



## Hand Hygiene Among Primary Healthcare Workers In Kafr-Shukr District, Qalyubia Governorate, Egypt.

Taghreed M Farahat <sup>1\*</sup>, Azza Zaghlol Labeeb <sup>2</sup>, Samer Sobhy <sup>3</sup>, Aml A. Salama<sup>1</sup>

<sup>1</sup>Family Medicine Department, Faculty of Medicine, Menoufia University, Egypt

<sup>2</sup> Microbiology Department, Faculty of Medicine, Menoufia University, Egypt

<sup>3</sup> Ministry of Health and Population, Egypt

### ABSTRACT

**Background:** Hand hygiene is a central component of patient care and infections prevention. This is a cost-effective preventive measure should be effectively used from advanced healthcare systems to primary healthcare units. **Objectives:** To assess the practice of hand hygiene through a perspective observation among primary healthcare workers (PHCWs) with its correlation to their hand hygiene knowledge and to assess the efficacy of hand hygiene. **Method:** This cross sectional study was conducted at primary care facilities at Kafer Shoker district, Qalyubia governorate, Egypt. WHO questionnaire for knowledge and observational check list of hand hygiene practice were used to assess the knowledge and practice of hand hygiene. A bacteriological study was conducted to swabs of the palms/fingers of the participants and were examined for microbial growths before and after perceived hand wash. **Results:** Among the studied group, 82.6% of healthcare workers had moderate knowledge and 52.2% of them practiced hand hygiene appropriately. Factors as being female, nurse, increased experience duration, working in family medicine clinic, and previous hand hygiene (HH) training were associated with statistically significant practice of appropriate HH. The compliance rate to HH guidelines was appropriate only in 44.7 % of studied group. The microbiological results of this study showed significant efficacy of practiced hand washing ( $p < 0.001$ ). **Conclusion:** There's still a considerable gap between self-perceived practice and actual practice of HH. It recommended to conduct hand hygiene specific training programs for healthcare workers at regular interval to strengthen the knowledge and practice of HH

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### INTRODUCTION

Healthcare-associated infections (HAIs) for both patient and health care workers after any procedures done in healthcare settings are considered as vital reasons for negative wellbeing results, for example, increased morbidity, mortality, postpone patient recovery and caused acquired infection for health care workers and additionally cost for human enduring of patients, families and healthcare staff.<sup>1,2,3</sup> Fortunately, researchers reported that significant proportion of HCAs are preventable, if effective

**Corresponding Author:** Aml Ahmed Salama ,Assistant professor, Family Medicine Department, Faculty of Medicine, Menoufia University, Email: aml\_salama2002@yahoo.com

structures, systems and procedures are in place to manage the potential risks.<sup>4,5</sup> A set of best practices guidelines followed for every patient by each healthcare personnel in order to prevent spread of infection, regardless of suspected diagnosis or confirmed infection e.g. hand hygiene, care with health products, use of personal protective equipment (PPE), respiratory etiquette, caring for the physical environment, waste management were called the standard precautions (SPs) are a part of the infection prevention and control programme.<sup>6</sup> Hand hygiene (HH) is a foundation in these SPs in the healthcare setting. This preventive and cost-effective system is heavily suggested by WHO that

**Table (1): Demographic characteristics of the studied group**

Demographic data		Total N = 115	
		N	(%)
<b>Gender</b>	Male	15	(13)
	Female	100	(87)
<b>Age</b>	Mean ±SD	32.92 ± 7.8	
<b>Experience</b>			
	≤ 10 years	47	(40.9)
	>10 years	68	(59.1)
<b>Working place</b>			
	- Family medicine clinic	35	(30.4)
	- Specialty clinic**	31	(27)
	- Emergency Room	21	(18.3)
	- Dental clinic	20	(17.4)
	- Laboratories	8	(7)
<b>Position in work place</b>			
	-Physicians	29	(25.2)
	- Nurses	72	(62.6)
	- Technicians and others	14	(12.2)
<b>Training *</b>			
	Yes	88	(76.5)
	No	27	(23.5)

