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Research Article

**KNOWLEDGE AND ATTITUDE REGARDING INFECTION CONTROL
AMONG MALE NURSES WORKING AT PRIMARY HEALTH CARE
CENTERS, TAIF CITY, 2017**

¹Dr. Faisal Saleh Alzahrani, ²Dr. Mohammed Alzaydi

¹Family Medicine Resident (R4)

²MBBS, SBFM, ABFM, Family Medicine consultant,
Postgraduate center of Family Medicine, MOH, Taif Region

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Abstract:

Background: Adherence to standard precautions measures is fundamental to control healthcare associated infections among in health care workers, including nurses.

Objectives: To investigate knowledge, and attitude of male nurses working in Taif primary health care centers regarding infection control measures.

Subjects and Methods: A cross sectional study was conducted in Taif city among all male nurses currently working at Ministry of Health, primary healthcare centers (n=115). A self-administered questionnaire was utilized for data collection. It consisted of four main sections: Socio-demographic characteristics, Knowledge about different aspects of infection control (38 questions), attitude towards infection control (7 statements) and perceived obstacles to adequate application of standard precautions and infection control.

Results: One hundred and nine male nurses participated in the study out of a total of 115 invited with a response rate of 94.8%. Their age ranged from 24 to 55 years with a mean of 34.2 and SD of 6.6 years. All are Saudis and registered nurses. Approximately half of them (50.5%) had attended any training program in infection control or standard precautions. The percentage of the total knowledge score ranged between 31.58 and 81.58 with a mean of 62.84 and SD of (\pm) 12.26. Overall, The highest level of knowledge was observed regarding hand hygiene (74.4%), followed by general concepts of infection control and standard precautions (73.9%) while the lowest level was observed regarding sharp disposal and sharp injuries (50.2%). Among studied factors, the only significant one was the highest qualification of male nurses as the mean rank of the percentage of knowledge score was significantly higher among nursed who had Bachelor degree compared to those who had Diploma (68.48 versus 51.97), $p=0.034$. Overall, 70.6% of the male nurses had positive attitude towards infection control and standard precautions. Regarding obstacles for application of infection control and standard precautions at primary health care centers, lack of awareness about standard precautions in health care settings is ranked first with a weighted mean of 3.96 ± 1.49 on a scale ranged between 1 and 5. Overcrowded work place and lack of guideline on standard precaution in the health facility are ranked second and third with weighted means of 3.79 ± 1.45 and 3.78 ± 1.46 , respectively.

Conclusion: The overall knowledge level for infection control among male nurses working at primary health care centers, Taif city was above average. However, most of them had positive attitude towards infection control and standard precautions.

Corresponding author:

Dr. Faisal Saleh Alzahrani,

Family Medicine Resident (R4)

Family Medicine Programme, Ministry Of Health, TAIF

QR code



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INTRODUCTION:

Background:

Infection control is defined according to the world health organization as policies and procedures applied to reduce the chance of spreading of infections mainly in hospitals and health care facilities¹.

The occupational risk of acquiring respiratory infection to healthcare professionals (HCPs), including nurses, increases when the respiratory diseases are not defined in the work place and measures of infection control are not properly applied². In 2003, severe acute respiratory syndrome (SARS) epidemic, 21% of probable cases involved health care professionals³. Also, HCPs are specifically more prone to blood-borne pathogens through contact with infected body parts, blood and body fluids during their work³⁻⁵.

It has been reported that the prevalence of healthcare acquired infection in developed countries is 7.6% while in developing countries it is 10.1%^{6,7}.

The World Health Organization (WHO) has estimated that every year, about 3 million HCPs all over the world experience exposure to blood-borne Hepatitis C and B and HIV viruses⁸. Also, it has been estimated by WHO that nearly 2.5% of HIV cases and 40% of HBV and HCV cases among HCPs all over the world are the result of these exposures⁸.

Most respiratory infections can be transmitted from patients with respiratory infection to uninfected HCPs on large droplets (> 5 µm in size) into their eyes or mouths. Droplet precautions are recommended for HCPs when examining patients with symptoms of respiratory infections⁹.

The Centers for Disease Control (CDC) has recommended using of standard precautions in both health care workers and patients¹⁰. Adherence to standard precautions measures is fundamental to control healthcare associated infections among in health care workers, including nurses as well as patients¹¹⁻¹².

Standard Precautions are nowadays widely promoted in developed countries, and to a lesser extent, in developing¹³. However, despite the existence of detailed guidelines, in many developing countries, level of knowledge of standard precautions for infection control among health care professionals is still substantially suboptimal, and their application is insufficiently reported¹³⁻¹⁶.

Studies have reported that failure of HCPs in compliance with standard precautions of infection control is associated with their lack of knowledge in this area, believing that this risk is a part of their work, inadequate preparation to deal with different situations, disregarding the patients' health status, and lack of support from both of institutions and patients^{17,18}. In addition, it has been documented that more duration of professional experience, training in standard precautions, and high risk perception have all been associated with improved adherence to standard precautions among HCPs¹⁶.

Rationale

- ❖ Nurses are at a greater risk of acquiring and transmitting blood-borne and respiratory infections at their work place.
- ❖ Effective knowledge about standard precautions of infection control and practicing them properly is very critical in preventing blood borne and respiratory tract transmitted infections.
- ❖ Up to our knowledge, no similar studies have been conducted tacking this important issue among male nurses in Taif city, Saudi Arabia

Aim of the study

To investigate knowledge, and attitude of male nurses working in Taif primary health care centers regarding infection control measures.

