitude towards HH was observed in previous Saudi studies where most of HCWs or medical students could recognize the importance of HH and were knowledgeable that having a strong immune system does not decrease the practice of HH as well as they were trying to follow guidelines for proper HH all the times in their practice (2, 23, 24, 25). Most of family medicine residents in the current study (81%) had good practice-related to hand hygiene, which is higher than the rate reported among healthcare providers in Nigeria (69.9%)

(19). In a previous Saudi study, compliance with hand hygiene was reported in 70% of medical students, while it was less reported among nurses (18.8%) and senior medical staff (9.1%), furthermore, the technique was inappropriate in all categories (26). In Al-Qassim (KSA), almost all HCWs reported good practice regarding HH (23), whereas in another study carried out in India, the overall adherence to hand hygiene by HCWs was below 50% (20). Observed variations in the rate of practicing hand hygiene could be related to many factors such as professional category of HCWs and time of study conduction (during an outbreak or pandemic or not). Therefore, the relatively high rate reported in the present study could be due to conduction of the study during the time of Covid-19 pandemic. In a recent Saudi study, observation of hand hygiene was done in critical care units at hospitals using the WHO patient safety observation form and revealed a compliance rate of 68.9%, with significant variation between different departments and HCWs and categories as nurses had overall higher compliance than physicians (71.9% vs. 65.7%) (22). Comparison between different studies regarding practice of HH should be taken with caution as some of them used subjective tool to evaluate HH such as the present study while some others used observational method. Majority of the family medicine residents in this study (92%) received formal training in hand hygiene in the last three years. Similar to this finding, most of medical and health profession students in Riyadh, Saudi Arabia reported training in hand hygiene, particularly nursing students, during the outbreak of Middle East respiratory syndrome coronavirus (MERS-CoV) (27). However, training in hand hygiene had no impact on the participants' knowledge, attitude or practice of hand hygiene, which raise a concern about the benefits of such training activities. The same has been reported in another study carried out in Iran (21).

Strengths and limitations: Some limitations of the present study should be mentioned. The cross-sectional design, which affects the interpretation of the direction of the associations between dependent and independent variables, was an important limitation of the study. Additionally, conduction of the study in only one family medicine program could affect the generalizability of results over other programs in Saudi Arabia. Also, depending on subjective self-reported tool to assess the practice of hand hygiene is considered an important limitation of the study. On the other hand, inclusion of all family medicine residents in this study is considered a strength point. Another strength point was using of a valid tool applied previously in similar studies and based on WHO information. In conclusion, majority of the family Medicine residents in Makkah, Saudi Arabia had good knowledge and practice as well as positive attitude towards hand hygiene, with no difference between them with regard to age, gender, residency training level and attending training courses in hand hygiene, with the exception that older resident physicians were more likely to express good practice of hand hygiene as compared to younger physicians. Furthermore, knowledge and attitude towards hand hygiene were not related to its practice among the participants. We recommend that continuous medical education should emphasize on hand hygiene for resident physicians of all specialties to improve their knowledge and practice and maintain their positive attitude. Also inclusion of practical sessions regarding hand hygiene in the educational activities with staff engagement in hand hygiene is also recommended.

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