

## Original Article

# Knowledge, Attitudes and Compliance with Hand Hygiene Practices among Health Care Workers in Alexandria Main University Hospital

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## Abstract

**Background:** Hand hygiene is the simplest and most cost-effective practice for controlling health care associated infections (HCAIs). Level of adherence and determinants of poor compliance to hand hygiene (HH) among health care workers (HCWs) should be investigated in all health care settings.

**Objective(s):** The study was conducted to assess knowledge and attitudes of health care workers towards hand hygiene and to assess their degree of compliance with moment one hand hygiene.

**Methods:** A cross sectional study including HCWs (residents and nurses) in Alexandria Main University Hospital was conducted. The World Health Organization questionnaires and observational checklists were used to collect data in addition to a structured questionnaire to assess attitudes towards hand hygiene. Knowledge and attitude scores were calculated.

**Results:** Only 15.5% of the studied HCWs had satisfactory level of hand hygiene related knowledge and more than half of them (55.8%) had a fair level of knowledge. The majority of HCWs (91.3%) agreed that hand hygiene practices are not practical in emergency situations. About half (49.5%) of them didn't feel guilty when they omit hand hygiene practices. Hand hygiene practices were missed in the vast majority of opportunities (>95%). Gloves were not available at any of the internal medicine or surgical wards but were rarely or intermittently available at the studied intensive care units (66.7% and 33.3% respectively). The most common cited barriers to hand hygiene practices among the studied HCWs were lack of sinks, soap, paper towels and alcohol-based hand rub.

**Conclusion:** Training, education and motivation of HCWs in Alexandria Main University Hospital in addition to availability of the required resources and supportive environment are the best ways to improve the level of compliance with hand hygiene.

**Keywords:** Hand hygiene, Health care associated infections, KAP study, barriers

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## INTRODUCTION

Health care-associated infections (HCAIs) affect patients in a hospital or other health-care facility and are not present or incubating at the time of admission. They also include infections acquired by patients in the hospital or facility but appearing after. They lead to prolonged hospital stay, create long-term disability, increase resistance to antimicrobials, represent a massive additional financial burden for health care systems and cause unnecessary morbidity and mortality.<sup>(1)</sup> Recent data from The World Health Organization (WHO) indicate that each year, hundreds of millions of patients are affected by HCAIs around the world.<sup>(1)</sup> In Egypt, the national surveillance reported an

incidence of HCAIs -in 28 hospitals in the period from 2012 to 2014- of 2 per 1000 patient days. In another study conducted in 11 hospitals during the period from April 2011 to March 2012, the incidence reached up to 5.2 per 1000 patient days.<sup>(2-3)</sup> Infection control (IC) is the field concerned with preventing HCAIs. It refers to all policies, precautions and activities directed to prevent or minimize chance of transmission of infections from patient to patient, from staff member to patient and from patient to staff member during the process of patients' care.<sup>(4)</sup> Standard IC precautions are a set of tasks designed to protect the staff and patients from contact with infectious agents, whenever health care is delivered.<sup>(5)</sup> These precautions include hand hygiene, personal protective equipment, aseptic techniques,

cleaning, disinfection, sterilization, immunization, environmental cleaning, post exposure prophylaxis and waste management.<sup>(6)</sup> Hands are the most common way through which microorganisms might be transmitted and subsequently cause infections. Hand hygiene (HH) is a major component of standard IC precautions. It is the most important, the simplest and the most cost-effective practice in controlling HCAIs<sup>(7,8)</sup> There are three types of HH techniques namely routine, aseptic and surgical. Routine HH include mainly hand wash and hand rub. If hands are visibly soiled they must be washed with soap and water however alcohol based hand rub is more effective against most bacteria and many viruses than either plain liquid soap or antimicrobial soap.<sup>(8)</sup>