Specific objectives

1. To explore the knowledge of male nurses, primary health care centers, taif city regarding different aspects of infection control.
2. To assess their attitude towards measures of infection control
3. To identify factors associated with their knowledge and attitude towards of infection control measures.
4. To identify obstacles that influence infection prevention at Primary health care centers, MOH, Taif city.

LITERATURE REVIEW

Searching online for studies investigating the knowledge and attitude of health care professionals, with special emphasis on nurses, regarding standard precautions of infection control yielded few studies. Two of them were carried out in Saudi Arabia. The following is summary of the most relevant studies to our proposed research.

-Saudi studies

A cross-sectional study was carried out in 2015 among Saudi nursing students to investigate the differences in knowledge, attitude, and practices of

the 5 moments of hand hygiene between male and female students. Both genders nursing had moderate knowledge regarding hand hygiene. However, female students had more positive attitude towards hand hygiene. On the other hand, male students had better practice¹⁹.

In Makkah, Alkot et al (2016) assessed the knowledge, attitude, and practice of health care professionals toward Middle East respiratory syndrome—coronavirus (MERS-CoV) among HCPs in primary health-care centers of Makkah, Saudi Arabia after an interventional education program. The level of satisfactory knowledge, positive attitude, and good practice of studied HCPs were significantly improved after exposure to the program, as it increased from 43.3%, 45%, and 57.4% before intervention to 67.9%, 63.8%, and 64.8% after intervention, respectively ($P < 0.001$). Older age, previous training, and experience were positively correlated with higher scores of knowledge¹⁸.

-Overseas studies

Adinma et al carried out a cross-sectional study amongst Nigerian house officers and nurses to investigate their knowledge and practice, as well as factors affecting practices regarding standard precautions. Knowledge of standard precautions measures was high for both of physicians (97%) and nurses (92%). Regarding practice, it was better among nurses (75%) compared to physicians (15.2%), $p < 0.05$. The most important factor influencing standard precautions practice was the lack of provision of adequate protective equipments. Other factors included carelessness, lack of display of standard precautions guidelines, emergency nature of the procedure, insufficient water supply, patient perceived to be at low risk of blood borne pathogens, pressure of time and standard precautions equipments interfering with technical skills²⁰.

Alice et al studied the knowledge and practice of standard precautions (SP) among health care workers in Edo state, Nigeria through a cross sectional study. Majority of the participants (93.2%) had ever heard of standard precautions. Of them, 5.7% had poor knowledge, 44.0% had fair knowledge, and 50.3% good knowledge regarding SP. Physicians had the highest proportion with good knowledge, and porters, the lowest. Minorities (3.9%) had poor compliance, 49.8% had fair and 46.8% had good compliance to standard precaution. Regarding compliance to SP practice, highest proportion of nurses had good practice compliance¹⁵.

Ogoina et al investigated through a cross-sectional study the knowledge, attitude and practice of standard precautions of infection control among HCPs (physicians, nurses and laboratory workers) of two tertiary hospitals in Nigeria. Overall median knowledge and attitude scores toward SPs were above 90%, but median practice score was 50.8%. The majority of the HCPs had poor knowledge of injection safety and complained of inadequate resources to practice SPs. House officers, laboratory scientists and junior nurses had lower knowledge and compliance with SPs than more experienced doctors and nurses²¹.

Acharya et al carried-out a cross sectional hospital-based study to define the knowledge level and practice of nurses working in tertiary care hospital in Delhi, India regarding standard precautions for infection control as well as to determine their source of information. The study revealed that 79.9% of nurses had poor knowledge about standard precautions and 64.5% of them had inadequate knowledge about the transmission of blood-borne pathogens. Most of them (77.5%) were aware about hepatitis-B vaccine, 72.7% practiced washing soiled hands immediately, and 58.7% used Gowns and Gloves very often. the major source of information was refresher training (34.5%)⁹.

Oliveria and his colleagues carried out a cross-sectional survey aimed to evaluate the knowledge and attitude of health care professionals working in a Brazilian public emergency hospital regarding their utilization of standard precaution measures. The rate of occupational health care accidents was 20.6%. Drivers were 20.7 times more likely to not adopting SP compared to physicians. However, the rate of occupational health care accidents was 2.7 times higher among physicians compared to drivers which indicated a gap between knowledge of SP and its practical application among physicians²².

Yakob et al have implemented a cross-sectional study among nurses working at Mizan-Aman general hospital, Ethiopia to explore knowledge, attitude and practice towards infection control measures among them. The results revealed that 42.2% of nurses thought that they apply standard precaution always. Almost two-third (65.6%) of them had ever participated in training program in infection control. All of the respondents know that dirty needle and sharp materials could transmit disease causing agents. Most of the respondents (76.3%) thought that they were at risk of acquiring HIV in their work place. Among participants, 43.7% disposed sharp materials in open pails, 67.4% in sharp and liquid proof

container without removing syringe. Approaching three-quarters of the nurses (70.4%) knew that gloves and gowns were required for any contact with patients. Standard blood and body fluid precautions were always practiced by 46.8% of the respondents and 76.5% of nurses wear gloves last time while they took blood sample. Almost two-thirds of them (68.7%) wash their hands before examining the patients and 62.5% recapped needle immediately after using them²³.

SUBJECTS AND METHODS:

Study design:

A cross sectional study

Study area/settings

This study was conducted in Taif city, which located in the western region of Saudi Arabia in Makkah Province. It has an estimated population of 1,281,613 (2011 census).²⁴

In Taif, there are 19 primary health care centers belonging to Ministry of health where the study was conducted.

