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Gender differences in hand hygiene among Saudi nursing students

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Abstract

Hand hygiene is the most common infection control measure in health care setting and forms the core of patient safety. Student nurses have direct contact to patients and other members of the healthcare team during their tour of duty. This cross-sectional study was conducted to determine the gender differences on knowledge, attitude, practices and performance of hand hygiene in the 5 moments of hand hygiene among Saudi nursing students. A questionnaire with 4 parts was used to gather data on knowledge, attitude and practices on hand hygiene and the students' self–reported performance of the 5 moments of hand hygiene. Both male and female nursing students have moderate knowledge on hand hygiene. Females have better attitude towards hand hygiene and higher self-reported performance of the 5 moments of hand hygiene. On the other hand, male students have better practice on hand hygiene. Attitude and practice is statistically different at $p < 0.05$ level of significance. Gender differences on attitude, practice and performance of hand hygiene was observed. Knowledge of both genders needs to be improved. Gender-specific hand hygiene educational interventions are essential in order to meet the gender specific needs of the students.

Keywords: Hand hygiene; Sex differences; Nursing students; Saudi Arabia; Compliance; Infection control; Health knowledge, attitudes, practices.

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Background

Hand hygiene is a general term referring to any action of hand cleansing. It is composed of hand hygiene practices that are essential for ensuring the cleanliness of the hands.[1] Hand hygiene is a very simple set of procedures but have a great impact to health. It is the most common infection control measure in health care setting and forms the core of patient safety.[2] Performance of hand hygiene is the most important factor in preventing the spread of illness and this fact is universally accepted.[3,4] It has a very important role in preventing cross infections in hospitals,[5] which are among the leading problem in many major hospitals resulting in soaring cost in managing its effect.[6]

In the United States, hospital patients get an estimated 722,000 infections each year. That's about 1 infection for every 25 patients. Infections that patients get in the hospital can be life-threatening and hard to treat.[7] Hospital acquired infections (HAI) are infections acquired during the course of hospitalization. These infections are not present or incubating upon admission.[8] The occurrence of incidences of HAI are manifestation of poor care given to the patient. It is a critical problem affecting the quality of health care and a principal source of adverse healthcare outcomes such as increase in mortality, morbidity and health care cost.[9-11] In Saudi Arabia, HAI is a great concern. It was reported that 48.3% (668 out of 1382) of patients who had develop infection upon admission in a military hospital in the kingdom had HAI.[12] Furthermore, a more recent study revealed that 48.3% of the 170 investigated patients developed HAI.[13] These infections include respiratory tract infection (RTI), urinary tract infections (UTI), blood stream infections (BSI) and surgical site infections (SSI).[12,13]

The members of the health care team are primarily responsible in the prevention of the incidences of these HAI. Transmission of health care associated pathogens generally occurs via the contaminated hands of health care workers and hand hygiene is the simplest most effective way to prevent it.[14] Despite the simplicity of the procedures involved, compliance with hand hygiene among health care providers is low.[15-21] Non-compliance to hand hygiene becomes a universal concern among health care workers.[20] The low compliance to hand hygiene is caused by increased HH opportunities, increased activity index, increased risk of cross-transmission, lack of knowledge, lack of motivation, and less time in emergency situations.[22] Moreover, doctors showed the highest compliance to hand washing compared to nurses and housekeepers.[23] This is in contrast with other studies which reported a higher compliance among nurses compared to doctors.[24-27] There is also a varying degree of knowledge and attitude between health workers towards hand hygiene. Studies show differences in knowledge and attitude between doctors, nurses and other members of the healthcare team.[22,23,28,29] In Saudi Arabia, adherence to hand hygiene was seen in 70% of medical students, 18.8% of nurses, and 9.1% of senior medical staff, but the technique was suboptimal in all.[30] The facilitation of compliance is not simply reliant to efforts such as installing alcohol hand rubs but is highly dependent on altering behavioural perception. Introduction of hand rub alone without an associated behavioural modification program is unlikely to induce a sustained increase in hand hygiene compliance.[31] Moreover, neither having good theoretical knowledge of hand hygiene guidelines nor social influence or moral perceptions had any predictive value relative to hand hygiene practice.[32]

Since nurses are present 24 hours a day, 7 days a week in the healthcare setting, it is essential to comply with hand hygiene policy and maintain patient safety.[33] Most nursing interventions require touching the patient or close contact and frequently they come in contact with contaminated articles. This can become an opportunity for transferring infection once hand hygiene is not done effectively. Nursing students are also directly involved in caring of patients. A study found out that both nurses and student nurses have moderate knowledge of hand hygiene. Approximately half of the respondents had good attitudes while majority had poor hand hygiene practices.[18] This result suggests that there is wide scope for improvement in hand hygiene practices.