\*on infection control in last three years, \*\* as internal medicine, ophthalmology, obstetric and gynecology and pediatric clinics in some primary care sitting

advanced a worldwide campaign keeping in mind the end goal to empower hand hygiene.<sup>1</sup> In late 2019, The importance of HH assured as one of an important measure in infection prevention and control (IPC) strategies for use when infection with COVID 19 which is suspected to control the worldwide outbreak beside the respiratory hygiene and other SPs as recommended by WHO.<sup>7</sup> To standardize HH practices globally the WHO released Guidelines on hand hygiene in health care and introduced simple concept of 'My five moments for hand hygiene' to define indications for hand hygiene manoeuvre in an evidence-based model for transmission of micro-organisms by healthcare workers' (HCWs) hands. These moments are before touching a patient, before clean/aseptic procedure, after body fluid exposure risk, after touching a patient and after touching patient surroundings.<sup>8</sup> It has been proven that PHC is more effective and efficient to manage the causes and risks of poor health and well-being today, and dealing with the developing difficulties that undermine health tomorrow.<sup>4,9</sup>

Despite the HH procedure is simple and effective still there is decrease in compliance rate which is believed to be due to lack of HH products and requirements, personal attitude factors as skin irritation, the belief that there is not an indication for HH, patient care is more important or time is not enough for it, forgetfulness, work overload or due to the ignorance of guidelines and lack of scientific information.<sup>10,11</sup>

HO developed the Hand Hygiene Multimodal Improvement Strategy as one of the first ever multimodal strategies in the infection control field. The organization published the first draft of the WHO Guidelines on Hand Hygiene in Health Care in 2006 and the final draft in 2009, which reported the WHO Multi-modal Hand Hygiene Improvement Strategy.<sup>12</sup> This strategy proved to be effective in achieving successful improvements of HH promotion and behaviour change worldwide across all HCW categories, hospitals, hospital wards and departments, and country levels of development in recent years.<sup>13</sup>

Adherence to effective infection control measures HH in PHC settings is essential as beside the curative role, another important objective of PHC is prevention of infections.

This study aimed to assess the practice of hand hygiene through a perspective observation among primary healthcare workers with its correlation to their hand hygiene knowledge and to assess the efficacy of hand hygiene.

## METHOD

This is a cross-sectional study which was conducted over a period of 6 months between January and June 2020.

The study was conducted at primary healthcare units affiliated to health administration in Kafr Shukur District, Qalyubia Governate. There were 14 primary healthcare facilities in this district, all were included in the study.

All HCWs who are engaged in giving care to attendants in the PHC facilities were included while those who are not engaged in giving health care to attendants were excluded. The total participants were 131 while 115 of HCWs agreed to participate in the study with response rate 87.8% (115/131). The participants were 29 physicians, 72 nurses and 14 other HCWs as (technicians, therapists and health care workers). Primary healthcare settings were inspected by the researchers to verify the existence of required protocols for hand hygiene, guidelines, and standardized procedures which were present and perfect in all studied setting. Inspection of