Despite the simplicity of the hand hygiene procedures compliance with hand hygiene among health care providers is low. Such poor compliance becomes a worldwide concern.<sup>(9-11)</sup> Several factors were found to be associated with suboptimal compliance with HH practices among HCWs. These factors might be related to the nature of work such as work overload and insufficient time. Others include lack of knowledge among HCWs, negative attitude and wrong beliefs about HH and IC practices. Moreover, poor compliance might be due to factors related to the healthcare facility such as insufficient resources required for HH, improper supervision, lack of training and absence of role model.<sup>(8,12)</sup> HH among HCWs is a preventive behavior that must be adopted by all of them as long as they contact with patients. According to the WHO "Clean Care is Safer Care" Program, when working with patients, hand hygiene should be performed by health care workers (HCWs) at 5 key moments; before touching a patient, before clean/aseptic procedure, after body fluid exposure risk, after touching a patient and after touching patient surroundings.<sup>(7,8)</sup>

Moment 1 is mainly aimed at protecting the patient against acquiring potential pathogens from the hands of the HCWs. Moreover, it prevents cross-transmission of germs between patients through the hands of HCWs.<sup>(8)</sup> It is usually missed by HCWs before non-invasive examination and treatment as there is a lower perception of risk of transmission of infection at these occasions. Many HCWs considered wearing gloves prevent transmission of germs to and from the patient.

The present study was conducted to assess knowledge and attitudes of HCWs (resident physicians and nurses) at Alexandria Main University Hospital towards HH and to assess their degree of compliance with Moment 1 HH practice. Barriers to compliance with the recommended HH practices at the study setting were also investigated.

## METHODS

The study was conducted in all General Critical Care Units (3 units) of Alexandria Main University Hospital in addition

to half of the general inpatient departments (eight departments) that were selected randomly from all internal medicine and general surgical departments in the hospital using simple random technique. A cross sectional survey was carried out, which included all resident physicians and nurses currently working at the selected departments and ICUs. They were all invited to participate in the study (n= 236) but only 206 of them agreed to participate; 73 physicians and 133 nurses (Response rate=87.7%).

Participants were asked to fill a self-administered questionnaire to obtain data about their profession, years of experience, whether they received formal training in infection control and their perceived barriers to HH practices in the hospital (open ended question); in addition to a structured questionnaire consisting of 7 statements with three possible responses (agree, not sure and disagree) aiming at assessing attitudes of HCWs towards HH practices. Moreover, the translated Arabic version of WHO HH knowledge questionnaire was used to assess their knowledge about HH practices.<sup>(13)</sup> Arabic translation and testing for validity and reliability were carried out by Cruz et al (2015)<sup>(14)</sup>. Authors were contacted to get their approval to use the questionnaire. The questionnaire consisted of 25 questions, all were single response questions.

The enrolled HCWs were observed during their working shifts to assess their compliance with moment 1 hand hygiene practice (before touching the patient) using WHO HH Moment 1 observation form (The total number of observations done was 1575). To avoid Hawthorne effect, where participant behavior is influenced by the awareness of the physical presence of the observer, the observation was carried out for all nurses and residents attending the ward at the time of filling the knowledge-attitude questionnaire by any of them. Moreover, assessment of the ward infrastructure was done using another observation form adapted from WHO infrastructure survey to assess the essential resources for optimum compliance with HH practices.<sup>(13)</sup> It was filled by a senior nurse for each ward or unit included in the study.

### Statistical Analysis

Data were entered, coded and analyzed using SPSS (Statistical Package for the Social Sciences) software Version 20.0 (SPSS Inc., Chicago, IL, USA). The total knowledge score was calculated by summing scores of all questions (each question scored 1 for correct answer and 0 for incorrect) yielding a total score ranging from 0 to 25 and a percent score was calculated and classified into: poor level of knowledge (<50%), fair level of knowledge (50% - <75%) and good or satisfactory level of knowledge ( $\geq 75\%$ ). Moreover, subtotal scores for the five main domains in the questionnaire were also calculated. Similarly, the total attitude score was calculated by summing the score for all statements (2 for positive attitude, 1 for not sure and zero for negative attitude) yielding a total score ranging from 0 to 14 that was transferred to a percent score. The higher the total score, the more positive the attitude of HCWs towards hand hygiene practices. The appropriate descriptive and analytic statistical methods were done at 5% level of significance.