Study population:

All male nurses currently working at MOH PHC centers in Taif city (n=115) constituted the target population for the study.

-Inclusion criteria

- Nurses currently working in primary health care centers, MOH, Taif
- Males
- All nationalities
- All ages

-Exclusion criteria

- Those who were on vacation, otherwise no specific exclusion criteria

Sample size:

The sample size included all male nurses, who were available at time of the study conduction (expected number is 115).

Data collection tool:

A self-administered questionnaire was utilized for data collection. It consisted of four main sections:

•Socio-demographic characteristics: age, nationality, profession, highest qualification and experience in PHC practice.

• Knowledge about different aspects of infection control composed of 38 questions of three options (true, false and I do not know). This part of the questionnaire was utilized in another Saudi study carried out among medical students.²⁵ The questionnaire included inquires about the different domains of infection control namely the general concepts of infection control and SPs (4 questions), hand hygiene (9 questions), personal protective equipment (PPE) (9 questions), sharps disposal and injuries (7 questions) and care of health care providers to avoid health care-related infections (9 questions), with a total of 38 items. Very limited modification was done by omitting three open ended questions. The new questionnaire was validated by three consultants in family medicine, community medicine and infectious diseases. Correct answers were assigned a score of one while wrong /do not know answers were assigned a score of 0. Total knowledge score was computed and utilized for comparison.

•Attitude was assessed in 7 statements regarding infection control and standard precautions using a likert scale ranged between strongly agree to strongly disagree. It was adopted from a two studies carried out by Humphreys and Richards (2011)²⁶ and Amin el al²⁵ and was validated by the same three consultants.

• Perceived obstacles to adequate application of standard precautions and infection control were identified on a 5-likert scale ranged between “very weak importances” to “very strong importance”.

Permission to utilize the questionnaire was asked from authors of the Saudi study.

Data entry and analysis:

• All collected data were coded before its entry to a personal computer.

• Data entry and analysis was done by using the Statistical Package of the Social Sciences (SPSS) statistical program version 22.

• Score system for knowledge was created to facilitate comparisons where a score of 1 was given to each right answer whereas a score of 0 was given to wrong or missing answers. The percentage of the total score was computed and utilized for comparisons.

• Score system for attitude s was computed in the way that the positive the attitude, the higher the score. Then, median value was computed for the total score. Those scored below the median value were considered having “negative attitude” whereas those

scored at or above the median value were considered having "positive attitude".

- The percentage of total knowledge score was abnormally distributed, p-value of K-S test was 0.003. Therefore, non-parametric statistical tests were applied; Mann-Whitney to compare two groups and Kruskal-Wallis test to compare more than two groups.

- Chi-square test was applied to investigate factors associated with attitude score. Fisher's Exact test was applied in case of small expected frequency (i.e. one or more of cells has <5).

- P-value of less than 0.05 was considered as a level for significance throughout the study.

Pilot Study:

Pilot study was conducted in two primary health care centers aimed to test the questionnaire applicability and understanding before starting the actual research. Questionnaire and methodology were tested and no modifications were needed. The data from pilot study were included in the main study since there was no difference between them.

Ethical consideration:

- Written permission from Joint Program of Family Medicine, Ministry of Health in Taif Region to start the study was obtained
- Approval by the local ethics and Research Committee was obtained before conducting the study.
- Written permission from the higher authorities in Taif city Ministry of Health was requested

Table 1: Personal characteristics of male nurses, primary health care centers, Ministry of health, Taif city (n=109)

	Number	Percentage
Age in years		
≤30	44	40.3
31-40	49	45.0
>40	16	14.7
Range	24-55	
mean±SD	34.2±6.6	
Nationality		
Saudi	109	100
Non-Saudi	0	0.0
Profession		
Registered nurse	109	100
Head nurse	0	0.0
Highest qualification		
Diploma	89	81.7
Bachelor	20	18.3
Experience in years		
≤5	37	33.9
6-10	29	26.6
>10	43	39.4

- Permission to use the questionnaire was requested through an e-mail communication with the corresponding author of the research.
- Written consents were taken at the beginning of the study from all participants.
- All information was kept confidential and will not be accessed except for the purpose of the scientific research.
- Ethical considerations were taken through all the researcher steps.

Budget:

Self-funded.

RESULTS:

Personal characteristics:

One hundred and nine male nurses participated in the study out of a total of 115 invited with a response rate of 94.8%. The personal characteristics of the participants are presented in Table 1. Their age ranged from 24 to 55 years with a mean of 34.2 and SD of 6.6 years. The age of 45% of them ranged between 31 and 40 years while the age of 40.3% was 30 years or less. All are Saudis and registered nurses. Diploma was the highest qualification of majority of them (81.7%). About one-third of them (33.9%) had an experience of 5 years or less whereas the experience of 39.4% exceeded 10 years.

Figure 1 shows that approximately half of them (50.5%) had attended any training program in infection control or standard precautions.