Table (2): The knowledge about HH among studied group

Knowledge parameters *	Total participants (n= 115)	
	True Answer No (%)	False Answer No (%)
<b>Main route of cross transmission of microbes between patient in health care facility (HCWs hands not clean)</b>	56 (48.7)	59 (51.3)
<b>The most frequent source of germs responsible for health care-associated infections (germs already within patients)</b>	55 (47.8)	60 (52.2)
<u>H.H actions prevent transmission of germs to the patient?</u>		
- Before touching a patient	105 (91.3)	10 (8.7)
- Immediately after a risk of body fluid exposure	95 (80.6)	20 (17.4)
-After exposure to the immediate surroundings of a patient	42 (36.5)	73 (63.5)
- Immediately before a clean/aseptic procedure	95 (82.6)	20 (17.4)
<u>H.H actions prevent transmission of germs to HCWs?</u>		
- After touching a patient	103 (89.6)	12 (10.4)
- Immediately after a risk of body fluid exposure	104 (90.4)	11 (9.6)
- Immediately before a clean/aseptic procedure	45 (39.1)	70 (60.9)
- After exposure to the immediate surroundings of a patient	97 (84.3)	18 (15.7)
- Hand rubbing is more rapid for hand cleansing than HW	81 (70)	34 (26.6)
-Hand rubbing causes skin dryness more than HW	47 (40.9)	86 (59.1)
- Hand rubbing is more effective against germs than HW	66 (57.4)	49 (42.6)
- HW and hand rubbing are recommended to be performed in sequence	41 (35.7)	74 (64.3)
- Minimal time needed for alcohol-based hand-rub to kill most germs on your hands? (20 seconds)	50 (43.5)	65 (56.5)
Which type of HH method is required in the following situations?		
-Before palpation of the abdomen (Rubbing)	43 (37.4)	72 (62.6)
- Before giving an injection (Rubbing)	21 (18.3)	94 (81.7)
-After emptying a bedpan (Washing)	106 (92.2)	9 (7.8)
-After removing examination gloves (Rubbing- Washing)	113 (98.3)	2 (1.7)
-After making a patient's bed (Rubbing)	40 (34.8)	75 (65.2)
-After visible exposure to blood (Washing)	98 (85.2)	17 (14.8)
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs?		
<b>Wearing jewelry</b>	107 (93)	8 (7)
<b>Damaged skin</b>	96 (83.5)	19 (16.5)
<b>Artificial fingernails</b>	108 (93.9)	7 (6.1)
<b>Regular use of a hand cream</b>	59 (51.3)	56 (48.7)
Total score of knowledge		
- <b>Good &gt; 75 % of total knowledge score</b>		26 (22.6)
- <b>Moderate 50-75 % of total knowledge score</b>		84 (73)
- <b>Poor &lt;50% of total knowledge score</b>		5 (4.3)

\*WHO. H H. Knowledge Questionnaire for HCW.

facilities preparedness for hand hygiene practice as clear tap water and soap or alcohol hand rub was assessed and were present and enough in all studied setting.

Study tools: Each participant was met separately by the researcher to discuss the study aims and designs, approve participation, filling the questionnaire with

the participant's own and hand swaps before and after hand washing were taken.

The knowledge of HCWs were assessed using the WHO "Hand Hygiene Knowledge Questionnaire"-revised and validated by WHO in 2009 edition<sup>14</sup> that have been modified to be in line with the context of primary care settings. The first part of the questionnaire consisted of demographic

**Table (3): Self-assessment of hand hygiene among studied group**

Practice parameters	Total	N = 115
	Appropriate N (%)	Poor N (%)
- I perform hand hygiene practice during following procedure		
a. Before touching a patient	75 (65.2)	40 (34.8)
b. Before clean/aseptic procedure	115 (100)	0 (0)
c. After body fluid exposure risk	115 (100)	0 (0)
d. After touching a patient	109 (94.8)	6 (5.2)
e. After touching patient surroundings	87 (75.7)	28 (24.3)
-During alcohol-based hand rub I practice hand hygiene for following duration? *	68 (59.1)	47 (40.9)
-During hand washing I practice hand hygiene for following duration?	93 (80.9)	22 (19.1)
-The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	49 (42.6)	66 (57.4)
-I follow how to hand rub & hand wash photographs to do hand hygiene properly.	99 (86.1)	16 (13.9)
-Due to lack of time, it is difficult for me to attend hand hygiene training courses.	65 (56.5)	50 (43.5)
Total Practice score:	60 (52.2)	55 (47.8)

\* (20 seconds), \*\*(1minute)

characteristics of the studied group to obtain data about age, sex, years of experience, working place, position in workplace and if had attended an infection control training program that contained HH practice during the last 3 years. The second part of the questionnaire was for assessing knowledge regarding HH through 26 questions (multiple choices / “yes” or “no” options).