### Ethical Considerations

The study protocol was approved by the Institutional Review Board and Research Ethics Committee in Faculty of Medicine, Alexandria university. The study conformed to the International Guidelines for Research Ethics. Participation in the study was voluntary and an informed oral consent was obtained from all participants after explaining the aim and concerns of the study. The questionnaires were anonymous to ensure confidentiality of participants' data.

## RESULTS

The majority of studied nurses were females (90.2%) as compared to only 35.6% of the physicians. The age of studied HCWs ranged between 17 and 55 years, with a mean of  $27.60 \pm 1.88$  years for physicians and  $32.62 \pm 11.01$  for nurses. About one third of nurses and physicians were working at surgical departments (36.1% and 34.2% respectively). More than two fifths of studied nurses (43.6%) were working at ICUs. However, only 20.3% were from internal medicine

departments. The mean working years among nurses was  $13.50 \pm 10.12$  years versus  $3.16 \pm 1.46$  years among studied resident physicians (Table 1). More than three quarters of studied nurses (78.9%) reported receiving formal training in IC including HH. Half of them (48.5%) were working at ICUs. On the other hand, only 38.4% of resident physicians received similar training. The difference between both groups was statistically significant. ( $p < 0.001$ ). The percentage of studied HCWs who responded correctly to some questions included in "Hand hygiene knowledge questionnaire" varied widely and ranged between 13.6% to 94.2%. The percentage of physicians who knew the minimal time needed for alcohol-based hand rub to kill most germs on their hands was significantly higher than nurses (58.9% versus 33.2% respectively). Similarly, the mean score of physicians was higher than nurses in areas concerned with differences between hand rubbing and washing and conditions associated with increased likelihood of colonization of hands with harmful germs ( $p = 0.03$  and  $0.001$  respectively) (Tables 2 & 3).

**Table (1): Distribution of studied HCWs according to their demographic and occupational characteristics**

Demographic and occupational Characteristics	Profession				Total (n=206)	
	Physician (n=73)		Nurse (n=133)		No.	%
	No.	%	No.	%		
<b>Sex</b>						
Female	26	35.6	120	90.2	146	70.9
Male	47	64.4	13	9.8	60	29.1
<b>Age (years)</b>						
Min. – Max.	24.0 – 34.0		17.0 – 55.0		17.0 – 55.0	
Mean $\pm$ SD.	1.88 $\pm$ 27.60		11.01 $\pm$ 32.62		9.22 $\pm$ 30.84	
<b>Department</b>						
Internal medicine	29	39.7	27	20.3	56	27.2
Surgery	25	34.2	48	36.1	73	35.4
Intensive care unit	19	26.0	58	43.6	77	37.4
<b>Working experience (years)</b>						
Min. – Max.	1.0 – 7.0		1.0 – 36.0		1.0 – 36.0	
Mean $\pm$ SD.	1.46 $\pm$ 3.16		10.12 $\pm$ 13.50		9.55 $\pm$ 9.83	

**Table (2): Healthcare workers with correct response to questions about the main route of transmission of germs, the most frequent germs and the time needed for hand rub to kill pathogens**

Statement	HCWs with correct responses						p-value
	Residents (n=73)		Nurse (n=133)		Total (n=206)		
	No.	%	No.	%	No.	%	
Health-care workers' hands when not clean are the main route of cross-transmission of potentially harmful germs between patients in a health-care facility.	32	43.8	62	46.6	94	45.6	0.701
Germs already present on or within the patient is the most frequent source responsible for health care-associated infections.	32	43.8	73	54.9	105	51.0	0.129
The minimal time needed for alcohol-based hand rub to kill most germs on your hands is 20 seconds	43	58.9	45	33.8	88	42.7	0.001*

