

# The Effect of Hand Hygiene Strategy on Internship Nurses Compliance at Alexandria University Hospitals: An Empirical Interventional Study

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**Abstract:** Non-compliance with hand hygiene (HH) protocols in hospitals, particularly, is widely recognized as one of the most important contributing and preventable causes of health associated infections. Hence, continuing efforts are being made to identify effective and sustainable strategies to improve HH compliance.

**Aim:** Determine the effect of hand hygiene strategy among internship nurses on their compliance at different Alexandria University Hospitals.

**Setting:** This study was carried out in six hospitals in Alexandria which all the internship nurses of the Faculty of Nursing have been trained; the Main University, Elhadara, Elshatby, Smouha University, Student University, and Elmoassat Alexandria University Hospitals. All nurses were enrolled to 5 departments to attain their internship year specialty requirements; Medical-Surgical, Critical, Administration, Pediatric, and Obstetric & Gynecologic departments.

**Subjects:** Subjects of this study comprised all internship nurses (n=190) available at the previously mentioned settings and providing direct patient care.

**Tools:** Two tools were used to collect the data; tool I: Hand hygiene 5 moments observation form; was used to measure (HH) compliance after an interventional strategy. Tool II: Hand hygiene intervention strategy, three-phase intervention strategies were provided to all internship nurses at different University Hospitals settings.

**Results:** The mean score of the internship nurses compliance to HH action in the Pediatric department was much better than in Obstetric & Gynecologic one month as well as three months post interventional strategy at both morning and evening shifts. Critical care department showed higher mean score compliance throughout the 5 indications the morning and evening shifts (38.9%, 46.0% respectively), while the Administration department showed the lowest mean score of compliance (19.4%, 20.0% consecutively).

**Conclusions:** Internship nurses' compliance was high in some departments after one month, and declined after three months post strategy. No marked differences were found between morning and evening shifts, in relation to HH compliance in some departments.

**Recommendations:** Compliance strategies should be implemented early and periodically in the clinical courses for internship nurses.

**Keywords:** Hand Hygiene (HH), HH compliance, internship nurses, and interventional strategy.

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## I. Introduction

Health-care-associated infections (HCAIs) are one of the most frequent issues of patient safety worldwide<sup>(1,2)</sup>. It remains a big concern that no organization or countries can claim to have solved as yet. (HCAIs) persists as a major and growing health problem, causing increased morbidity, prolonged hospital stay, and a high number of in-hospital deaths<sup>(3,4)</sup>. Hundreds of millions of patients around the world each year are affected by (HCAIs)<sup>(3)</sup>.

Healthcare-associated pathogens that can lead to infection are transmitted through direct and indirect contact, droplets, air, and the contaminated hands of healthcare workers (HCWs). They are the most common vehicles of transmission in most settings<sup>(5)</sup>. Hand contamination increases with increasing time spent providing direct patient care, and in the absence of appropriate hand hygiene<sup>(5)</sup>. Among different hospital specialties, intensive care units (ICUs) are consistently found to have the highest prevalence rate of (HCAIs), when compared to other units in the hospitals<sup>(6)</sup>. Hand hygiene, either by hand washing or hand disinfection, remains the single most important measure to prevent (HCAIs)<sup>(7)</sup>. Optimal hand hygiene behavior is considered the cornerstone of (HCAIs) prevention<sup>(8, 9)</sup>. Furthermore, not only it is a key element of standard and isolation precautions, but its importance is emphasized also in the most modern 'bundle' approaches for the prevention of specific site infections such as catheter-related bloodstream infection (CRBSI), catheter-related urinary tract infection (CRUTI), surgical site infection (SSI), and ventilator-associated pneumonia (VAP)<sup>(10,11)</sup>. Non-compliance with HH protocols in hospitals, particularly, is widely recognized as one of the most important

contributing and preventable causes of HAIs<sup>(12)</sup>. Several studies have reported that compliance to HH remains inefficient and needs corrective actions to be sustained. Average adherence with hand hygiene' recommendations is usually estimated to be below 50%, but varies between different hospital settings, among professional categories, and according to working conditions .the world health organization (WHO) has compiled guidelines in this regard in order to reduce the prevalence of HCAI<sup>(13, 14)</sup>.