The need to improve the knowledge, attitude, skills and compliance of student nurses and other medical staffs towards hand hygiene is very important. The inability to motivate and change the hand washing practices of health care workers suggests that hand washing behaviour is complex, involving individual

beliefs and attitudes and institutional commitment and rigor.[34] Improving the knowledge and skills and influencing for behavioural change towards hand hygiene could be best achieved while they are still in the university. The concept of hand hygiene is being taught in nursing schools. Its skills and its application are developed inside nursing laboratories and through hospital or community affiliations. Compliance to hand hygiene vary from one individual to another and from one institution to another because of many factors that influence it.

Saudi Arabia's culture and religion does not allow mixture of both genders. Universities are not exempted from this. Boys and girls have separate campuses. Much had been studied about hand hygiene in general population and to health care workers. However, there are limited studies focusing on gender differences in hand hygiene. Most of the studies are focused on hand washing rates between genders but not on differences between gender on knowledge, attitude and practice. An article explored sex differences in hand washing rates subsequent to the use a public bathroom. They found out that females wash their hands more often compared to boys.[35] Visual aid did not prompt improvement in hand washing behaviour in both genders.[36] Furthermore, gender may influence hand washing rates in health care workers in the Critical Care Units, although this difference appears to be modified in particular professional groups.[37] It was recommended that further research should examine factors that modify hand washing rates within professional groups and how they differ based on gender. Since it was suggested that these differences may differ in a particular professional group, it is worth studying this topic among Saudi nursing students. In addition, there is also a paucity of research on this matter in the Arab countries. This study would be an addition to the scarce literature in this area.

Therefore, the need to assess the students' knowledge, attitude, practice and compliance to hand hygiene practices is essential. Gender differences on these factors: knowledge, attitude, practice and performance of hand hygiene in the 5 moments should also be studied in order to understand better the differences on gender and in order to develop an effective teaching plan to improve their compliance.

Objectives of the Study

This study aimed to determine the gender differences in hand hygiene among Saudi nursing students. Specifically, it:

1. Evaluated the nursing students' knowledge in hand hygiene;
2. Determined the attitude of the nursing students towards hand hygiene;
3. Assessed the practices on hand hygiene among nursing students;
4. Determine the self-reported performance to the 5 moments of hand hygiene among the students;
5. Determined the difference between genders on their knowledge, attitude, practice and self-reported performance of hand hygiene.

Methods and Procedures

This cross sectional study was conducted in the College of Applied Medical Sciences in a university in Saudi Arabia. The whole population of 223 nursing students of which 112 are males and 111 are females; from levels 3 to 8 enrolled during the first semester of school year 2014 – 2015 were included in the study.

Permission to conduct the study and ethical clearance were obtained from the office of the dean of the college. Coordination with the female college through the vice dean was done considering the gender sensitivity. The researcher explained the content, nature and the significance of the study to the participants. Participation to the study was voluntarily and a written informed consent form was attached to each questionnaire. The students who agreed to participate signed the consent form before returning the filled questionnaire to the researcher. Students who refused to join were not included in the study.

A self-administered questionnaire was administered to each student containing items to assess their knowledge, attitude, practice to hand hygiene and their self-reported performance to the 5 moments of hand hygiene. The students were asked to answer the questionnaire honestly. Enough time to answer the questionnaires was given to the students. No incentive at any kind was given to the students.