**Table (3): Knowledge of HCWs in the five main domains of hand hygiene knowledge questionnaire**

Domain	Percent score of HCWs			P-value
	Min-max Mean $\pm$ SD			
	Residents	Nurses	Total	
Actions prevents transmission of germs to the patient (4 questions)	0-100 66.75 $\pm$ 23.5	25-100 74 $\pm$ 18.25	0-100 71.25 $\pm$ 20.5	Z=-2.565 (0.01)*
Actions prevent transmission of germs to the health-care worker (4 questions)	0-100 74 $\pm$ 9.25	0-100 69 $\pm$ 23.75	0-100 69.75 $\pm$ 22.75	Z=-0.325 0.745
Differences between hand rubbing and washing (4 questions)	0-75 40 $\pm$ 23.25	0-75 36.75 $\pm$ 16.5	0-75 38 $\pm$ 19.25	Z=1.042 (0.03)*
The recommended hand hygiene action in different situations (6 questions)	16.67-100 58.17 $\pm$ 16.76	0-100 63.17 $\pm$ 25.5	0-100 3.68 $\pm$ 61.33	Z=-1.718 0.087
Conditions associated with increased likelihood of colonisation of hands with harmful germs (4 questions)	25-100 77.75 $\pm$ 19.25	25-100 63.25 $\pm$ 26	25-100 68.5 $\pm$ 24.75	Z=4.5 (<0.001)*

Z for Man Whitney test

\*: Statistically significant at  $p \leq 0.05$ 

Only 15.5% of studied HCWs had satisfactory level of HH related knowledge and more than half of them (55.8%) had a fair level. Although the level of knowledge was significantly lower among nurses compared to physicians as 33.8% of nurses had poor level of knowledge compared to only 19.2% of physicians ( $p=0.041$ ), yet no statistically significant difference was found between studied nurses and physicians regarding their mean total knowledge percent score. ( $p=0.519$ ) (Table 4). Upon examining factors that significantly affected the mean knowledge score of HCWS (nurses and residents separately), receiving a formal training on HH in the previous three years was significantly associated with higher score. On the other hand, no significant association was found between knowledge score of HCWs and other studied factors namely their age, gender, their department or working years (Table 5). Table 6 demonstrates attitudes of studied HCWs towards

hand hygiene practices. Only 49.5% of them felt guilty when they omit HH practices and 37.9% of them agreed that administrative orders and continuous supervision can improve compliance with HH practices. Moreover, 8.7% agreed that hand hygiene practices are always feasible in emergency situations. A significantly higher percentage of nurses compared to physicians agreed that training, administrative orders, continuous supervision and displaying posters and reminders can improve HH compliance among HCWs ( $p<0.05$ ). The total attitude percent score among studied workers towards hand hygiene practices was positive with a mean of 82.99 $\pm$ 8.39 with no significant difference between studied nurses and physicians regarding their total attitude percent score. (81.67 $\pm$ 7.88 versus 83.71 $\pm$ 8.60 &  $p=0.088$ ). A positive correlation was found between the total knowledge percent score and the attitudinal score of studied HCWs ( $r=0.220$  and  $p=0.001$ ).

**Table (4): Level of knowledge about hand hygiene among the studied HCWs**

	Profession		Total (n=206)	Test of significance (p value)
	Resident (n=73)	Nurse (n=133)		
<b>Level of knowledge</b>				
Poor level	14(19.2)	45(33.8)	59(28.6)	$\chi^2=6.365$ (0.041)*
Fair level	49(67.1)	66(49.6)	115(55.8)	
Good/satisfactory	10(13.7)	22(16.5)	32(15.5)	
<b>Total knowledge percent score</b>				
Min. – Max.	24.0 – 84.0	28.0 – 84.0	24.0 – 84.0	t= 0.519 (0.604)
Mean $\pm$ SD.	60.82 $\pm$ 11.79	59.52 $\pm$ 14.15	59.98 $\pm$ 13.35	