Furthermore, many studies done to assess the knowledge, attitudes, compliance and reasons for non-adherence of HH by health care workers;denoted pooradherence to HH,due to several constraints including; high number of clinical procedures, lack of appropriate equipment, low staff to patient'ratios, allergies to hand washing products, and insufficient knowledge among staff about risks procedures,the time required and casual attitudes among HCWs towards bio-safety<sup>(15, 16, 17)</sup>.Students in their clinical training phase throughout the healthcare facilities can potentially transmit infections besides being the healthcare providers of future, their patterns of training will reflect on their infection control practices. Multiple studies that have been conducted to study HHpractices among nursing and medical students, found that medical students have anoverall lower rate of HH, compared to nursing students<sup>(18, 19)</sup>.

To address the problem of lack of compliance with HH, published studies has increased considerably in recent years, with questions about improved adherence to recommended policies remaining unanswered<sup>(20,21)</sup>.Continuingefforts are being made, to identify effective and sustainable strategies. One of such efforts is the introduction of an evidence-based concept of "my five moments for hand hygiene" by WHO. These five moments that call for the use of HHinclude the moment before touching a patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids, after touching a patient, and after touching patient' surroundings. This concept has been properly used to improve understanding, training, monitoring, and reporting hand hygiene among healthcare workers<sup>(22)</sup>.

Most studies have explored the knowledge, attitudes and practices of doctors and nurses with only a few including nursing students. The primary training of these groups is the responsibility of the faculty and the hospital where they receive their initial training<sup>(18, 21, 23)</sup>. Moreover, HH guidelines need to be taught to student nurses in their first semester, before their first clinical placement at a time when they may have no healthcare experience<sup>(24)</sup>. So, the present study seeks to explore the effect tohand hygiene strategy among internship nurses on their compliance at different settings.This would be useful in identifying gaps in knowledge, poor attitudes and substandard practices to improve existing training strategies and enhance good practices and work ethics in the future.

### **Aim oftheStudy**

This study aimed to determinethe effect of hand hygiene strategy among internship nurses on their compliance at different Alexandria University hospitals.

### **Research Hypothesis**

Internship nursesattending hand hygiene strategy hadhigher compliancemean practice scores post strategy than before?.

## **II. Materials And Methods**

### **Research Design:**

A quasi experimental study design was used to conduct this study.

### **Setting**

This study was carried out atsixUniversity teaching hospitals in Alexandriain which all the internship nurses of the faculty of nursing are trained;namely the Main university ,Elhadara,Elshatby, Smouha, Student, and El-Moassat Alexandria university hospitals. All nurseswererecruited to 5 departments to fulfill their internship yearrequirements at Medical-Surgical, Critical, Administration, Pediatric, and Obstetricspecialties departmentsas follow;

- 1. Medical- Surgical Nursing (MSN)Department:**all the internship nurses were enrolled to different units in three hospitals as follows;
  - a. Main University hospital's units as; Burn ICU, Neuro-surgery ICU,Medical ICU, and Operating rooms related to; Cardio-Thoracic, Plastic, Headand Neck, and Urosurgeries.
  - b. Elhadaraunits as; NeuropsychiatryICU, Orthopedic surgery, Critical and Epilepsy ICU and Orthopedic ICU.
  - c. El-Moassatdialysis unit.
- 2. Critical Nursing Specialties (CN):** Emergency (ER), Recoveryrooms (RR), Thoracic ICU and general ICU
- 3. Nursing Service Administrationspecialties(NA):**The Intensive Care UnitsICU.
- 4. Pediatric Nursing Specialties (PN):**Pediatric neonatal Intensive Care Unit (NICU), Pediatric Intensive Care Unit (PICU).

**5. Obstetric&Gynecologicnursing Specialties(Obs&Gyn):** All the internship nurses were rotated to Elshatby hospital at the Obstetric ICU.

**Subjects:**

The subjects of this study comprised all internship nurses (190) available at the previously mentioned academic nursing departments, and providing direct patient care namely; 83 from the Critical care, 4 from Nursing service Administration, 60 from Medical- Surgical, 35 from Pediatric, and 8 from Obstetric Nursing.

**Tools:**

Two tools were used to collect the necessary data: **tool I: Hand Hygiene 5 Moments Observation Form:** this was adapted from the original WHO 5 moments "Observation Form" (2009) and was modified after reviewing the related literature<sup>(13)</sup>. It was used to measure HH compliance after an interventional strategy. It included two parts;

**Part I:** This part included items related to basic data in relation to; facility, service, hospital department, phase (pre or post-intervention), date, start/end time, session duration (difference between start and end time), session n<sup>o</sup> (attributed at the moment of data entry for analysis), observer name, (interns nurse ' name, group and academic year) and number of observed interns nurse.