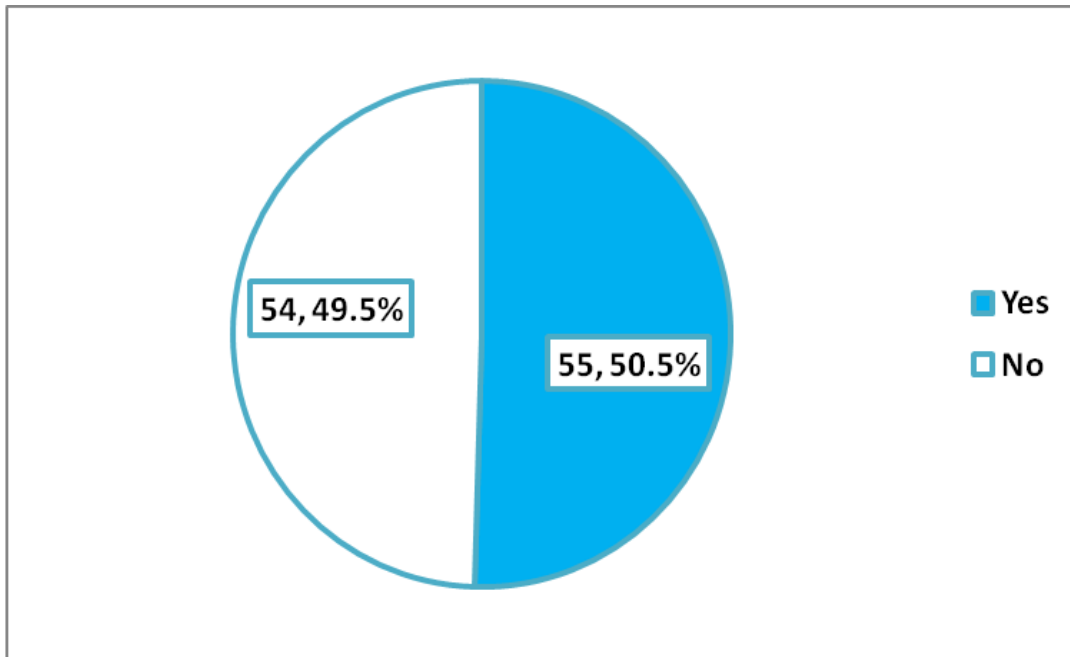


Figure 1: History of attending any training program in infection control or standard precautions among male nurses, primary health care centers, Ministry of health, Taif city

Knowledge about infection control

-General concepts of infection control and standard precautions

Majority of the male nurse could recognize correctly that standard precautions should be practiced on all patients and laboratory specimens irrespective of diagnosis (95.4%) and all health providers are at risk of occupational infections (94.5%). About two-thirds of them (67.9%) knew correctly that all patients are sources of infection regardless their diagnoses whereas only 37.6% knew that all body fluids except sweat should be viewed as sources of infection. Table 2.

Table 2: Knowledge of general concepts of infection control and standard precautions among male nurses, primary healthcare, Ministry of Health, Taif city

Statement	Right answer	
	No.	%
All patients are sources of infection regardless their diagnoses. (True)	74	67.9
All body fluids except sweat should be viewed as sources of infection. (True)	41	37.6
All health providers are at risk of occupational infections. (True)	103	94.5
Standard precautions should be practiced on all patients and laboratory specimens irrespective of diagnosis. (True)	104	95.4

-Hand hygiene

Table 3 shows that majority of the participants knew correctly that hand washing reduces the incidence of healthcare-related infections (94.5%), hand washing is indicated after removal of gloves (88.1%), hand washing minimizes microorganisms acquired on the hands if soiled (86.2%) and standard hand washing includes washing of both hands and wrists (82.6%). On the other hand, only 57.8% knew that hand washing is indicated between tasks and procedures on the same patient and 59.6% knew that alcohol hand rub doesn't substitute hand washing even if the hands are soiled.

Table 3: Knowledge of hand hygiene among male nurses, primary healthcare, Ministry of Health, Taif city

Statement	Right answer	
	No.	%
Hand washing minimizes microorganisms acquired on the hands if soiled. (True)	94	86.2
Hand washing reduces the incidence of healthcare-related infections. (True)	103	94.5
Standard hand washing includes washing of both hands and wrists. (True)	90	82.6
Hand decontamination: includes washing the hand with antiseptic soap for 30 seconds. (True)	74	67.9
Alcohol hand rub substitutes hand washing even if the hands are soiled. (False)	65	59.6
Hand washing is indicated between tasks and procedures on the same patient (True)	63	57.8
Use of gloves replaces the need for hand washing. (False)	68	62.4
Hand washing is indicated after removal of gloves. (True)	96	88.1
Hand washing is needed with patients with respiratory infections. (True)	77	70.6

-Personal protective equipment's

It is realized from table 4 that majority of male nurses could recognize that PPE such as masks and head caps provides protective barriers against infection (85.3%) and most of them knew that masks and gloves cannot be re-used if dealing with same patient (74.3%), gloves should be changed between different procedures on the same patient (72.5%) and PPE should not be used only whenever there is contact with blood (71.6%) while only 30.3% of them knew that used PPE are not be discarded through regular municipal disposal systems and 38.5% of them could recognize that PPE is not exclusively suitable to laboratory and cleaning staff for their protection.

Table 4: Knowledge of personal protective equipments among male nurses, primary healthcare, Ministry of Health, Taif city

Statement	Right answer	
	No.	%
PPE such as masks and head caps provides protective barriers against infection. (True)	93	85.3
Use of PPE eliminates risk of acquiring occupational infections. (True)	66	60.6
PPE is exclusively suitable to laboratory and cleaning staff for their protection. (False)	42	38.5
PPE should be used only whenever there is contact with blood. (False)	78	71.6
Gloves and masks can be re-used after proper cleaning. (False)	73	67.0
Used PPE are to be discarded through regular municipal disposal systems. (False)	33	30.3
Gloves should be changed between different procedures on the same patient. (True)	79	72.5
Masks made of cotton or gauze are most protective. (False)	51	46.8
Masks and gloves can be re-used if dealing with same patient. (False)	81	74.3

-Sharp disposal and sharp injuries

Most of the participants knew that sharps injuries should be managed with need of reporting (72.5%) and 61.5% knew that sharps container is not labeled with blue. More than half of them (56%) knew that used needles should not be bent after use to prevent injuries. Only 26.6% of them knew that soiled sharps objects should be shredded before final disposal and 40.4% knew that needle-stick injuries are not the least commonly encountered in general practice.

