Perception of Knowledge, Attitude, and Behavior of Hand Hygiene among Nurses in the Emergency Department at King Abdul-Aziz Hospital in Makkah Al Mukaramah

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Abstract: Background*:* Hand washing is the single most important preventive measure for reducing nosocomial infections, however, nurses frequently do not wash their hands in emergency departments. ***Aim:*** This study was carried out to assess nurses' knowledge, attitude and behavior regarding hand washing between patient contact in the emergency department of the above hospital. ***Subjects and Methods:*** A cross-sectional observational study was conducted including a convenience sample of 60 staff nurses in the emergency department at King Abdul-Aziz Hospital in Makkah Al-Mukaramah. Data were collected through a predesigned questionnaire to assess nurses' knowledge, attitude and behavior regarding hand washing. ***Results:*** The results of the present study revealed that more than half of the subjects have a satisfactory knowledge and positive attitude towards hand hygiene. There is a statistically significant relationship between the nurses' gender and their knowledge, and there is also a statistically significant relationship between the nurses' formal training in hand hygiene in the last three years and their knowledge, attitude, and behavior. ***Conclusion and recommendations*:** The nurses' knowledge, attitude, and behavior towards hand hygiene in the emergency department (ED) need to be improved by the educational and program approach. Based on the findings of the study, the researchers recommend providing written guidelines about hand hygiene for all healthcare providers and introducing and demonstrating hand hygiene protocols to all caregivers.
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1. Introduction

Infection associated with health care affects hundreds of millions of patients worldwide, contributing to death or incapacity as well as generating additional costs to those of the disease which initially required patient care. The most common cause of healthcare-associated infections is person-to-person transmission of nosocomial pathogens via the hands of healthcare personnel. Nursing practices, such as direct touching, contact with bodily fluids, and wound care, can result in high levels of microorganism contamination [1-3].

Lijima and Ohzeki (2006)[4] have determined that the number of microorganisms found on the hands of nurses increased significantly after they had performed care procedures. The microorganisms that colonize the external layer of the skin are temporarily eradicated when hands are washed with antiseptic and antimicrobial agents [5]. The number of bacteria was reduced considerably after hands had been washed with soap and alcohol-based agents [6].

Hospital-acquired infections affect 5% to 10% of all hospitalized patients and are the most common cause of preventable morbidity and mortality facing healthcare today. It is estimated that 30% of hospital-acquired infections are avoidable with healthcare provider adherence to hand hygiene (HH) guidelines, thus preventing patient-to-patient and healthcare worker-to-patient transmission of microorganisms that cause most nosocomial infections. In a seminal observational study by Semmelweis[7] over 150 years ago, maternal mortality because of puerperal fever was reduced from 22% to 2% as a result of hand washing between performing necropsies and newborn deliveries.

For almost 150 years, healthcare workers have been taught that cross-infections are transmissible but not contagious and that the most effective way to prevent these cross-infections is hand washing before and after every patient contact. As one physician investigator observed: "but they don't do it. They don't merely not do it every time, they don't do it most of the time and sometimes not even when it might be most expected, as when caring for an intensive care unit (ICU) or emergency room patient" [8].

Hand Hygiene (HH) was defined as hand washing with soap and water with a minimum of 15 seconds scrubbing before rinsing or use of antiseptic gel applied to and rubbed into all hand surfaces until dry. The definitions of hand hygiene opportunities, invasive procedures, and patient contact used for the study are consistent with the guidelines set by the Centers for Disease Control and Prevention CDC and the Association for Professionals in Infection Control

and Epidemiology. Any HH opportunity that did not completely adhere to these definitions was considered a failed attempt[1].

Hand hygiene is the simplest, most effective measure for preventing nosocomial (hospital-associated) infections, yet studies indicate that, on average, healthcare workers follow recommended hand hygiene procedures on less than half the number of occasions[9]. The term 'hand hygiene' includes two primary actions: (1) washing the hands with soap and water to decrease colonization of transient flora by removing dirt, soil, and loose flora and (2) rubbing hands with a small amount of highly effective, fast-acting antiseptic agent, termed a 'hygienic hand rub' [10].