**Part II:** This part included indications in HH 5 moments Observation Forms; Opportunity (name of procedure that was done in the shift), indications (all 5 indications that apply at one moment must be recorded) as follow; **1.bef.pat:** before touching a patient, **2.bef.asept:** before clean/aseptic procedure, **3.aft.b.f:** after body fluid exposure risk, **4.aft.p:** after touching a patient, **5.aft.p.surr:** after touching patient 'surroundings. HH actions response to the hand hygiene indication(s); it can be either **HR:** hand hygiene action by rubbing with alcohol (70%), or **HW:** washing with soap and water, **missed:** no HH action performed, or **improper:** improper hand washing by not following all the steps of HW/HR. The opportunity exists whenever one of the indications for HH occurs and is observed in nursing procedures as; (changing dressing, IM or S. C. injections, suction, nasogastric feeding, measuring CVP, range of motion exercise, patient's care, giving medication, e.g. blood sample, ABG, IV infusion, blood transfusion, preparing & administering of anesthetic medications, assessment & preparing epidural catheter, preparation & insertion of foley catheter, insertion of venous catheter, connection & disconnection of patient from dialysis machine, and shunt care).

**Tool II: Hand Hygiene Interventional strategy:** This strategy aimed to improve the study nurses practice of hand hygiene. It included four phases:

**Phase I: Intervention Stage.**

-The intervention took the form of theory and clinical training. Two sessions for all the participant nurses in the study were given about the necessity, time, correct steps of hand washing as well as hand rub, suggested plans to enhance hand washing, the application of the WHO five moments. Written leaflets were provided to all participant nurses about 5 moments HH, and WHO HH (washing/disinfection) steps.

-Evaluation for every internship nurse was done immediately after the clinical training sessions by using HW/HR observational checklist.

**Phase II: Post Intervention- Initial Follow Up:**

This phase started one month post strategy application. It included observation of internship nurses HH compliance using **Hand Hygiene Moments 5 Observation Form** through the internship nurse ' preceptors, who were assigned from the faculty of nursing to teach and evaluate every internship nurse.

**Phase III: Post Intervention- Late Follow Up:**

This phase started three months post strategy. It included observation of internship nurse ' HH compliance through the internship preceptor.

Compliance to HH using alcohol based hand rubbing and hand washing practices, were recorded against each opportunity. Every nurse was watched for three opportunities in the varied units.

Compliance to HH practices was assessed and scored from 0 to 3, where missed step scored as (0) =, improper step scored as (1) =, HW scored as (2) =, and HR scored as (3) =. The percent score of compliance in relation to HH actions was calculated from 0 to 100 where; (0) = 0%, (1) = 33.3%, (2) = 66.7%, and (3) = 100%.

Compliance in relation to indications was assessed and scored by using percent scoring ranging from 0 to 15, where (0) = 0%, and (15) = 100% compliance. Then the percent score of compliance for every internship nurse was calculated as; total score of indications/15 %.

### III. Method

1. Approval to conduct the study was obtained from the responsible authorities of Alexandria Main University Hospitals, Elshatby, Smouha, Students, El-Moassat and Elhadara Hospitals.
2. The study tools were adapted and modified based on a review of the related literature<sup>(13)</sup>. Content validity was tested by 5 experts in the field of Medical-Surgical, Critical, Administration, Pediatric, and Obstetric, Gynecologic departments. Accordingly, all necessary modifications were introduced.
3. The reliability of the modified Hand Hygiene Moments 5 Observation Form tool was established by testing and retesting, on 20 Medical-Surgical internship nursing.
4. A pilot study was carried out after tool modification, on 5 internship nurses, in the previous mentioned settings; to ensure clarity, applicability, and feasibility of the tool.
5. To minimize the differences between the observers, only one internship preceptor was recording observations, to every internship nurse regarding HH opportunities, and the number of actual HH events in every unit. Concealed observations were maintained, throughout the study data collection phase.
6. **Data Collection:**- Every preceptor was trained on how to apply all the strategy steps, and how to fill-in the observation checklist items. This checklist was used to observe internship nurse 'hand hygiene compliance during providing patient' care in her assigned department, throughout varied opportunities.
  - Each time an observed internship student entered the patient zone from the health-care area, the preceptor observed him/her if follow the WHO "Five Moments For Hand Hygiene" in each procedure that was done for the patient or not.
  - Observations were carried out for every internship nurse two times (initially one month post the interventional strategy, and the other ' three months later.
  - Every nurse was observed on various days of the week throughout the morning and evening shifts, in all units except operating rooms (morning shifts only) to allow multiple observations of internship nurse 'compliance, obtain more representative results and to identify if differences existed between the two shifts.
  - Observations were to the extent possible, without compromising patient care or privacy. Sinks for hand washing were available at each unit in all hospital plus wall mounted dispensers containing 70% alcohol- based hand gel. The data were collected from the beginning of September 2016 till the end of December 2016.