Table 5: Knowledge of sharp disposal and sharp injuries among male nurses, primary healthcare, Ministry of Health, Taif city

Statement	Right answer	
	No.	%
Used needles should be recapped after use to prevent injuries. (False)	53	48.6
Used needles should be bent after use to prevent injuries. (False)	61	56.0
Sharps container is labeled with blue. (False)	67	61.5
Soiled sharps objects should be shredded before final disposal. (True)	29	26.6
Sharps injuries should be managed with no need of reporting. (False)	79	72.5
Needle-stick injuries are the least commonly encountered in general practice. (False)	44	40.4
Post-exposure prophylaxis is used for managing injuries from an HIV-infected patient. (True)	50	45.9

Care of healthcare providers

Majority of the participants knew that for the prevention of hepatitis B, immunizations are recommended for all healthcare workers (91.7%), healthcare providers should receive annual influenza vaccine (89.9%) and immunization history of health care providers should be obtained before recruitment (85.3%). On the other hand, only 28.4% of them could recognize that routine immunizations for healthcare providers don't include HIV, rubella and rabies and 24.8% knew that healthcare providers should be tested annually by tuberculin skin test.

Table 6: Knowledge of care of healthcare providers among male nurses, primary healthcare, Ministry of Health, Taif city

Statement	Right answer	
	No.	%
Immunization history of health care providers should be obtained before recruitment. (True)	93	85.3
Routine immunizations for healthcare providers include HIV, rubella and rabies. (False)	31	28.4
Healthcare providers should receive annual influenza vaccine. (True)	98	89.9
Healthcare providers should be tested annually by tuberculin skin test. (True)	27	24.8
The risk for a health provider to acquire HIV infection after needle-stick injury is low. (False)	50	45.9
Post exposure immunization prevents the risk of hepatitis B infection following exposure. (True)	43	39.4
For the prevention of hepatitis B, immunizations are recommended for all healthcare workers. (True)	100	91.7
Following exposure to a patient with flu, antibiotics are required for prevention of infection. (False)	69	63.3
Health providers with highest risk of exposure to tuberculosis include radiologists. (True)	61	56.0

Overall, The highest level of knowledge was observed regarding hand hygiene (74.4%), followed by general concepts of infection control and standard precautions (73.9%) while the lowest level was observed regarding sharp disposal and sharp injuries (50.2%). Figure 2

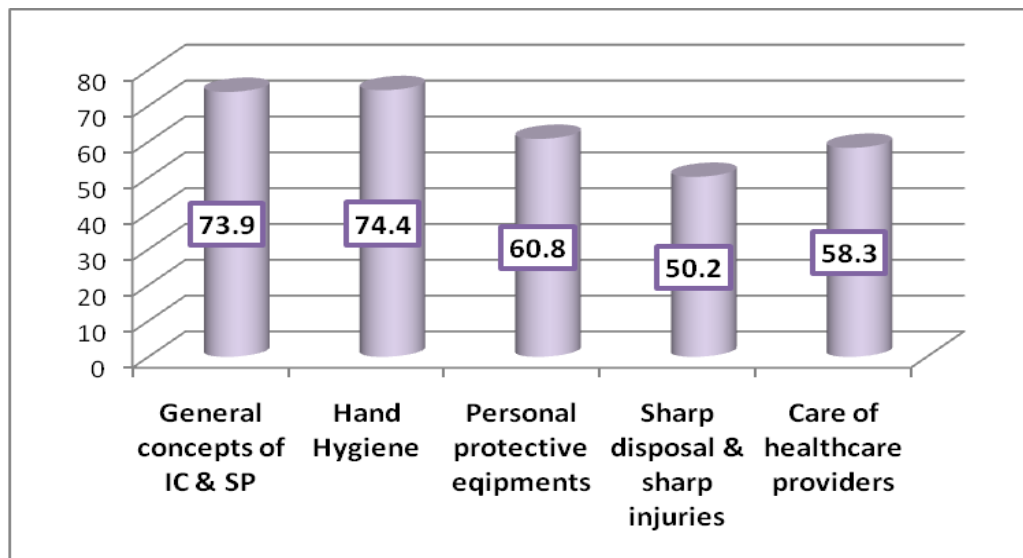


Figure 2: Level of knowledge of male nurses regarding different aspects of infection control

The percentage of the total knowledge score ranged between 31.58 and 81.58 with a mean of 62.84 and SD of (\pm) 12.26. It was abnormally distributed as evidenced by significant Kolmogorov-smirnov (K-S test), $p=0.003$.