The perceived practice of HCWs regarding HH were assessed using predesigned questionnaire, which was validated by a panel of 4 expertise who are working in infection control unite in Menoufia University Hospitals. The expertise were asked to evaluate individual items in relation to its relevance and appropriateness and rate items on a 4 point scale: score 4 for Adequate (simple ,relevant &clear item), 3 for adequate but needs minor modification , 2 for items needs major modification , 1 for not so adequate ( can be omitted). Content validity index (CVI): percentage of total item rated by expertise as either 3 or 4. The score of ≥ 80% is generally considered to have a good validity. CVI of the designed questionnaires was calculated. It was 85%. The questionnaire consisted of 14 questions (multiple choices / “yes” or “no” options). Each correct answer was given one point, and an incorrect answer was given zero. The total knowledge score was considered good if it was 75-100%, moderate if

it was 50-75% and poor if less than 50% of the optimal score. The practice was considered appropriate if it was 75-100% and poor if it was less than 75% of the optimal score. The selection of these cut-off points based on reviewing the most related studies that use the same cut-off points to allow comparison between the results of the different studies <sup>10,16,18</sup>

All the questionnaires were self administered and were translated to Arabic in order to match some participants` culture. The Arabic version was reviewed by a panel of three senior researchers in family medicine to ascertain accuracy of translation to be easily understood by HCWs. CVI of the translated questionnaires was calculated to be 88%. A modified version of the WHO (2009) observation form.<sup>15</sup> for hand hygiene direct observation was used for observing the participants` HH compliance in all the departments of the fourteen primary healthcare facilities by the researcher during their contact with the attendants. Observation was done in the facilities at random times without prior announcement to decrease the possibility of a Hawthorn effect. A standardized validated checklist and a trained observer was used.

A bacteriological study was also conducted through collecting samples from various sites of the subjects` dominant hands (palm and web spaces) and fingers

**Table (4): Relation between socio-demographic characteristics of the study group and their HH practice**

Demographic data	GROUP (1)	GROUP (2)	Total	$\chi^2$	P value
	Appropriate practice N= 60	Poor practice N= 55	N = 115		
	N (%)	N (%)	N (%)		
<b>Sex</b>					
Male	2 (3.3)	13 (23.6)	15 (13)	10.429	0.001 †
Female	58 (96.7)	42 (84.8)	100 (87)		
<b>Age</b>					
≤ 30 year	22 (36.7)	28 (50.9)	50 (43.5)	2.369	0.088
> 30 year	38 (63.3)	27 (49.1)	65 (56.5)		
<b>Experience</b>					
≤ 10 years	26 (43.3)	42 (76.4)	68 (59.1)	12.955	0.001 †
>10 years	34 (56.7)	13 (23.6)	47 (40.9)		
<b>Working place</b>					
-Family medicine clinic	22 (36.7)	13 (23.6)	35 (30.4)	15.086	0.005 †
-Specialty clinic	11 (18.3)	20 (36.4)	31 (27)		
-Emergency	17 (28.3)	4 (7.3)	21 (18.3)		
-Dental clinic	7 (11.7)	13 (23.6)	20 (17.4)		
-Laboratories	3 (5)	5 (9.1)	8 (7)		
<b>Position in workplace</b>					
-Physicians	4 (6.7)	25 (45.5)	29 (25.2)	51.309	0.001 ‡
- Nurses	56 (93.3)	16 (29.1)	72 (62.6)		
- Technicians and others	0 (0)	14 (25.5)	14 (12.2)		
<b>Training *</b>					
No	7 (11.7)	20 (36.4)	27 (23.5)	9.742	0.002 †
Yes	53 (88.3)	35 (63.6)	88 (76.5)		