#### Statistical Analysis:

Data were fed to computer and analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. Quantitative data were described using mean, standard deviation. Significance of the obtained results was judged at the 5% level. Chi-square test was used for categorical variables, to compare between different hospitals departments, Monte Carlo correction ; correction for Chi-square when more than 20% of the cells have expected count less than 5. In addition, f-test (ANOVA) was used to compare between more than two hospitals. P value of  $\leq 0.05$  was used to assess the significance of the results.

### IV. Results

**Table (1): Shows compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning shift post strategy one and three months in Pediatric and Obstetric at Elshatby hospital.** After one month post the interventional strategy, the findings showed that the percent of hand washing compliance among more than half of the internship nurses was high in the pediatric department in the 5 indications as well as in three opportunities. In the obstetric department, the results showed that more than half of the internship nurses complied with hand wash in some indications but more than one third of them were not complying, before touching patients and their surrounding (50.0 %, 37.5% respectively). A significant difference was detected between the two departments; as p value 0.001%, 0.043%, 0.015 % respectively after touching patient surrounding, and before touching a patient. Three months post intervention; the findings showed that the percent of hand washing compliance was decreased as compared to one month later. In pediatrics, more than one third of the participants didn't comply especially before touching patients and after touching the surroundings (42.9 %, 48.6 %, and 60.0% respectively). Regarding Obstetric, the table shows that half and more than half of the nurses didn't comply at all with HH action in almost all the 5 indications. A highly statistical significant difference was present between the two departments.

**Table (2): Portrays compliance perception of internship nurses regarding HH practice in the 5 indications throughout evening shift post strategy one and three months in Pediatric and Obstetric & Gynecologic at Elshatby hospital.** The findings revealed that one month post intervention the percent of compliance to hand washing and rub among the studied nurses, were prominent in the Pediatric department in the 5 indications of the

three opportunities. In relation to Obstetric department, the table shows that half and more than half of the nurses didn't comply to hand washing in the 5 indications, while 37.5%, and 50.0% of them didn't comply before touching patients and after touching the surroundings. A highly statistical significant difference was observed between the two departments before touching patient, after body fluid exposure risk, and after touching patient surrounding (0.045 %, 0.023%· 0.014 %· 0.018%, 0.004 %· 0.001%· and 0.040 % respectively) in the three opportunities. Three months post intervention, the table shows that the percent of compliance significantly declined as compared after one month in the Pediatric department regarding three opportunities (57.1%, 8.6 %, 42.9 % respectively). On the other hand (45.7 %, 40.0 %, 51.4 %, 48.6%) of participants were non-complying to HH after body fluid exposure risk, after and before touching patients and after touching surroundings. In relation to obstetric department, the findings show that more than half of the study sample were non-compliant to HH as compared to the first month. A highly statistical significant difference was evident between the two departments.

**Figure (1): Illustrates comparisons between the mean value of the compliance perception to HH action in the 5 indications throughout the morning and evening shifts post strategy one and three months in Pediatric and Obstetric departments at Elshatby hospital.** The findings reveal that the mean percent score of the nurses compliance to HH action in the Pediatric department was much better than in Obstetric after one as well as three months post intervention at both shifts. Moreover, the figure shows that the mean percent score of compliance to HH action in the Pediatric department was markedly decreased three months post intervention than before (67.62%, 52.78% respectively) & (44.57%, 44.25% respectively).