The questionnaire was used to gather data on knowledge, attitude, practice and the performance in

the 5 moments of hand hygiene. The questionnaire has 4 parts. Part 1 elicited data on the knowledge of the students on hand hygiene. Knowledge on the students about hand hygiene was assessed using the WHO Hand Hygiene Knowledge Questionnaire for Health-Care Workers. It includes multiple choice questions and questions answerable by yes or no. Permission was obtained for the use of the tool. Modification was done to suit the participants and the study. A score of more than 75% was considered good, 50–74% as moderate, and less than 50% was taken as poor.[18,29] Part 2 and part 3 of the questionnaire gathered data for attitude and practice on hand hygiene among the nursing students, respectively. Attitude towards hand hygiene and hand hygiene practice were assessed by an adopted questionnaire.[18,29] It consists of 10 items and 6 items respectively, with a 1 to 5 point scale between strongly disagree and strongly agree. The questionnaires were modified to suit the current study. The total score for attitude is 50 and 30 for the hand hygiene practice. A higher score indicates a more positive attitude towards hand hygiene and better practice. A score of more than 75% was considered good, 50–74% moderate, and less than 50% was taken as poor attitude and practice.[18,29] The questionnaires were re-evaluated for reliability and validity. The modified tools for attitude and practice showed acceptable validity and reliability with a Cronbach's alpha of 0.80 and 0.74 respectively. Part 4 included question soliciting the self-reported performance of the students in the 5 moments of hand hygiene. Each item was answerable by yes or no.

All questionnaires were separately translated to Arabic language by three Arabic and English speaking faculty members. Forward-backward translation method was used. The translated questionnaire was presented and re-translated to English by another three bi-lingual nurses. After the consensus, the final Arabic translation was prepared. The translated questionnaires were presented to three bi – lingual (Arabic and English) infection control experts. Comments and suggestions were carried out to come up with the translated questionnaire. The Arabic questionnaires were subjected for validity and reliability testing and they demonstrated acceptable validity and reliability.

Data analysis

The researcher used descriptive statistic and inferential statistic to treat and analyze the data. Frequency count, percentages and mean were used to determine the knowledge, attitude and practices among nursing students to hand hygiene. Inferential statistics, Z-test was used to determine the gender differences. A p-value less than 0.05 was considered to be statistically significant difference.

Result

From the total of 223 questionnaires distributed to the nursing students, 209 questionnaires were adequately answered and returned. This gave a response rate of 93.72%. Out of the 209 respondents, 103 (49.28%) were males and 106 (50.72%) were females.

Knowledge on Hand Hygiene

Table I shows the comparison between genders on the correct responses to each question of the WHO Hand Hygiene Knowledge Questionnaire for Health-Care Workers. As shown, males and females have the same rate of correct responses on almost all of the items except in 5 questions. More male nursing students (54.37%) know the minimal time needed for alcohol-based hand rub to kill most germs on the hands compared to female nursing students who has a correct response rate of 36.79% only. Furthermore, the number of male students who knows the appropriate hand hygiene method required after making a patient's bed is highly significant at $p < 0.01$ compared to the number of female students who answered correctly. However both genders have few numbers of students who answered it correctly. On the other hand, three questions were answered correctly by significantly more female students than the male. More female students (90.57%) know that damaged skin is associated with increased likelihood of colonization of hands with harmful germs and that it should be avoided compared to only 79.61% of the male students. It was also found out that 87.74% of the females know that wearing jewelleries should be avoided while only 66.02% of the male answered it correctly. Moreover, correct responses from female (69.81%) on type of hand hygiene method required after removing examination gloves is significantly higher compared to males (39.81%). Both the latter findings were highly significant at $p < 0.01$.

It is also worth mentioning that majority of the students in both genders answered some items incorrectly. Majority of the students does not know that hand hygiene after exposure to immediate surroundings of a patient cannot prevent transmission of germs to the patient. Likewise, only few students know that performing hand hygiene immediately before a clean/aseptic procedure cannot prevent transmission of germs to the health care worker. Furthermore, few students know that hand rubbing is more rapid for hand cleansing than hand washing and hand washing and hand rubbing are not recommended to be performed in sequence. It can also be seen that majority of the students have low knowledge on which type of hand hygiene method should be used before doing nursing interventions such as abdominal palpation, and giving injections. The need to avoid the regular use of a hand cream is also known by only few students.