\* On infection control in last three years, †  $P < 0.05$  (significant), ‡  $P < 0.001$  (highly significant), § NS (not significant)

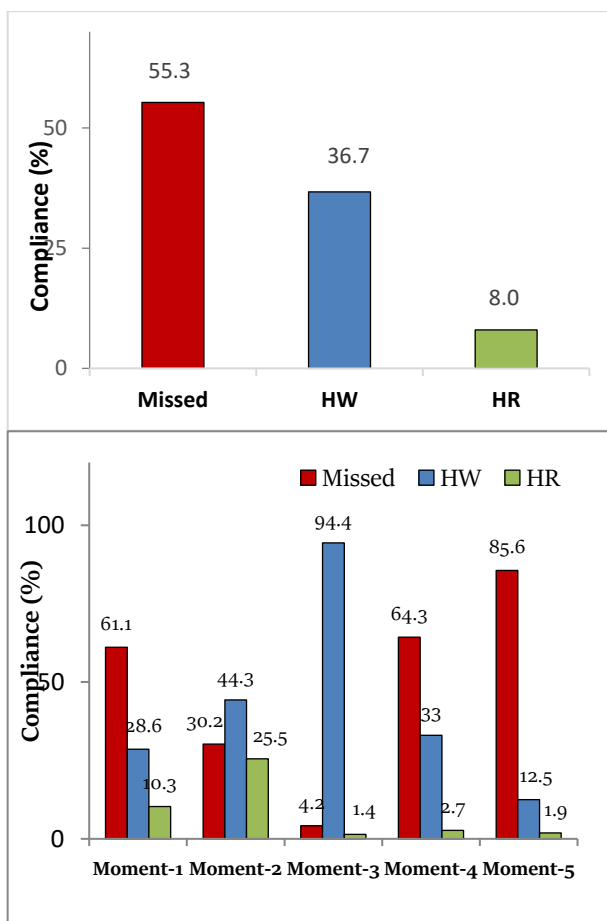
(fingertip and beneath nail) before hand washing using sterile cotton swabs. Then the participants were asked to wash their hands with soap and water performing all steps within specified time (40-60seconds). They were instructed not to touch the tap after washing hands and dry their hands with disposable towels. After completely drying their hands, another swab from above mentioned sites were taken. These swabs were immediately transferred to the microbiology laboratory of the faculty of medicine, Menoufia University and plated onto blood agars. The plates were then incubated for 24 hr at 37 ° C and then were examined for microbial growth. Any visible colony forming units (CFUs) were counted and recorded.

**Statistics analysis:** Coded data were entered on the computer using a database developed for data entry on Microsoft Office Excel program for windows, 2010. Then the data were transferred to the Statistical Package of Social Science, version 20 (SPSS - v 20) for quantitative data analysis. Quantitative data were expressed as mean and

standard deviation ( $X \pm SD$ ) and analyzed by Student t- test for comparison of two groups of normally distributed variables. Qualitative data were expressed as number and percentage and analyzed by Chi-square test. At p value  $\leq 0.05$ , statistical significance was assumed.

## RESULTS

The Demographic characteristics of the study sample are represented in Table (1). The participants were (25.2%) physicians, (62.6%) nurses and (12.2%) others (Lab Technicians, physiotherapists and cleaners). females represented (87 %). They were distributing as follow (30.4%) family medicine clinic, (27%) specialty clinics (18.3%) emergency room, (17.4%) dental clinic and (7%) laboratories. The age of studied group ranged between 22 and 56 years, with a mean of  $32.92 \pm 7.8$  years. Years of experience were more than 10 years in (59.1%). Most of the sample (76.5%) had attended an



**Figure (1): Total compliance rate of participants HH practice according to the WHO five moments infection control training program that contained HH practice during the last 3 years.**