Studies [11, 12] indicate that poor hand washing habits of nurses can be attributed to many reasons, which include the complicated structure of emergency departments, the characteristics of the patients in emergency departments, the heavy workload in such units, and an insufficient number of nurses.

Factors identified as having positive influences on hand washing adherence are knowledge that hand washing prevents nosocomial infections, personal commitment to hand washing, easy access to hand-rub solution, and knowledge of being part of a study. Behavioral change has undergone extensive investigation, resulting in various ideas of what influences change. Unfortunately, hand washing adherence in daily work routines has not improved with the implementation of these theories. The use of role models or mentors to influence behavior has been suggested in the past. Role models in nursing education influence the knowledge, skills, and values that are brought to the bedside, and have a significant influence on the career choices made by graduating nursing students. The impact of role modeling by senior physicians and nurses on the HH behavior of their junior colleagues has not received much scholarly attention. It has been suggested that the effect of the role model is highly significant, but most potent in negatively influencing hand hygiene behavior. In a large cross-sectional survey, the belief of being a role model for other colleagues positively influenced the behavior of the nurses involved [13].

Other studies recommended washing the hands for 1-2 minutes to be effective. However, not only is good hand washing technique vital, but what is also needed is a hygienic way of drying hands. It is pointless taking time to wash properly if it involves the same towel that everyone else has been using. Habif (2009) [14] suggested that paper towels operate effectively by two mechanisms. First, they rub away transient organisms and old dead skin loosely attached to the surface of the hands. Second, they remove bacteria from deeper layer of skin brought to the surface by friction plus the warmth and moisture generated through washing.

Theoretically, the choice of hand washing agent depends on the type of clinical procedure performed and the degree of contamination likely to result, but really in most cases there is no alternative to soap. Even when skin disinfectants are available they may be avoided because they are perceived to be damaging to skin when used frequently [15].

Barclay(2010) [16] indicates that large areas of the hand surfaces were missed by nurses asked to wash hands in their usual manner. For improving hand washing in clinical settings, implementation of an effective hand disinfectant system should beconsidered. However, factors that contributes to poor compliance in hand washing practices for prevention of nosocomial infections has received little attention.

Education is the cornerstone of improved hand hygiene practices. Healthcare workers need scientific information about hand hygiene, healthcare-associated infections, and resistant organism transmission rates. They need to know how to cleanse their hands and use appropriate and efficacious antiseptic and protective agents [17]. Written guidelines should be available to everyone, including visitors. New employees should receive these guidelines during their initial orientation. Then, all caregivers should be observed and given feedback about how consistently they are adhering to established hand hygiene protocols[18].

In order to improve hand washing in clinical settings, implementation of an effective hand disinfectant system should be considered. However, factors that contribute to poor compliance in hand washing practices for prevention of nosocomial infections have received little attention [19]. To be able to develop successful interventions for the improvement of hand hygiene, it is essential to identify the factors influencing hand hygiene behavior, and to investigate which interventions best target these factors [20].

Significance of the study:

Hand washing is the single most important technique in the prevention and control of nosocomial infections. The safest way for health care workers to protect themselves and their patients is through careful hand washing. At a time when costs for patient care are increasing and hospitals are threatened by bacterial resistance, prevention of nosocomial infections is a critically important issue.

Aim of the study

This study was carried out to assess nurses' knowledge, attitude and behavior regarding hand washing between patient contacts in the emergency department.

Hypotheses

Nurse employees in the critically important setting of an emergency department have a satisfactory knowledge and a positive attitude and behavior towards hand hygiene.

Subjects & Methods

Research design:

A descriptive and quantitative approach was used for this study.

Subjects:

A convenience sample consisting of 60 staff nurses (32 female & 28 male) employed in the emergency department of King Abdul-Aziz hospital in Makkah Al-Mukaramah were selected as participants in this study.

Setting:

The study was conducted in the emergency department (both male ED and female ED) at King Abdul-Aziz hospital in Makkah Al-Mukaramah.