Table I. Comparison between gender on correct response to each question of the WHO Hand Hygiene Knowledge Questionnaire for Healthcare Workers

No.	Questions *(Answers)*	Male Nursing Students *(n = 103)*	Female Nursing Students *(n = 106)*	*P - value*
1	Which of the following is the main route of transmission of potentially harmful germs between patients? *(health care workers hands when not clean)*	45 (43.69%)	33 (31.13%)	0.060 *
2	What is the most frequent source of germs responsible for health care associated infections *(germs already present on or within the patient)*	55 (53.40%)	55 (51.89%)	0.826 *
Which of the following hand hygiene actions prevents transmission of germs to the patient?				
3	Before touching a patient *(yes)*	89 (86.41%)	87 (82.08%)	0.390 *
4	Immediately after risk of body fluid exposure *(yes)*	67 (65.05%)	63 (59.43%)	0.401 *
5	After exposure to immediate surroundings of a patient *(no)*	28 (27.18%)	27 (25.47%)	0.779 *
6	Immediately before a clean/aseptic procedure *(yes)*	83 (80.58%)	93 (87.74%)	0.156 *
Which of the following hand hygiene actions prevents transmission of germs to the health care worker?				
7	After touching a patient *(yes)*	78 (75.73%)	78 (73.58%)	0.719 *
8	Immediately after a risk of body fluid exposure *(yes)*	68 (66.02%)	68 (64.15%)	0.779 *
9	Immediately before a clean/aseptic procedure *(no)*	24 (23.30%)	17 (16.04%)	0.187 *
10	After exposure to the immediate surroundings of a patient *(yes)*	72 (69.90%)	75 (70.75%)	0.897 *
Which of the following statements on alcohol-based hand rub and hand washing with soap and water is true?				
11	Hand rubbing is more rapid for hand cleansing than hand washing *(true)*	43 (41.75%)	32 (30.19%)	0.082 *
12	Hand rubbing causes skin dryness more than hand washing *(false)*	52 (50.49%)	44 (41.51%)	0.193 *
13	Hand rubbing is more effective against germs than hand washing *(false)*	48 (46.60%)	59 (55.66%)	0.190 *

14	Hand washing and hand rubbing are recommended to be performed in sequence *(false)*	21 (20.39%)	17 (16.04%)	0.412 *
15	What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? *(20 seconds)*	56 (54.37%)	39 (36.79%)	0.011 **
Which type of hand hygiene method is required in the following situations?				
16	Before palpation of the abdomen *(rubbing)*	20 (19.42%)	29 (27.36%)	0.177 *
17	Before giving an injection *(rubbing)*	25 (24.27%)	18 (16.98%)	0.194 *
18	After emptying a bed pan *(washing)*	64 (62.14%)	65 (61.32%)	0.904 *
19	After removing examination gloves *(rubbing/washing)*	41 (39.81%)	74 (69.81%)	<0.001 ***
20	After making a patient's bed *(rubbing)*	27 (26.21%)	12 (11.32%)	0.006 ***
21	After visible exposure to blood *(washing)*	64 (62.14%)	62 (58.49%)	0.589 *
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs?				
22	Wearing jewellery *(yes)*	68 (66.02%)	93 (87.74%)	<0.0002 ***
23	Damaged skin *(yes)*	82 (79.61%)	96 (90.57%)	0.026 **
24	Artificial fingernails *(yes)*	84 (81.55%)	87 (82.08%)	0.920 *
25	Regular use of a hand cream *(no)*	29 (28.16%)	30 (28.30%)	0.984 *

* Non – significant; ** Significant at p <0.05; *** highly significant at p <0.01

Table II shows the comparison between genders on knowledge on hand hygiene among nursing students. Majority of males (63.11%) have moderate knowledge to hand hygiene. Likewise, majority of the female (64.15%) have moderate knowledge too. Further, table VII shows the comparison of mean scores of the students' knowledge. Males have a mean score of 12.97 (51.88%) and females have a mean score of 12.78 (51.12%) which is interpreted as both moderate knowledge. Z-test revealed that the mean score of males and the mean score of females are not statistically significant at p <0.05. This means that there is no difference between the knowledge on hand hygiene among male and female nursing students.