The response to knowledge questionnaire Table (2), shows that true and wrong answers percentage among the studied health care workers. Knowledge level of the participant HCWs regarding HH was moderate, good and poor in 73%, 22.6% and 4.3% respectively

The percentages of correct responses of the participant primary HCWs to the individual questions on hand hygiene practices are given in Table (3). HH practice of the participants was appropriate in 52.2%, poor in 47.8% respectively. Regarding to effect of the demographic features of the sample on the HH practice Table (4). This study showed that nurses appropriately practiced HH significantly more than physicians ( $p < 0.001$ ). Females reported appropriate HH practice more than males with  $p$  value = 0.001. Previous formal training was significantly associated with increasing the appropriate practice among PHCWs ( $p = 0.002$ ). There was a statistically significant relationship between the working place of the participants and their appropriate practice ( $p = 0.005$ ), practice of HH was more appropriate at the family medicine clinic

followed by emergency rooms then specialty clinic, dental clinics and laboratories 36.7%, 28.3%, 18.3%, 11.7% and 5% respectively. This study showed that experienced HCWs practiced appropriately more than less experienced ( $p = 0.001$ ). The mean practice score was not associated with age ( $p = 0.088$ )

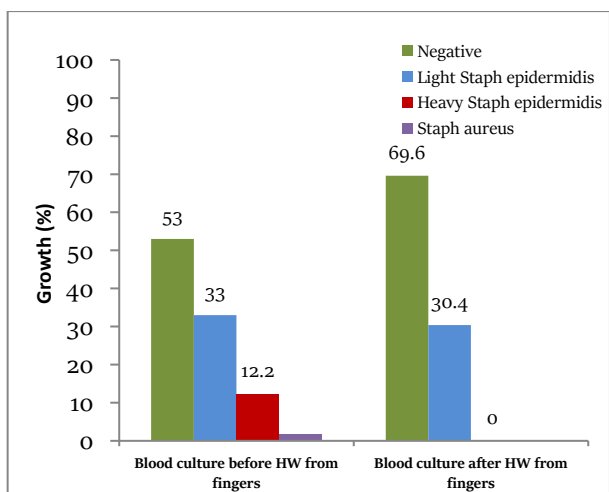
The Pearson correlation between participant knowledge and their practice was coefficient,  $r = 0.228$ , and that it was statistically significant ( $p = 0.014$ ).

The compliance rate during the total 705 opportunities that was directly observed was 44.7% (315 with appropriate hand hygiene). The participants were more adherent to HH practice at moment 3 (95.8%) and moment 2 (69.8%) and less adherent to moments 1 (38.9%) and 4 (35.7%). The least compliance rate was at moment 5 (14.4%) Figure (1).

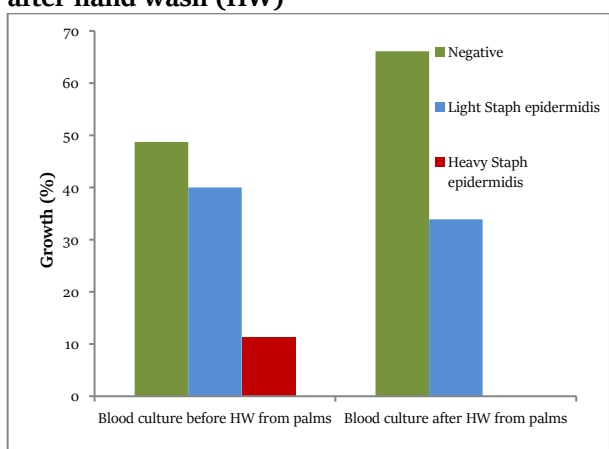
The microbiological study for the participants' samples indicated efficacy of HH ( $p < 0.001$ ). As the fingers cultured Staph epidermidis heavy growth in 14 participants (12.2%) before hand washing with water and soap that became light growth in 8 and negative in 6 of them after HW. Staph epidermidis colonies was light growth in 38 participants (33%) and became negative in 13 of them while 25 participants still cultured Staph epidermidis after hand wash. The two samples that cultured Staph aureus had become negative (Figure 2). The palm samples showed Staph epidermidis heavy growth in 13 participants (11.3%) before HW that became light growth in 5 and negative in 8 of them after HW. Staph epidermidis colonies was light in 46 participants (40%) and became negative in 15 of them while 31 participants still cultured Staph epidermidis after HW (Figure 3).