t and p values for Student t-test for comparing between the two groups

\*: Statistically significant at  $p \leq 0.05$

**Table (5): Knowledge of HCWs about hand hygiene in relation to their demographic and occupational characteristics**

	Profession	
	Physician (n=73)	Nurse (n=133)
<b>Age</b>	r=0.060, p=0.614	r=0.071, p=0.419
<b>Gender</b>	Mean ± SD.	Mean ± SD.
Female	15.46 ± 2.39	15.12 ± 3.36
Male	14.98 ± 3.12	13.08 ± 3.77
<b>t (p-value)</b>	0.686 (0.495)	2.055 (0.052)
<b>Years of working experience</b>	r=0.163, p=0.169	r=0.075, p=0.392
<b>Department</b>	Mean ± SD.	Mean ± SD.
Internal medicine	14.17 ± 2.88	16.0 ± 2.67
Surgery	16.16 ± 2.87	14.63 ± 3.92
Intensive care unit	15.32 ± 2.47	14.66 ± 3.29
<b>F(p-value)</b>	3.486 (0.066)	1.697 (0.187)
<b>Receiving formal training in HH</b>	Mean ± SD.	Mean ± SD.
No	12.69 ± 3.10	13.07 ± 3.83
Yes	15.89 ± 2.33	15.41 ± 3.17
<b>t (p-value)</b>	2.733(0.008)*	4.670 (<0.001)*

r: correlation coefficient, F: ANOVA, t: independent samples t test

\*: Statistically significant at  $p \leq 0.05$

**Table (6): Attitude of studied HCWs regarding hand hygiene**

Statement	HCWs with positive attitude						p-value#
	Physician (n=73)		Nurse (n=133)		Total (n=206)		
	no.	%	no.	%	no.	%	
Correct HH practices should be followed at all times	70	95.9	128	96.2	198	96.1	<sup>FE</sup> p=1.000
A health care personnel should have sufficient knowledge and training about HH	67	91.8	118	88.7	185	89.8	0.488
Feeling guilty when you omit hand hygiene	37	50.7	65	48.9	102	49.5	0.803
Hand washing is always possible in case of emergencies	4	5.5	14	10.5	18	8.7	0.220
A health care personnel should enrol in regular training sessions regarding IC and HH practices	61	83.6	125	94.0	186	90.3	0.016*
Compliance with HH can be improved by administrative orders and continuous observation	20	27.4	58	43.6	78	37.9	0.022*
HH compliance can be improved by displaying posters and reminders at point of care	54	74.0	129	97.0	183	88.8	<0.001*

# p values for Chi square test for comparing between the two groups

<sup>FE</sup>p: p value for Fisher Exact test

\*: Statistically significant at  $p \leq 0.05$

Table 7 shows that out of 1575 opportunities of observation of studied HCWs (579 among physicians and 996 among nurses) to assess their compliance with moment 1 HH practices (before touching the patient), HH actions were

missed in the vast majority of them (>95%). The most common cited barriers to HH practices among the studied HCWs were lack of sinks, lack of soap & paper towels and alcohol-based hand rub. (56.8, 51.5 and 36.9 respectively)

Other reported obstacles were being busy and understaffing (41.3 and 39.8%), other less commonly cited reasons were lack of knowledge, irritation by HH agents and giving priority to the patients' needs. Nearly one fifth (18.9%) of studied HCWs considered wearing gloves a substitute to HH (Table 8). The ward infrastructure survey for 40 wards at Alexandria Main University Hospital (16 from internal medicine, 18 surgical and 6 ICUs) revealed that water was not regularly available in any of the studied wards. Soap also was not available at all internal medicine or surgical wards.

However, it was intermittently available in one ICU. Alcohol-based hand rub was intermittently available at the studied internal medicine and surgical departments, but always available in all ICUs. Gloves were not observed at any of the internal medicine or surgical wards but rarely or intermittently available at the studied ICUs (66.7% and 33.3% respectively). Reminders on HH practices like posters illustrating steps of hand rub were displayed at all ICUs, half of internal medicine wards and only 16.7% of studied surgical wards.

**Table (7): Compliance of observed HCWs with moment 1 hand hygiene practices**

		Department							
		Internal Medicine		Surgery		Intensive care unit		Total	
		No.	%	No.	%	No.	%	No.	%
Residents	Missed	164	97.0	123	94.6	268	95.7	555	95.9
	Hand rub	3	1.8	4	3.1	8	2.9	15	2.6
	Hand wash	2	1.2	3	2.3	4	1.4	9	1.5
	<b>Total</b>	<b>169</b>	<b>100.0</b>	<b>130</b>	<b>100.0</b>	<b>280</b>	<b>100.0</b>	<b>579</b>	<b>100.0</b>
Nurses	Missed	161	97.0	259	95.9	530	94.6	950	95.4
	Hand rub	2	1.2	5	1.9	19	3.4	26	2.6
	Hand wash	3	1.8	6	2.2	11	2.0	20	2.0
	<b>Total</b>	<b>166</b>	<b>100.0</b>	<b>270</b>	<b>100.0</b>	<b>560</b>	<b>100.0</b>	<b>996</b>	<b>100.0</b>