**Table (3): Conveys comparison among the different departments according to compliance perception at the Main university, Smouha, Student, and El-Moassat Alexandria University Hospitals.** After one month, the results showed that ICU unit had the highest mean/standard deviation of compliance compared with other units one month post HH intervention at both shifts (57.92± 24.55, 72.92± 13.87, 70.0±10.33, 80.0±8.78, 75.42±6.76, and 77.50±9.07 respectively). For Administration departments, it was noted that the mean percent score of compliance was high at evening shift than the morning (65.0±12.62, 63.33±11.55 consecutively). OR unit's nurses showed higher mean percent score of compliance in all opportunities in the morning and evening shifts than other Medical-Surgical units (70.67± 16.06, 40.0± 16.33, 46.67±28.67, 72.0±15.20, 52.0±24.68, 52.0±30.33 respectively). Significant differences found among different departments. The table shows an observable decrease in the mean percent of compliance of the nurses three months post HH interventional strategy both at morning and evening shifts as compared to the initial follow up. The mean percent of compliance in the ICU was decreased than before in both shifts (39.58±14.29, 57.50±16.31, 52.08±17.42, 60.42±13.44, 50.0±21.50, and 52.08±14.85 respectively), and in Administration departments (15.0±11.39, 25.0±17.53, 18.33±10.0, 21.67±10.0, and 20.0±10.89 consecutively). In relation to the Medical- Surgical departments, the results show that the mean percent of the nurses' compliance in the Urology unit was markedly improved than before (37.78±10.18, 46.67±6.67, 28.89±19.25, 42.22±10.18, 53.33±13.33, and 62.22±21.43 respectively). Positive statistical significant differences existed among the different departments (p = 0.033, 0.001 respectively).

**Table (4): Portrays comparison between the different departments according to compliance perception at Elhadara hospital:** the results revealed positive significant differences among the three units one month as well as three months post HH intervention at morning and evening shifts. After one month, the Epilepsy ICU had a higher percent score of nurses compliance as compared to the other units both at morning, and evening shifts (73.33 ± 9.43, 63.33 ± 6.67, 75.0 ± 10.0, 81.67 ± 10.0, and 65.0 ± 16.67 respectively). After three months of HH intervention, in spite of the marked decline in the mean score of the nurses' compliance throughout all units in the morning and evening shifts, Epilepsy ICU unit still had a high percent score of the compliance of the subjects as compared to the other units in the three opportunities (37.22 ± 17.63, 37.22 ± 13.77, 42.78 ± 14.90, 45.0 ± 27.95, 30.0 ± 19.25, and 33.33 ± 18.05 consecutively).

**Table (5): Shows compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning shift post strategy one and three months at the main university/Elhadara hospital.** In relation to Critical care department; the table shows that more than one quarter of the internship nurses became compliant one month after the educational intervention of hand washing in the 5 indications. Regarding Administration department, half and more than half of the study subjects were compliant in relation to hand washing as well as rub in 5 indications. Concerning Medical- Surgical department, the table denotes that non-compliance was observed in more than one quarter of the nurses, especially before and after touching patients, after touching patient surrounding, and before clean/aseptic procedure technique in the three opportunities. There

were statistical significant differences among the three departments ( $p=0.026\%$ ,  $0.001\%$ ,  $0.007\%$ ,  $40.0\%$ ,  $0.029\%$  respectively). However, after three months, there was a significant decline in the mean percent score of subjects' compliance in the three departments. Concerning the Critical care department, the results concluded that the majority of the internship nurses had missed /improper HH in the 5 indications in the three opportunities. Regarding the Administration, Medical- Surgical departments, it was observed that all the nurses were non-compliant regarding HH actions in the 5 indications. Statistical significant difference among the three departments, were detected ( $p=0.049\%$ ,  $0.003\%$ ,  $0.001\%$ ,  $0.038\%$ ,  $0.036\%$ , and  $0.002\%$  -  $0.016\%$  consecutively).

**Table (6): Portrays compliance perception of internship nurses regarding HH practice in the 5 indications throughout evening shift post strategy one and three months at the main university/Elhadara hospital.** After one month, there were statistical significant differences among the three departments. Regarding Critical care department; the table shows that all the study nurses complied to hand washing in 5 indications. In relation to Administration department, the findings showed that the percent of compliance to (HW/HR) was markedly high among all the nurses in the 5 indications after implementation of educational intervention throughout the three opportunities. concerning Medical- Surgical department, the table denotes that more than one quarter of nurses were compliant in relation to hand washing in almost the 5 indications in spite of more than one quarter of them were non-compliant especially before and after touching patients, after touching patient surrounding, and before clean/aseptic technique in the three opportunities ( $40.0\%$ ,  $43.3\%$ ,  $36.7\%$ ,  $31.7\%$ ,  $35.0\%$ , consecutively). Three months later, it was found that hand washing compliance was observed in more than one quarter of the study nurses in Critical care department. In contrast to these findings, the table showed that all the nurses non-compliant to HH in all 5 indications throughout the three opportunities in Administration and Medical- Surgical department. There were statistical significant differences among the three departments ( $p=0.006\%$ ,  $0.004\%$ ,  $0.001\%$ ,  $0.003\%$ , and  $0.019\%$  consecutively).