**DISCUSSION**

The present study was conducted to assess the adherence to proper HH practice among participant PHCWs and comparing it with their background knowledge regarding HH. The results revealed that the knowledge level was mainly moderate and the percentage that had good and poor were knowledge 22.6% and 4.3% respectively while slightly more than half of the participants in this study reported appropriate practice. This positive finding of proper practice of hand hygiene could be attributed to the fact that the PHCWs appreciated the importance of



**Figure (2): Results of cultural swaps from fingers of the studied participants before and after hand wash (HW)**



**Figure (3): Results of cultural swaps from palms of the studied participants before and after hand wash (HW)**

HH practice. This result was slightly lower than a Nigerian study among primary HCWs in semi-urban communities of Sokoto State and a Nigerian study among HCWs in a tertiary hospital in which about two-thirds practiced appropriately and the majority of the respondents had good knowledge of hand hygiene<sup>16,17</sup>. Another Saudi study among primary HCWs in Arar city revealed that despite the knowledge of hand hygiene was good in 90.5% of participants, the hand hygiene practices was appropriate in only 23.3% of them.<sup>18</sup> The result of another Saudi study was much higher than current study in Taif Armed Forces Hospitals, where hand hygiene practice was excellent among almost three-quarters of participants and the knowledge of hand hygiene was good in 79%.<sup>19</sup> On the other hand other two studies in Sirilanka and in India revealed poor HH practice in more than half of the study participants despite of their moderate knowledge.<sup>20-22</sup> The difference of HH practice may be attributed to

the difference of health care levels and effectiveness of infection control units between primary and tertiary hospitals.

The present study found that the correlation between the HH knowledge and practice was significantly coefficient with a direct positive slope supported by increasing the appropriate practice among the HCWs who received previous formal training that contained HH practice during the last 3 years that was statistically significant (p=0.002). This finding suggested more stress and modification in training methods will enhance the HH compliance. This was in line with study by Sarani et al., who showed that coefficient correlation between those who had more knowledge about infection control had a better practice.<sup>23</sup> The self-assessment to the adherence to HH practice in the present study appeared to be higher than the detected actual compliance using the direct observation. Despite most of the participants stated that facilities are adequate for HH in their area of work, having sufficient knowledge regarding hand hygiene and that HH became as a habit in their ordinary life, the total HH compliance rate was 44.7%. This disparity might be explained by lack of knowledge of HH guidelines. According to WHO 5 moments of HH practice the adherence was highest at moment 3 (95.8%) followed by moment 2 (69.8%) while low adherence was disturbingly appeared in moment 1 (38.9%),4 (35.7%) and 5 (14.4%). This agrees with the compliance rate among health care workers in Ain Shams University hospitals in Cairo that was 34% in which the prevalence of hand washing was higher after doing the different procedures or interventions than before doing them, yet hand washing was done in a more appropriate way before doing the different intervention except for the non-invasive procedures were it was nearly similar before and after.<sup>24</sup> This was much better than a study by Malundo and Berba who showed that the compliance rate to HH was 11 % in a tertiary teaching hospital in the Philippines. This default in the adherence to HH proper practice could be due to shortage in the knowledge regarding HR timing and effectivity that might increase the compliance, the negative effect of the frequency of HH as often required as necessary on the HH practice, not attending hand hygiene training courses due to time pressure, forgetfulness and work pressure.<sup>25</sup> Most of the participants in this study agreed that infection prevention team has a positive influence on their HH practice and that HR & HW posters and

photos were helpful to do hand hygiene properly. These positive findings might be helpful in improving the HCWs' HH compliance through modifying HH monitoring system in PHC and using more developed reminder system and most of studies support that.<sup>20,21,23</sup>