**Table (8): Self-Reported barriers to compliance with hand hygiene practices among studied HCWs**

Cited barriers to compliance with HH	Profession*					
	Residents (n=73)		Nurse (n=133)		Total (n=206)	
	No.	%	No.	%	No.	%
Sinks are inconveniently located/lack of sinks	35	47.9	82	61.7	117	56.8
Lack of soap and paper towels	55	75.3	51	38.3	106	51.5
Too busy/insufficient time	33	45.2	52	39.1	85	41.3
Understaffing/overcrowding	31	42.5	51	38.3	82	39.8
Unavailability of alcohol-based hand rubs	37	50.7	39	29.3	76	36.9
Lack of knowledge about guidelines/ protocols	35	47.9	29	21.8	64	31.1
Hand washing agents cause irritation and dryness	21	28.8	42	31.6	63	30.6
Patient needs take priority	14	19.2	28	21.1	42	20.4
Always wearing gloves	20	27.4	19	14.3	39	18.9
Low risk of acquiring infection from patients	0	0.0	3	2.3	3	1.5
Others*	3	4.1	0	0.0	3	1.5

\*poor supervision and lack of incentives

## DISCUSSION

Health care associated infections are important causes of morbidity and mortality. They are associated with additional diagnostic and therapeutic interventions, which generate added costs to those already taken by the patient's underlying disease. HCAs occur in all types of health care settings including acute, surgical, outpatient, chronic and long term care facilities.<sup>(1)</sup> Transmission of infective agents from HCWs is one of the major risk factors for HCAs. Hand hygiene is one of the standard precautions for effective HCAs control program. Any person involved in direct or indirect patient care needs to be concerned about HH and should be able to perform it correctly and at the right time.<sup>(8)</sup>

In the current study only 15.5% of studied HCWs had a satisfactory level (score >75%) of knowledge and less than one third of studied workers (28%) had a poor level (score <50%), with a mean score of 59%. Previous studies conducted to assess KAP of nurses regarding HH showed that the majority of nurses had either poor or unsatisfactory level of knowledge as it seldom exceeded 65%. In a study conducted at a selected Egyptian cancer hospital 2013<sup>(15)</sup>, critical care nurses had unsatisfactory knowledge level where two thirds (63.6%) of the studied sample had knowledge level <75%. Another study conducted in India on nursing and medical students at a tertiary care center showed that only 9% of participants had a knowledge score of more than 75%.<sup>(16)</sup> Similarly insufficient HH knowledge was found among 21% of HCWs at Armed Forces Military Hospitals, Taif, Saudi Arabia.<sup>(17)</sup>

Lack of knowledge about the most frequent sources of germs in HCAs and the minimal time needed for alcohol-based hand rub to kill most germs was evident among almost half of studied workers in the current study. Similarly, in a study conducted in a tertiary health care setting of Bhopal City, only 45% of residents and 27.5% of nurses knew the most frequent source of germs responsible for HCAs.<sup>(18)</sup> In another study conducted in a dialysis unit at Alexandria University Hospital, Egypt, less than half of nurses (47.1%) knew that they had to wash their hands before and after caring for a patient.<sup>(19)</sup>

Previous formal training was significantly associated with higher knowledge score among nurses in the current study. This finding was not true for residents and this might be attributed to the fact that the majority of resident physicians finished their undergraduate courses recently and retained knowledge regardless of receiving formal training. Similar to the findings of the current study, Hamid *et al.*, (2010)<sup>(20)</sup>, found that factors such as age and years of experience did not contribute to acquisition of knowledge about the universal precautions. In accordance, Gijare, (2012)<sup>(21)</sup> reported no significant statistical difference in pre and post-test knowledge & practice scores of various age groups and different years of experience. In contrary, age and years of experience of HCWs in a study conducted at a selected Egyptian cancer hospital (2013)<sup>(15)</sup>, were negatively correlated with their knowledge and practice of infection

control. In this regards Alwutaib *et al.* (2012)<sup>(22)</sup> reported that older age is an important determinant of lower level of knowledge score. Loss of motives, poor supervision and lack of continuous training might be possible explanations for their findings.