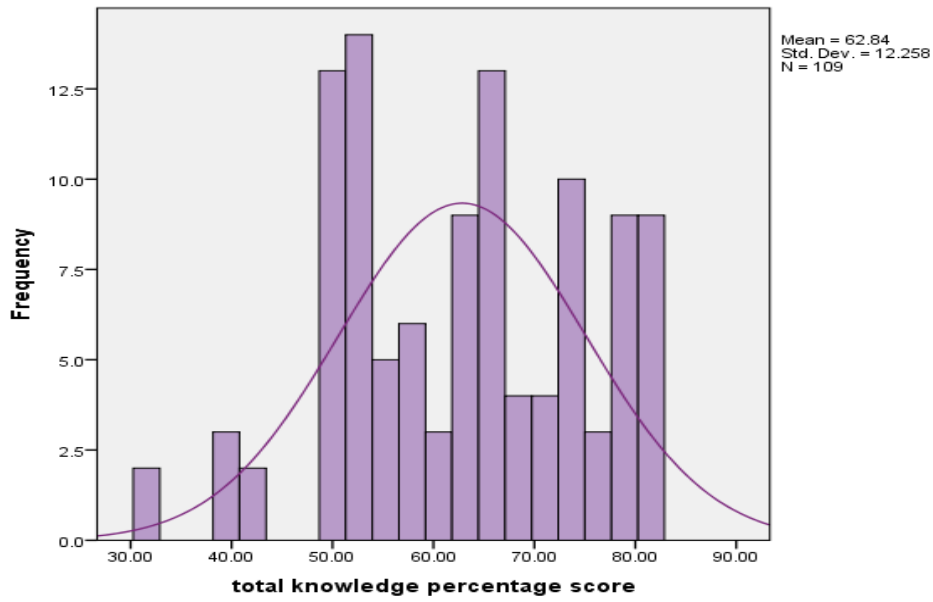


Figure 3: Distribution of the total knowledge score percentage regarding infection control among male nurses, Ministry of Health primary healthcare centers, Taif city.

Factors associated with knowledge about infection control

It is demonstrated from table 7 that among studied factors, the only significant one was the highest qualification of male nurses as the mean rank of the percentage of knowledge score was significantly higher among nurses who had Bachelor degree compared to those who had Diploma (68.48 versus 51.97), $p=0.034$. Other factors (age, experience and attending training programs in infection control) were not significantly associated with the percentage of the knowledge score.

Table 7: Factors associated with knowledge of male nurses about infection control, Ministry of Health primary healthcare centers, Taif.

	Percentage of overall knowledge regarding infection control			p-value
	Median	IQR	Mean rank	
Age in years				
≤30 (n=44)	64.47	50.0-73.68	55.27	0.460*
31-40 (n=49)	63.16	52.63-73.68	57.59	
>40 (n=16)	57.89	39.47-73.68	46.31	
Highest qualification				
Diploma (n=89)	60.53	52.63-73.68	51.97	0.034**
Bachelor (n=20)	65.79	65.79-73.68	68.48	
Experience in years				
≤5 (n=37)	65.79	51.32-73.68	55.61	0.763*
6-10 (n=29)	63.16	53.95-65.79	51.43	
>10 (n=43)	65.79	52.63-73.68	56.88	
Attending any training program in infection control or standard precautions				
Yes (n=55)	63.16	52.63-73.68	56.74	0.561**
No (n=54)	63.16	50.0-71.71	53.23	

IQR: Inter-quartile range

* Kruskal-Wallis test

** Mann-Whitney test

Attitude towards infection control

Table 8 summarizes the response of male nurses to statements/questions concerning attitude towards infection control. Majority of them strongly agreed or agreed that standard precautions will prevent from acquiring infection from the health care facility (96.4%), glove use for all patient care contacts is a useful strategy for reducing risk of transmission of organisms (83.4%), the risk of occupational infection among health workers in work place is high (81.7%), and in the absence of standard precaution, health care facilities can be the source of infection and epidemic diseases (79%). On the other hand, 67.9% of them strongly disagreed or disagreed that there was no need to wash or decontaminate hands after touching patients' surroundings.

Overall, 70.6% of the male nurses had positive attitude towards infection control and standard precautions as seen in figure 4.

Table 8: Attitude of male nurses, Taif primary health care centers towards infection control precautions

	Strongly agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)
Standard precautions will prevent from acquiring infection from the health care facility.	78 (71.6)	27 (24.8)	2 (1.8)	0 (0.0)	2 (1.8)
There was no need to wash or decontaminate hands after touching patients' surroundings.	20 (18.3)	6 (5.5)	9 (8.3)	17 (15.6)	57 (52.3)
Sharps should never be recapped	59 (54.1)	17 (15.6)	2 (1.8)	5 (4.6)	26 (23.9)
Sharp needles can be bent or broken after use.	17 (15.6)	20 (18.3)	17 (15.6)	15 (13.8)	40 (36.7)
Glove use for all patient care contacts is a useful strategy for reducing risk of transmission of organisms?	67 (61.4)	24 (22.0)	5 (4.6)	4 (3.7)	9 (8.3)
In the absence of standard precaution health care facilities can be the source of infection and epidemic diseases?	58 (53.3)	28 (25.7)	7 (6.4)	2 (1.8)	14 (12.8)
The risk of occupational infection among health workers in work place is high	58 (53.3)	31 (28.4)	18 (16.5)	2 (1.8)	0 (0.0)