Attitude towards Hand Hygiene

Table III reflects the comparison of the frequency distribution of the responses on attitude among Saudi nursing students. Moreover, the attitude of male and female nursing students toward hand hygiene is shown in table IV. The majority of male students (60.19%) have moderate attitude towards hand hygiene, 37 (35.92%) of the have good attitude and only 4 (3.88%) have poor attitude towards hand hygiene. On the other hand, 50 (47.17%) of the female nursing students have good attitude towards hand hygiene while 53 (50.00%) and 3 (2.83%) female nursing students have moderate and poor attitude, respectively. Females have higher frequency of students having good attitude towards hand hygiene than males. The z-test revealed that there is no significant difference on the number of students with good attitude, moderate attitude and poor attitude between gender at p <0.05. Further analysis was done to determine if there is a difference on the mean score of attitude for both genders. As shown in table VII, the mean score of attitude of female nursing students is 37.53 (75.05%) which is higher compared to the mean score of attitude of male nursing students of 35.43 (70.86%) which can be interpreted as good attitude and moderate attitude, respectively. The difference was statistically tested and was found to be relevant. There is a difference between the attitude of male and

Table II. Comparison of knowledge between genders among nursing students

	Male Nursing Students (%)	Female Nursing Students (%)	P - value
Good Knowledge	0 (0%)	0 (0%)	
Moderate Knowledge	65 (63.11%)	68 (64.15%)	0.87288 *
Poor Knowledge	38 (36.89%)	38 (35.85%)	0.87288 *

* Non – significant; ** Significant at p <0.0

Table III. Comparison of the frequency distribution of responses on attitude

	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
Statements	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
I adhere to correct hand hygiene practices at all times	60	47	27	23	8	4	0	0	8	5
I have sufficient knowledge about hand hygiene	45	46	40	48	11	9	1	0	6	3
Sometimes I have more important things to do than hand hygiene	17	12	20	32	26	16	19	9	21	37
Emergencies and other priorities make hygiene more difficult at times	29	23	33	15	23	22	7	11	11	35
Wearing gloves reduces the need for hand hygiene	26	23	32	32	16	16	16	12	13	23
I feel frustrated when others omit hand hygiene	43	55	27	29	15	19	6	0	12	3
I am reluctant to ask others to engage in hand hygiene	21	15	30	29	25	18	16	27	11	17
I have been properly instructed about hand hygiene in my class	56	53	29	27	12	21	1	0	5	5
I feel guilty if I omit hand hygiene	42	52	32	27	16	24	10	0	3	3
Adhering to hand hygiene practices is easy in the current setup	56	51	26	38	16	12	0	6	5	9

*M = Male Student Nurses; F= Female Nursing Students

female towards hand hygiene at p <0.05. The female nursing students have better attitude towards hand hygiene compared to the male nursing students.

Practices of Hand Hygiene

Table V shows the distribution of responses on practice of hand hygiene among Saudi nursing students. Table VI further present the practices of hand hygiene among the student nurses. It can be seen that most of the male (73.79%) and female (67.92%) nursing students have moderate practice of hand hygiene and 26 (25.24%) males and 32 (30.19%) of the females have good practice. Both genders registered low number of student with poor practice. Further analysis revealed that the number of male and female students with good, moderate and poor practice is not statistically different with each other. The mean score for practice for both genders is reflected in table VII. The computed

Table IV. Comparison of attitude between genders among nursing students

	Male Nursing Students (%)	Female Nursing Students (%)	P - value
Good Attitude	37 (35.92%)	50 (47.17%)	0.09894 *
Moderate Attitude	62 (60.19%)	53 (50.00%)	0.13888 *
Poor Attitude	4 (3.88%)	3 (2.83%)	0.67448 *

* Non – significant; ** Significant at p <0.05

mean score for male and female student nurses is 21.33 (71.10%) and 19.99 (66.63%), respectively. Both males and females have moderate practice based from their mean scores. Z-Test showed the statistical difference between genders on practices of hand hygiene at p <0.05. Male student nurses have better practice compared to the female nursing students.