Tools of the study:

The data was collected using the Perception of Hand Hygiene among Nurses in Emergency Department questionnaire. This is an existing questionnaire obtained from the World Health Organisation (WHO guidelines on hand hygiene in health care 2009)[(1)] to assess nurses' knowledge, attitude, and behavior about hand washing in the ED. The questionnaire consisted of four parts:

- The first part is concerned with the demographic characteristics of nurses (age, gender, years of experience, qualification degree and nursing shifts).
- The second part is comprised of 11 questions for assessing nurses' existing knowledge regarding hand- washing (technique and duration).
- The third part is concerned with nurses' attitudes regarding hand- washing (importance, preferred method).
- The last part is concerned with nurses' self-reported behavior regarding hand- washing.

Score of calculating nurses' knowledge:

The nurses achieving 60% are judged to have satisfactory knowledge, while those who score less than 60% are assessed as having unsatisfactory knowledge.

2. Methods:

1. An official letter was directed from the Dean of the Faculty of Nursing to the Director of King Abdul-Aziz Hospital.
2. Administrative permission to conduct the study was obtained from the Director of King Abdul-Aziz Hospital and the head nurse of the emergency department after explanation of the aims of the study.
3. The tools of data collection were developed after reviewing the literature.
4. The developed tools were reviewed by consultant specialists for content validity, clarity, feasibility, and applicability of the tools.
5. Written consent was obtained from nurses in the emergency department who participated in the study after explanation of the aims and nature of the study.
6. A pilot study was conducted on 10% of the study subjects (6 nurses) to test the clarity and applicability of the selected tools, and the necessary modifications were implemented as a result. The nurses selected for the pilot study were included as subjects of the study.

The data was collected over a period of 3 months (August, September and October) in 2012.

The researchers distributed the questionnaire about perception of hand hygiene among the nurses in the ED after illustration of its content. The nurse subjects were helped to understand or have the questions translated to ensure there were no obstacles to participation. Each researcher was responsible for observing two subjects in one shift. A researcher was present while the nurses filled out the questionnaire. It took each nurse an hour to complete it. Each researcher was present one day per week to collect the data.

Statistical analysis:

The collected data was organized, categorized, tabulated and statistically analyzed to evaluate the difference between the groups under study as regards the various parameters using the Statistical Package for Social Science (SPSS) program, version 16.0 for Windows Data Editor. The statistical significance and associations were assessed using the arithmetic mean ($\overline{X}$), the standard deviation (SD), and the T-test to calculate the difference between two independent variables. A significant P value was considered when $P < 0.05$, and it is not significant when $P > 0.05$.

Ethical consideration:

This study was approved by Um Al Qura University, King Abdul-Aziz hospital, and permission to conduct the research during the shift was obtained from the head nurse of the emergency department.

3. Results

The results obtained from this study are categorized as follows:

Table 1 shows the characteristics of the study sample. It included 60 nurses, 53.3% of which were females. Concerning years of experience, 51.7% had one year experience. The majority (96.7%) of subjects had the profession of nurse and 45.0% worked in the morning shift. Most of the sample (86.7%) had attended a hand hygiene training program and (88.3%) used an alcohol-based hand rub.

Table 2-a showsthat 73.3% of the nurses are aware of the definition of hand hygiene,63.3% know

how to improve hand hygiene adherence in health care facilities, 36.7% are aware of the antimicrobial activity of alcohol-based hand rubs against bacterial spores, 41.7% know that hand rubs are not indicated for visibly soiled hands, 38.3% know that hand rubs do not have to exceed 60 seconds to be effective, 43.3% know that hand hygiene is necessary even if wearing gloves, 50% know what the main route of cross-transmission of germs is, and 50% know what the main source of infection is. Regardingprevention of germ transmission to patients, the majority of nurses (91.7%) answered that transmission is prevented when hand hygiene actions are taken immediately after a risk of body fluid exposure, and 83.3% responded that transmission is prevented hand hygiene actions are immediately before a clean/aseptic procedure. Regarding the prevention of germ transmission to workers, the majority of nurses (93.3%) responded that hand hygiene actions after touching a patient prevents transmission of germs to the healthcare worker, and then immediately after a risk of body fluid exposure by 85% of respondents.