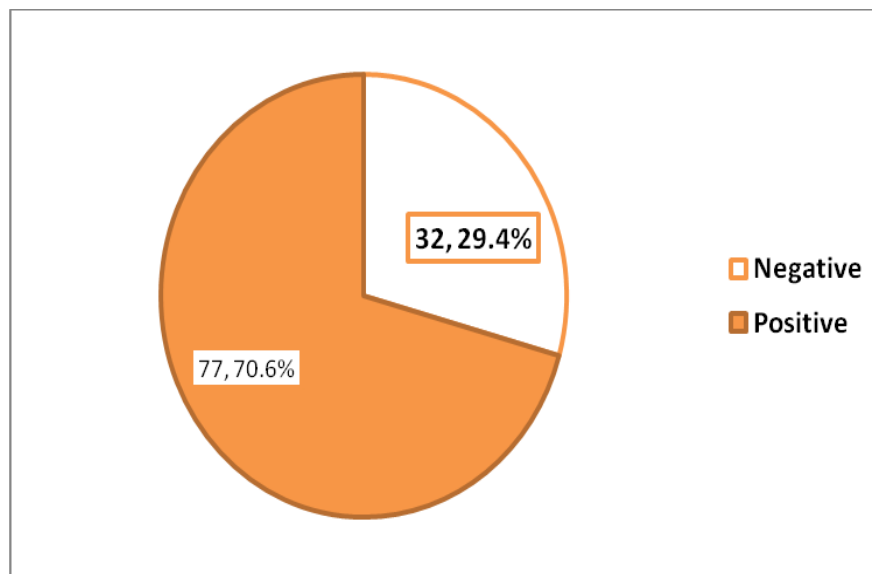


Figure 4: Attitude of the male nurses, Ministry of Health primary healthcare centers, Taif city towards infection control precautions

Factors associated with attitude towards infection control

It is clear from table 9 that none of the studied viable of male nurses (age, high qualification, experience and attending training programs in infection control) was significantly associated with the attitude towards infection control although younger (≤ 30 years), Bachelor holders, those with experience ranged between 6 and 10 years expressed more positive attitude towards infection control.

Table 9: Factors associated with attitude towards infection control among male nurses, Ministry of Health primary healthcare centers, Taif.

	Attitude towards infection control precautions		χ^2*	p-value
	Negative N=32 N (%)	Positive N=77 N (%)		
Age in years				
≤ 30 (n=44)	8 (18.2)	36 (81.8)	4.77	0.092
31-40 (n=49)	19 (38.8)	30 (61.2)		
>40 (n=16)	5 (31.3)	11 (68.8)		
Highest qualification				
Diploma (n=89)	29 (32.6)	60 (67.4)	0.095**	
Bachelor (n=20)	3 (15.0)	17 (85.0)		
Experience in years				
≤ 5 (n=37)	12 (32.4)	25 (67.6)	4.83	0.089
6-10 (n=29)	4 (13.8)	25 (86.2)		
>10 (n=43)	16 (37.2)	27 (62.8)		
Attending any training program in infection control or standard precautions				
Yes (n=55)	18 (32.7)	37 (67.3)	0.61	0.436
No (n=54)	14 (25.9)	40 (74.1)		

* Chi-square value

** Fisher`s Exact test

Obstacles that influence infection prevention: Nurses` perspectives

Regarding obstacles for application of infection control and standard precautions at primary health care centers, lack of awareness about standard precautions in health care settings is ranked first with a weighted mean of 3.96 ± 1.49 on a scale ranged between 1 and 5. Overcrowded work place and lack of guideline on standard precaution in the health facility are ranked second and third with weighted means of 3.79 ± 1.45 and 3.78 ± 1.46 , respectively.

Table 10: Obstacles that influence infection prevention from the male nurses` perspectives

	Very weak Importance	Weak importance	Medium importance	Strong importance	Very Strong importance	WtM \pm SD	Rank
	N (%)	N (%)	N (%)	N (%)	N (%)		
Overcrowded work place	14 (12.8)	8 (7.3)	19 (17.4)	14 (12.8)	54 (49.5)	3.79 ± 1.45	2
Lack of health care workers and work load	12 (11.0)	7 (6.4)	34 (31.2)	26 (23.9)	30 (27.5)	3.50 ± 1.27	5
Lack of personal protection equipment	16 (14.7)	13 (11.9)	14 (12.8)	28 (25.7)	38 (34.9)	3.54 ± 1.44	4

Lack of commitment on the part of health facility to invest in infection control programs	32 (29.4)	15 (13.8)	15 (13.8)	21 (19.3)	26 (23.9)	2.95±1.57	7
Lack of guideline on standard precaution in the health facility	13 (11.9)	16 (14.7)	3 (2.8)	27 (24.8)	50 (45.9)	3.78±1.46	3
Lack of awareness about standard precautions in health care settings	17 (15.6)	13 (11.9)	1 (0.9)	34 (31.2)	44 (40.4)	3.96±1.49	1
Inadequate hand washing facility	34 (31.2)	10 (9.2)	20 (18.3)	13 (11.9)	32 (29.4)	2.99±1.63	6

WtM: Weighted mean

SD: Standard deviation

DISCUSSION:

It is mandatory for nurses to comply with infection control and standard precautions policy and maintain patient safety, as they are present twenty-four hours a day, seven days a week in the healthcare setting²⁷. Many nursing interventions require close contact or touching the patient as well as being frequently come in contact with contaminated articles¹⁹.

It has been documented by Shinde and Mohite that nurses had moderate knowledge of infection control, particularly hand hygiene and almost half of them had good attitudes while majority had poor practices²⁸. Therefore, this study was carried out to investigate knowledge, and attitude of male nurses working in Taif primary health care centers regarding infection control measures as well as to identify possible obstacles that influence application of infection control procedures at primary healthcare centers.