Self-Reported Compliance to the 5 Moment of Hand Hygiene

Table VIII shows the comparison of the self-reported performance to the 5 moments of hand hygiene among the nursing students. Most males reported (91.26%) that they performance hand hygiene before touching a patient and 91.51% of females reported doing so. More male students (82.52%) reported performing hand hygiene immediately after risk exposure to body fluids and after glove removal than female students (75.47%). However, no significant difference between genders was found for both moments of hand hygiene. More female nursing students, however, reported performance of hand hygiene immediately before any aseptic task (86.79%), after touching a patient and his or her immediate surroundings (90.57%) and after touching any object or furniture in the patient's immediate surroundings - even without touching the patient (88.68%) than male student nurses with 75.73%, 80.58% and 77.67% self reported rate,

Table V. Comparison of the frequency distribution of the responses on practice

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	M	F	M	F	M	F	M	F	M	F
Sometimes I miss out hand hygiene simply because I forget it	24	23	26	27	20	36	11	12	22	8
Hand hygiene is an essential part of my role	74	46	21	21	6	33	0	6	2	0
The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	27	20	21	24	23	30	14	12	16	20
Infection prevention team have a positive influence on my hand hygiene	38	26	29	23	26	45	3	12	7	0
Infection prevention notice boards remind me to do hand hygiene	50	50	27	15	12	33	3	2	11	6
It is difficult for me to attend hand hygiene courses due to time pressure	10	20	21	21	25	30	16	6	31	29

*M= Male Student Nurses; F= Female Student Nurses

Table VI. Comparison of practices between genders among nursing students

	Male Nursing Students (%)	Female Nursing Students (%)	P - value
Good Practice	26 (25.24%)	32 (30.19%)	0.42372 *
Moderate Practice	76 (73.79)	72 (67.92%)	0.35238 *
Poor Practice	1 (0.97%)	2 (1.89%)	0.57548 *

* Non – significant; ** Significant at p <0.05

respectively. Statistical difference at p <0.05 was found between genders on the latter 3 moments of hand hygiene.

Discussion

This current study was conducted to determine the gender differences on knowledge, attitude and practices on hand hygiene and the self-reported compliance with the 5 moments of hand hygiene among Saudi nursing students.

As revealed in the results of this study, the students' knowledge on hand hygiene for both genders ranges from poor to moderate; however, majority for both genders have moderate knowledge on hand hygiene. This study also revealed that the knowledge of both genders is not different from each other. This means that both genders have equal knowledge on hand hygiene. The result support the claim that nursing students have moderate knowledge on hand hygiene.[18,29,38] Moreover, the result is the same with another study that revealed that the overall score in knowledge did not differ between male and female students.[39] Similarly, a study conducted in a university in Saudi Arabia showed that there was no significant difference (*P* >0.05) on the awareness to hand hygiene between the two genders among medical students.[40] The findings is in contrast with the result obtained in the study where they found out that female students showed a better self-assessment regarding the knowledge of hand hygiene. However, they also mentioned in their study that all the variables they examined showed no statistical significant difference between female and male students (p <0.05).[41] Another point was that female students' scores (mean = 6.94 ± 0.10; CI 6.75-7.13) were significantly higher (p < 0.001) than those of male students (mean = 6.39 ± 0.15; CI 6.10-6.67).[42] Knowledge to hand hygiene is very important to student nurses and to all members of the healthcare team. High knowledge to hand hygiene positively correlates with a decreased risk of transmitting infection among healthcare workers.[43,44] Knowledge to hand hygiene can also significantly influence hand hygiene beliefs, practice and compliance.[22,45] The moderate knowledge of both genders to hand hygiene suggest that more effort to improve their knowledge should be undertaken. Furthermore, both genders showed low level of knowledge when asked about which method of hand hygiene should be used in specific situation. The same result was reported in a study on hand hygiene knowledge, beliefs and practices of Italian nursing and medical students where mean scores on the knowledge questions were low for both groups reflecting primarily a knowledge deficit in relation to

Table VII. Comparison of the mean knowledge, attitude and practices to hand hygiene between genders among nursing students

Variable	Male Nursing Students (Mean)	Female Nursing Students (Mean)	P - value
Knowledge	12.97	12.78	0.574 *
Attitude	35.43	37.53	0.016 **
Practices	21.33	19.99	0.025 **