Regarding alcohol-based rubs versus hand washing with soap and water, table 2-b shows that the majority of nurses (93.3%) believe that employing hand rub ensures more rapid hand cleansing than hand washing. Regarding the time needed to kill germs, the table shows that 53.3% of the study sample responded that the minimal time needed for alcohol-based hand rub to kill most germs on the hands is 20 seconds. The table shows that 90% of the study subjects wash their hands after visible exposure to blood. Regarding avoiding colonization of hands with germs, the table shows that 96.7% of the study subjects believe that the wearing of jewelry should be avoided, as it is associated with increased likelihood of colonization of hands with harmful germs. Also, the majority of nurses (96.7%) in this study responded that the spreading of bacteria in hospitals occurs mainly via the hands of personnel.

Regarding Nurses' attitudes about hand hygiene in EDs table 3 shows that 71.7% of the study subjects responded that they wash their hands always before endotracheal suctioning, and 68.3% responded that they always wash their hands after going to the toilet, and after contact with blood or body fluids.

In addition,table 4 shows that there was agreement by the majority of nurses in the ED in relation to appropriate hand hygiene behavior in the ED.

There is a statistically significant relationship between the nurses' gender and their knowledge, attitude andbehavior as shown in table 5 (T-test =3.197, 2.312, 2.805 and P value < 0.05).

Table 6 shows that there is no statistically significant relationship between the nurses' years of experience and their knowledge, attitude, and behaviour (T-test = -0.895, 1.559 and 0.323 and P value > 0.05).

Table 7 shows that there is a statistically significant relationship between being a professional nurse and HH knowledge, but there is no statistically significant relationship between being a professional nurse and attitude and behaviour towards hand hygiene (T-test =-1.638, 0.731 and 0.371& P value > 0.05).

Table 8 shows that, there is no statistically significant relationship between the nursing shifts and their knowledge, attitude, and behavior (T-test = 0.607, -0.202 and -1.693 and P value > 0.05).

Table 9 Shows that there is a statistically significant relationship between the nurses' formal training in hand hygiene in the last three years and their knowledge, attitude, and behaviour (T-test = -2.126, 0.256 and 0.787 and P value <0.05).

Table 1: Socio-demographic characteristics of nurses in the emergency department at King Abdul-Aziz Hospital

Socio-demographic characteristics	Frequency (60)	% (100)
Gender:		
Females	32	53.3
Males	28	46.7
Years of experience:		
1 year	31	51.7
1-4 years	13	21.7
5-10 years	12	20.0
> 10 years	4	6.7
Profession:		
Nurse	58	96.7
Auxiliary nurse	2	3.3
Nursing shifts:		
Day (7am-3pm)	27	45.0
Evening (3pm-11pm)	18	30.0
Night (11pm-7am)	15	25.0
Training in hand hygiene:		
Yes	52	86.7
No	8	13.3
Use of alcohol-based hand rub:		
Yes	53	88.3
No	7	11.7

Table 2-a: Nurses' knowledge about hand hygiene in the emergency department at King Abdul-Aziz Hospital

Knowledge	Frequency (60)	% (100)	$\overline{X}$ ±SD
1. Definition of hand hygiene	44	73.3	1.27 ±0.44
2. Improving hand hygiene	38	63.3	1.28 ±0.45
3. Antimicrobial activity against bacterial spores	22	36.7	2.25 ± 1.26
4. No hand rubs for visibly soiled hands	25	41.7	2.80 ±1.01
5. Time required for applying hand rubs.	23	38.3	2.95 ±0.91
6. Necessity of hand hygiene when wearing gloves	26	43.3	3.13 ±0.81
7. Main route of cross-transmission of germs	30	50.0	1.85 ±0.73
8. Main source of infection	30	50.0	2.43 ±0.78
9. Prevention of germs transmission to patients			
a) Touching patients	48	80	1.20 ±0.40
b) Risk of body fluid exposure	55	91.7	1.23 ±0.42
c) Patient's immediate surroundings	46	76.7	1.17 ±0.37
d) Clean/aseptic procedure	50	83.3	1.17 ±0.37
10. Prevention of germs transmission to workers			
a) Touching patients	56	93.3	1.15 ±0.36
b) Risk of body fluid exposure	51	85	1.27 ±0.44
c) Clean/aseptic procedure	44	73.3	1.27 ±0.44
d) Patient's immediate surroundings	47	78.3	1.07 ±0.25