Regarding the correlation between the participant's HH practices and their demographic features, the present study revealed that nurses appropriately practiced HH more than physicians ( $p < 0.001$ ). Females reported appropriate HH practice more than males with  $p$  value = 0.001. The better hand washing practice among the nurses may be as a result of the need to wash their hands frequently after some nursing procedures such as children routine immunization and giving IM and IV drugs. This was in line with other studies were conducted in Saudi primary care centers located in Riyadh, in Armed Forces Military hospitals in Taif and in India.<sup>19,22, 26</sup> In contrast, an Egyptian study found that doctors significantly had higher compliance rate than nurses.<sup>24</sup>

The current study showed that more experienced HCWs appropriately practiced significantly ( $p = 0.015$ ), this may be due to experienced HCWs more oriented to HH through ongoing training. In contrast other studies showed no significant difference in the HH practices and experience.<sup>26</sup> This result was consistent with other studies which reveals no significant difference between the HH practices and the mean age of the participants.<sup>19,26, 27</sup> There was a statistically significant relation between the working place of the participants and their appropriate practice ( $p = 0.005$ ). The practice of HH was more appropriate at the family medicine clinic and emergency rooms. Working in emergency rooms in PHC units which requires dealing with simple surgical maneuvers as stitching simple wounds, giving IM and IV injections or IV solutions, and doing first aid to urgent cases before referral to secondary or tertiary healthcare facilities. A study showed that HH practice was low in the high patient density areas as emergency rooms and explained that by overload of the work in emergency or lack of HH requirements.<sup>28</sup>

The microbiological results of palm and finger swaps of the participants in this study indicated significantly effective hand hygiene ( $p < 0.001$ ). This was a practical demonstration that the proper HH eliminates the microorganisms present in HCWs hands that might cause HAIs. The bacteria identified from the hands of the participants belong to the

normal flora of the hand and pose no significant health hazard to healthy individuals, but it could be pathogenic especially in immunocompromised patients.<sup>29</sup> As other studies reported, hand hygiene has been shown to be an effective method to control transmission of infection by reducing the transient flora.<sup>1,30</sup>

One of the strengths of this study was that the assessment of practice which incorporated with an observational study. This enabled the investigators to observe the actual hand hygiene practices among these health care workers.

The present study highlights the need for introducing measures in order to increase the knowledge, practices and compliance for hand hygiene among the PHCWs in the PHC units and to increase awareness of the importance of HH. Modifying "HH continuous monitoring system" in PHC with using of more developed "reminder performance system" is beneficial beside ensure continuous availability of supplies necessary for HH. PHCWs need more orientation about the effectivity of HH and HR in protecting themselves and their patients from serious infections as COVID 19 may increase their compliance rate.

Future studies can be conducted to access barriers of compliance among HCWs and to assess the impact of recommended interventions. This information can then make ground for the development of effective policies on HH both at local and national level.

## CONCLUSION

This study showed that although most of HCWs had moderate level of knowledge, there was low compliance rate towards effective HH and presence of a gap between self perceived practice and actual practice. It recommended to conduct hand hygiene specific training programs for doctors, technicians, workers and nurses to improve their actual practice of HH according to WHO guidelines.

## Ethical Consideration

The study obtained all required approvals from the Institutional Review Board (or other appropriate ethics committee) of Menoufia University

**Recommendation:** More training courses regarding infection control measures including hand hygiene among health care workers are needed at regular interval to strengthen the knowledge and practice of HH.



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**Author contributions:** First author: Idea, literature search, and writing; Second author: Idea, literature search, and writing; Third author: analysis, critical review, and literature search; Fourth author: Critical review and literature search

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