* Non – significant; ** Significant at p <0.05

Table VIII. Comparison between genders of the self – reported performance of hand hygiene on the 5 moments

	Moments of Hand Hygiene	Male Nursing Students 103 (%)	Female Nursing Students 106 (%)	P - value
1	Before touching a patient when approaching him or her	94 (91.26%)	97 (91.51%)	0.95216 *
2	Immediately before any aseptic task	78 (75.73%)	92 (86.79%)	0.04036 **
3	Immediately after an exposure risk to body fluids and after glove removal	85 (82.52%)	80 (75.47%)	0.2113 *
4	After touching a patient and his or her immediate surroundings when leaving	83 (80.58%)	96 (90.57%)	0.0394**
5	After touching any object or furniture in the patient's immediate surroundings, when leaving - even without touching the patient	80 (77.67%)	94 (88.68%)	0.03318**

* Non – significant; ** Significant at p <0.05

the use of alcohol-based hand rubs to decontaminate hands in the healthcare setting.[45]

Most of the Saudi nursing students in both genders have moderate attitude towards hand hygiene, but more females have good attitude. The female nursing students have better attitude towards hand hygiene compared to the males. The same result was revealed in the study where female staff scored higher than male staff members ($p<0.001$) in attitudes regarding clinical practice guidelines in general including hand hygiene.[46] Also, positive attitude was significantly higher among female personnel on hand decontamination in a study that evaluated the knowledge, attitudes, and behaviour regarding hand decontamination in personnel of intensive care units (ICUs) in Italy.[47] A significant association was also founded between gender and hand washing behaviour, with more female students having positive behaviour towards washing their hands.[36] Further, studies comparing the attitude towards hand hygiene of nursing students from other groups revealed that nursing students have better attitude.[18,29,38] The importance of having positive attitude towards hand hygiene was proven by past studies. Positive attitude towards hand hygiene after patient contact were independently associated with good observed hand hygiene performance.[48,49] Furthermore, attitudes were significantly correlated with self-reported hand hygiene adherence.[46,50] Having good attitude can increase self-reported adherence to hand hygiene.

The majority of both genders have moderate practice on hand hygiene. Higher numbers of females have good practice and more males have moderate practice. However, the mean score for practice shows that male nursing students have better practice of hand hygiene compared to the females. The difference may be caused by cultural influences where males are socially dominant than females. This claim needs to be validated through a study since information about it is lacking. In contrast with this result, more females reported a significant performance of hand hygiene on most of the moments for hand hygiene. Past studies also support this claim that females have better adherence and performance of hand hygiene.[35,36,51,52] In another study, it was found that female students had a higher rate of hand hygiene practice (59%) than males (32%).[36] Female students also showed a better adherence to hygiene guidelines in comparison to males in another study.[41,53] This supports the theory that female students may show better self-assessment than males regarding adherence to hygiene guidelines. The females' higher compliance maybe associated with their tendency to practice socially acceptable behaviors.[35,36]

Limitation of the Study

The study focused only in identifying the differences between genders on knowledge, attitude, practice and performance of hand hygiene. It did not touch the possible factors that contributed to the existence of differences. Further study should be undertaken to determine the factors that might have contributed to the gender differences. Furthermore, the study was conducted only in a single university. A study of bigger population should be undertaken.

Conclusion

This study determined the gender differences on knowledge, attitude, and practice to hand hygiene and the self-reported performance of hand hygiene in the 5 moments where hand hygiene should be performed, among Saudi nursing students. The findings show the differences in hand hygiene between genders. These differences can be observed in the attitude and practice of hand hygiene and in the performance of the 5 moments of hand hygiene. Female Saudi nursing students have better attitude towards hand hygiene and better self-reported performance of the 5 moments of hand hygiene while males have better practice. Male nursing students need more encouragement than women to engage in proper hand washing behaviour and compliance to hand hygiene. Knowledge for both genders is moderate. Therefore, the knowledge needs to be improved in order to enhance hand hygiene beliefs and practices of the students, thus decreasing the risk of transmitting infection in the healthcare facility. Measures to improve hand hygiene should be targeted based on the findings of the studies. Moreover, these gender differences require gender specific hand hygiene educational interventions in order to meet the gender specific need of the students.

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