In the present study, the percentage of the total knowledge score ranged between 31.58 and 81.58 with a mean of 62.84 and SD of (\pm) 12.26. The highest level of knowledge was observed regarding hand hygiene (74.4%), followed by general concepts of infection control and standard precautions (73.9%) while the lowest level was observed regarding sharp disposal and sharp injuries (50.2%). In a similar study carried out among medical students at their clinical stage, in Saudi Arabia,²⁵ the total score for knowledge was 19.3±9.1 (out of 41 points) with 26.7% with acceptable level. The students' knowledge score was highest regarding hand

hygiene, and care of the health care providers, while lowest regarding sharp management and injuries and personal protective equipments. In another Saudi study compared the differences in knowledge regarding infection control and hand hygiene between male and female nursing students and concluded that both had moderate knowledge¹⁹. In a study carried out by Tavalacci et al. (2008) among healthcare students in France, the highest knowledge scores were observed regarding standard precautions and hand hygiene, and the lowest score was for knowledge of nosocomial infection.²⁹ In Nigeria, knowledge of standard precautions measures was high for nurses (92%)²⁰. In another Nigerian study, majority of the healthcare workers, including nurses (93.2%) had ever heard of standard precautions. Of them, 5.7% had poor knowledge, 44.0% had fair knowledge, and 50.3% good knowledge regarding SP¹³. Ogoina et al reported an overall median knowledge and attitude scores toward SPs as above 90% among nurses in Nigeria, but median practice score was 50.8%. The majority of them had poor knowledge of injection safety. Junior nurses had lower knowledge and compliance with SPs than more experienced nurses²¹.

Fortunately, in the present study, the highest level of knowledge was concerned with hand hygiene as it has been documented by Tavalacci that hand hygiene is the most effective measure for interrupting the transmission of microorganisms responsible for nosocomial infection. In the present survey, 67.9% of male nurses could recognized correctly the standard

duration of hand washing compared to 39% in another Saudi study carried out among medical students²⁵.

In the current study, 67.9% of nurses could recognize that patients irrespective of their diagnoses are sources of infection, compared to 41.8% reported by Amin et al among medical students.²⁵ Lower findings were reported by Amin and Al Wehedyt (2009) among primary care providers in Al Hassa, Saudi Arabia.³⁰ However, deficiency of knowledge regarding some issue has been reported as only one-quarter of them knew that healthcare providers should be tested annually by tuberculin skin test, slightly more than one-third of them could recognize that post exposure immunization prevents the risk of hepatitis B infection following exposure and approximately half of nurses knew that the risk for a health provider to acquire HIV infection after needle-stick injury is not low. In A study carried out in Ethiopia, most of the nurses (76.3%) thought that they were at risk of acquiring HIV in their work place.²³

In the present study, higher qualified nurses were more knowledgeable regarding infection control compared to Diploma holder nurses. The positive role of education on the knowledge of infection control has been also documented by others^{31,32}.

This study revealed that almost half of male nurses have attended training programs in infection control. Higher figure (65.6%) has been reported among nurses in Ethiopia.²³ In accordance with others,²⁵ attending any training program in infection control or standard precaution was not significantly associated with both knowledge of and attitude towards infection control. This finding could reflect the nature and elements of these training programs; being mostly non-specific, lack practical training and limited in time. On the other hand, it has been documented that specific training of standard precautions can quickly enhance knowledge of infection control in a short time³³.

In a study carried out among nursing students of both genders, female students had more positive attitude towards hand hygiene while, male students had better practice.¹⁹ In the present study, we investigated only male nurses and positive attitude towards infection control and standard precautions was observed among 70.6% of them.

Regarding obstacles for application of infection control and standard precautions at primary health care centers, lack of awareness about standard precautions in health care settings is ranked first,

followed by overcrowded work place and lack of guideline on standard precaution in the health facility. In Brazi, Padoveze and de Figueiredo (2014) documented that among challenges faced by health services related to primary healthcare's direct role in healthcare –associated infection control are the facts that all health professionals did not receive training in infection control and did not take the necessary precautions to prevent infections as well as lack of effective communication of patients with health professionals to facilitate patient engagement in infection control³⁴.

Study Limitations

The study design is cross-sectional which carries some inherent disadvantages. In addition, the study included only male nurses. Practice of nurses was not evaluated as it was impossible in this study. Finally, all of knowledge items of the questionnaire had the options of true/false which may provide the opportunity for guessing. Despite those limitations, the study provided important information which could have an impact on decision makers concerning the training of nurses in infection control.

CONCLUSION:

The overall knowledge level for infection control among male nurses working at primary health care centers, Taif city was above average. The highest level of knowledge was observed regarding hand hygiene, followed by general concepts of infection control and standard precautions while the lowest level was observed regarding sharp disposal and sharp injuries. Higher educated nurses were more knowledgeable regarding infection control than their lower educated peers. Most of the male nurses had positive attitude towards infection control and standard precautions. Lack of awareness about standard precautions in health care settings ranked first as an obstacle for application of infection control and standard precautions at primary health care centers, while overcrowded work place and lack of guideline on standard precaution in the health facility ranked second and third.

RECOMMENDATIONS:

Based on results of this study, the following are recommended:

1. Organizing regular educational programs for nurses working at primary healthcare centers are needed to increase their knowledge in infection control generally and in particular in the area of sharp disposal and sharp injuries
2. Further studies are recommended to include also female nurses beside males.

3. Evaluation of the practice of nurses in infection control is very important as assessment of knowledge and attitude alone is not enough.
4. Addressing the obstacles raised by the participants concerning the application of infection control precautions at PHC centers and discussing them with decision makers.

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