Table 2-b: Nurses' knowledge about hand hygiene in the emergency department at King Abdul-Aziz Hospital

Knowledge	Frequency (60)	% (100)	$\overline{X}$ ±SD
11. Alcohol-based rubs versus hand washing with soap and water			
a) Time for hand cleansing	56	93.3	1.28 ±0.45
b) Causing Skin dryness	43	71.7	1.37 ±0.48
c) Effectiveness against germs	38	63.3	1.28 ±0.45
d) Both are recommended to be performed	43	71.1	1.02 1.85
12. Time needed to kill germs is 20 seconds	32	53.3	1.45 ±0.53
13. Indications of hand hygiene in different situations			
a) Preparation of abdomen	43	71.7	1.75 ±0.43
b) Injections	34	56.7	1.68 ±0.56
c) Bedpan	45	75	1.25 ±0.43
d) Using examination gloves	35	58.3	1.93 ±0.31
e) Making beds	28	46.7	1.03 ±0.18
f) Blood exposure	54	90	1.18 ±0.39
14. Avoiding colonization of hands with germs			
a) Jewelry	58	96.7	1.17 ±0.37
b) Damaged skin	49	81.7	1.18 ±0.39
c) Artificial fingernails	50	83.3	1.03 ±0.18
d) Hand cream	43	71.7	1.13 ±0.34
15. a) Spreading of bacteria in hospitals occurs mainly via the hands of personnel	58	96.7	1.03 ±0.18
b) nosocomial infections are mainly caused by bacteria brought into the hospital by hospital workers	52	86.7	1.13 ±0.34
c) hand jewelry makes a good hand hygiene impossible	43	71.7	1.28 ±0.45

Table 3: Nurses' attitude towards hand hygiene in the emergency department at King Abdul-Aziz Hospital

Attitude	Frequency (60)	% (100)	$\overline{X}$ ±SD
1. After going to the toilet	41	68.3	1.03 ±0.18
2. Before caring for a wound	32	53.3	1.03 ±0.18
3. After caring for a wound	42	70	1.08 ±0.27
4. After touching potentially contaminated objects	35	58.3	4.60 ±0.74
5. After contact with blood or body fluids	41	68.3	4.15 ±1.05
6. After inserting an invasive device	36	60	4.60 ±0.69
7. Before entering an isolation room	41	63.3	4.43 ±0.75
8. After contact with a patient's sink	34	56.7	4.58 ±0.69
9. After exiting an isolation room	36	60	4.43 ±0.76
10. Before endotracheal suctioning	43	71.7	4.53 ±0.67
11. After contact with a patient's secretions	34	56.7	4.38 ±0.82
12. Before patient contact	32	53.3	4.48 ±0.70
13. After removing gloves	41	63.3	4.52 ±0.83
14. If they look or feel dirty	42	70	4.20 ±1.08

Table 4: Nurses' self-reported behavior towards hand hygiene in the emergency department at King Abdul-Aziz Hospital

Behavior	Frequency (60)	% (100)	$\overline{X}$ ±SD
1. I wash visibly soiled hands with water and soap	58	96.7	1.03 ±0.18
2. I wash or disinfect hands before and after each patient contact	58	96.7	1.03 ±0.18
3. I wash hands or rub with alcohol before performing simple surgery And caring for wounds, in patients with normal immune systems	55	91.7	1.08 ±0.27

Table 5: The relation between the nurses' gender and their knowledge, attitude, and behavior

Gender	Female*(n=32)*		Male *(n=28)*		T-test	P Value	Sig.
	No.	%	No.	%			
Knowledge	22	68.8	8	28.5	3.197	< 0.05	**(S)**
Attitude	26	81.2	6	21.4	2.312	< 0.05	**(S)**
Behavior	23	71.8	7	25.0	2.805	< 0.05	**(S)**