In the present study, the majority of the studied HCWs had positive attitude towards HH, however only one third of them agreed that compliance with HH can be improved by administrative orders and continuous observation. Moreover, the majority agreed that hand hygiene practices in emergency situations are not always possible. Hospitals with low nurse staffing levels and patient overcrowding in emergency departments and ICUs usually have poor compliance with hand hygiene as time to complete patient care duties competes with time needed for hand washing. HCWs perceived it to be more important to perform their patient care task quickly rather than taking time to clean their hands.<sup>(23)</sup> Attitude of nurses was significantly better than young physicians in the current study regarding the importance of training, supervision and reminders in improving HH compliance. This difference could be explained by the difference in the duration of working experience between both studied groups.

A positive correlation was found between the attitude and knowledge scores. This is in agreement with the fact that modifying behavior starts by getting the person knowledgeable as this will change his attitude to positive. Moment 1 HH is the one concerned with protecting the patient against colonization, against exogenous infection, by harmful germs carried on hands. In Aseer Central Hospital, south-western Saudi Arabia, the overall, HH non-compliance was observed in 41%.<sup>(24)</sup> However, in the current study the level of non-compliance was much higher compared to Aseer study, as only 4% of HCWs washed or rub their hands before touching the patient. In accordance to these findings, a study conducted in India to assess KAP of nursing students at a tertiary care center showed that 57 % of the nurses had poor HH practices and only 5% had good practice.<sup>(16)</sup> Another study conducted in a dialysis unit at Alexandria reported that none of the nurses washed hands before and after the different activities that required hand washing.<sup>(19)</sup> In another study conducted in Ethiopia 2014, only 16.5% of participants scored more than 50% in the observation checklist for compliance with HH.<sup>(25)</sup> Such poor compliance might be partially attributed to the cited barriers by participants that were mostly related to lack of supportive infrastructure and required resources in the hospital. The most common cited barriers were lack of sinks, lack of soap and paper towels and non-availability of alcohol-based hand rubs. Similarly, inaccessibility of sinks, high workload or lack of appropriate staffing, and interference with the practice of care, were cited as the most important barriers in previous similar studies.<sup>(19, 25)</sup> One of the common reported misconceptions among nurses was that wearing gloves replaces washing hands or alcohol based hand rubbing.<sup>(8, 26)</sup> This was evident in the current study as 18.5% of studied workers considered wearing gloves enough to prevent transmission of infection.

Results in the current study could reflect a gap between knowledge and practice. A similar finding was reported in a previous Egyptian study.<sup>(16)</sup> In accordance, Askarian et al (2007)<sup>(27)</sup> found no correlation between knowledge and practice regarding IC among nurses and doctors. Such gap could be partially explained by poor supervision as it was reported in a previous study at Ain Shams University (2009)<sup>(28)</sup> that most of the nurses (97.3%) agreed that HH practices can be improved by administrative orders and continuous observation.

## CONCLUSION AND RECOMMENDATIONS

Very poor compliance with HH practices among studied HCWs is calling for urgent intervention. Hand hygiene is the responsibility of the individual practitioner and the institution. The best ways to improve hand washing compliance is training and continuous education of all HCWs including newly educated physicians and nurses. Strict observation and regular audit of their compliance with IC standard precautions and correction of poor practices by the IC team are also required as pre-planned patient safety activities. Moreover, ensuring availability of the required resources and supportive infrastructure is recommended. These resources include: sinks, hand rubbing and drying facilities and availability of reminders on HH practices like posters that should be displayed in a proximity of sinks and hand rubbing at all ICUs and wards.

**Conflict of Interest:** None to declare

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