Table 6: The relation between the nurses' years of experience and their knowledge, attitude, and behavior

Years of experience	1 year (n=31)		1-4 Years (n=13)		5-10 years (n=12)		> 10 years (n=4)		T-test	P Value	Sig.
	No.	%	No.	%	No.	%	No.	%			
Knowledge	9	29.0	3	23.0	3	25.0	1	25.0	-0.895	> 0.05	(NS)
Attitude	7	22.5	4	30.7	3	25.0	1	25.0	1.559	> 0.05	(NS)
Behavior	6	19.3	3	23.0	2	16.6	2	50.0	0.323	> 0.05	(NS)

Table 7: The relation between the nurses as a profession and their knowledge, attitude, and behavior

Profession	Nurse (n=58)		Auxiliary nurse (n=2)		T-test	P Value	Sig.
	No.	%	No.	%			
Knowledge	32	55.1	0	0	-1.638	> 0.05	(S)
Attitude	37	63.8	1	50.0	0.731	> 0.05	(NS)
Behavior	39	67.2	1	50.0	0.371	> 0.05	(NS)

Table 8: The relation between nursing shifts and nurses' knowledge, attitude, and behavior

Nursing shifts	Day (7am-3pm) (n=27)		Afternoon (3pm-11pm) (n=18)		Night (11pm-7am) (n=15)		T-test	P Value	Sig.
	No.	%	No.	%	No.	%			
Knowledge	9	33.3	6	33.3	5	33.3	0.607	> 0.05	(NS)
Attitude	8	29.6	7	38.8	6	40.0	-0.202	>0.05	(NS)
Behavior	7	26.0	6	33.3	5	33.3	1.693	>0.05	(NS)

Table 9: The relation between the formal training in hand hygiene in the last three years and their knowledge, attitude, and behavior

Training in hand hygiene	Training in hand hygiene (n=53)		No training in hand hygiene (n=7)		T-test	P Value	Sig.
	No.	%	No.	%			
Knowledge	47	88.6	1	14.2	-2.126	< 0.05	(S)
Attitude	39	73.5	2	28.5	0.256	< 0.05	(S)
Behavior	44	83.0	1	14.2	0.787	< 0.05	(S)

Discussion

The results of this study suggest that there was an intrinsic difference in hand washing rates between female and male nurses in the ED as female nurses represented more than half of the study sample. This confirmed what was reported by McGuckin and Porten (2009) recorded that[21]on hand washing frequency in selected hospitals and among adults in EDs, which showed that females hand washed more frequently than males following use of toilet facilities.

Studies Saint et al.,(2009) and Blackmore (2008)[22, 23]suggested that inter-gender differences in hand washing behavior may be the result of intrinsic differences in the emphasis parents place on hand hygiene for girls and boys. It also may be the case that females tend to be more compliant.

Regarding the relationship between the nurses' gender and their knowledge towards hand hygiene, the present study shows that there is a statistically significant relationship between the nurses' gender and their knowledge. The findings of the present study was in agreement with Pitts et al.,(2006) and Haas and Larson (2008) [24, 25] comparing hand drying methods which found that females scored higher on the knowledge question and had more positive scores on the beliefs, practice and hand hygiene importance scales.

Also, regarding the assessment of attitude and behavior, the present study indicated that female nurses generally were more compliant with HH guidelines than males. The present study showed that 75% of females washed their hands after using the toilet compared to 58% of males. (Giroue*t al.,* 2004) [26]Showed that 47% of females hand washed after using the toilet compared to 61% of males. In the study of (Klausner*et al.,*2009) [27] 90% of females hand

washed after going to the toilet compared to 72% of males.

According to the results of this study there is no statistically significant relationship between the nurses' years of experience and their assessment of knowledge, attitude, and behavior. This may be because nurses who have more than 10 years of experience do not perform hand washing because of their decreased contact with patients in EDs, as they are more likely to work as head nurses in the ED.

In the same line, Findik et al., (2011)[28]. found that no significant relations were determined between the demographic characteristics of nurses such as length of work, educational background, and their hand washing knowledge, the number of hand washes in each shift, their preferred agents for hand washing and preferred materials for hand-drying.

About nursing shifts in EDs, this study reveals that about half of the study sample of nurses work the day shift and this is due to the increased numbers of patients to the ED during the day time more often than during the evening and night.

In this study there was no statistically significant relationship between the time of the shifts and the nurses' knowledge, attitude, and behavior. Generally, when an ED is overcrowded by the critically ill patients, this may be a barrier to hand hygiene frequency. However, in our case the ED was overcrowded all day long, meaning that there were no great differences between the morning, the afternoon and the evening shift. This explains why there was no statistically significant relationship between the time of the shifts and the nurses' knowledge, attitude, and behavior.

This finding coincides with Gould 2012[29] who found that the frequency of hand washing is decreased in busy wards and when resources are not readily available. He reported that the lack of direct benefit associated with hand disinfection in the clinical setting was taken to justify the exclusion of expensive medicated agents from routine use and to establish what is considered acceptable.

In the present study the majority of nurses have received formal training in hand hygiene during the past three years, while only 13,3% of nurses who responded had not received any formal training. The results disagree with a previous study on hand hygiene in the emergency department: degree of compliance, predictors and change over time. More than half of nurses in that study (59%) had attended training sessions about hand hygiene in the two years before conducting of study[30].

Furthermore, there is a statistically significant correlation between formal training in hand hygiene in the last three years and the respondents' knowledge, attitude, and behavior, and this reflects that training programs about hand hygiene are important to improve knowledge, attitude, and behavior among nurses in EDs.

These results were in accordance with [31, 32] who stated that when the influence of training on the hand-washing behavior of nurses was assessed, there was a significant increase in the frequency of hand-washing events in a single shift. Similarly, other studies found that the total time spent on hand washing by assistant nurses increased significantly after training.

Sax et al.,(2007)[33] aimed at changing hand-washing behaviors determined that, following training, nurses washed their hands more frequently before providing care to patients. The results obtained in the present study imply that the nurses were affected by the training, that they understood the importance of hand washing after the training, and thus spent more time on it as a result.

Regarding the use of an alcohol-based hand rub for hand hygiene, most of the nurses in this study preferred to use hand hygiene with alcohol-based hand rub, and the number of those who reported washing their hands with antiseptic soap was low. The reason for this is that bars of soap may become contaminated during use and thus trigger an outbreak.

These results were in accordance with Kac, et al.,(2011) [34] who stated that most of medical and nursing staff cleans their hands more frequently by rubbing them with alcohol-based hand products than by washing with soap.Widmer, (2011) [35] stated that the availability of alcohol-based hand antiseptics in units at all times, and the emphasis on the importance of this practice during in-service training might have influenced the preference of the nurses.

In Europe, alcohol hand disinfectant is a standard practice used in hospitals and health care environments. But in Europe, this hand rub disinfectant is not common in household environments. While in some countries, such as Australia, standard hand washing is more applicable. The reason why hand rub disinfectant is more convenient for healthcare workers is because its rapid effect kills micro bacteria from the hands, and therefore it is called "waterless hand disinfection" [36].

Although the knowledge, attitude and behavior towards hand hygiene are present among nurses in the ED in this study, improving hand hygiene perception to the student nurses needs both understanding and motivation about their individual behaviors.

Conclusion

The study shows that overall nurse employees in the emergency department of King Abdul-Aziz hospital in Makkah Al-Mukaramah have

adequate knowledge, attitude, and behavior towards hand hygiene, but their professional practice needs to be improved through training courses which enhance their skills and knowledge.

Recommendations

Based on the findings of the study, the researchers recommend:

1. Provision of written guidelines about hand hygiene for all healthcare providers.
2. Introduction and demonstration of hand hygiene protocols to all caregivers.
3. Encouragement for leaders to be good role models and support antiseptic hand hygiene practice.
4. Monitoring and feedback for all healthcare providers, including physicians, nursing care providers, food service personnel, laboratory technicians, pharmacists, and therapists.

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