**Figure (2): Demonstrates comparison among the mean value of the compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning and evening shifts post strategy one and three months in Critical, Administration, and Medical- Surgical departments at the Main university and Elhadara hospital.** The figure reveals that one month post HH intervention, the mean percent value of the internship nurses compliance to HH action in the Critical care department was much better than in Administration and Medical- Surgical department ( $60.4\%$ ,  $57.2\%$ ,  $46.0\%$  respectively) in the morning shift as compared to evening shift, the Administration department showed higher mean percent of compliance to HH action than those in the other two departments ( $69.4\%$ ,  $65.5\%$ ,  $50.8\%$  consecutively). On the other hand, three months post intervention, the figure conveys that these mean percent values were markedly decreased as compared to after one month. Moreover, Critical care department showed higher mean percent score of compliance throughout the 5 indications in the three opportunities both at morning as well as evening ( $38.9\%$ ,  $46.0\%$  respectively). Administration department showed the lowest mean percent score of compliance ( $19.4\%$ ,  $20.0\%$  consecutively) in the morning as well as in the evening.

**Figure (3): Portrays comparison between different departments in the three hospitals according to the compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning and evening shifts post strategy one and three months.** The follow up revealed that, the highest mean percent score of the participants' compliance to HH action was in the Pediatric department in both morning and evening shifts ( $67.6\%$ ,  $68.5\%$ ,  $44.6\%$ , and  $44.3\%$  respectively). On the other hand, the figure shows that the Medical- Surgical department had the lowest mean percent score of the nurses' compliance throughout the 5 indications in the three opportunities ( $46.0\%$ ,  $50.8\%$ ,  $27.0\%$ , and  $26.5\%$  respectively).

**Table (1):**Distribution of compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning shift post strategy one and three months in Pediatrics and Obstetric&Gyne at Elshatby hospital.(n =43)

Morning shift			El Shatby										MC_p
			Month 1				MC_p	Month 3				MC_p	
			Pediatrics (n= 35)		Obstetric (n= 8)			Pediatrics (n= 35)		Obstetric (n= 8)			
Oppo.	Indications	Action	No.	%	No.	%	No.	%	No.	%			
Opp1	Before touching patient	Missed	3	8.6	1	12.5	0.180	6	17.1	4	50.0	0.008*	
		Improper	0	0.0	1	12.5		0	0.0	1	12.5		
		Hand washing	26	74.3	6	75.0		29	82.9	3	37.5		
			Hand rub	6	17.1	0	0.0	0	0.0	0	0.0		
	Before clean/aseptic technique	Missed	3	8.6	1	12.5	0.587	4	11.4	1	12.5	1.000	
		Improper	1	2.9	0	0.0		1	2.9	0	0.0		
		Hand washing	20	57.1	6	75.0		29	82.9	7	87.5		
			Hand rub	11	31.4	1	12.5	1	2.9	0	0.0		
	After body fluidexposure risk	Missed	0	0.0	1	12.5	0.085	12	34.3	1	12.5	0.330	
		Improper	3	8.6	0	0.0		2	5.7	2	25.0		
		Hand washing	22	62.9	7	87.5		20	57.1	5	62.5		
			Hand rub	10	28.6	0	0.0	1	2.9	0	0.0		
	After touching patient	Missed	5	14.3	3	37.5	0.057	7	20.0	4	50.0	0.144	
		Improper	1	2.9	0	0.0		9	25.7	0	0.0		
		Hand washing	15	42.9	5	62.5		19	54.3	4	50.0		
		Hand rub	14	40.0	0	0.0	0	0.0	0	0.0			
After touching patient surrounding	Missed	11	31.4	1	12.5	0.001*	15	42.9	6	75.0	0.449		
	Improper	0	0.0	1	12.5		2	5.7	0	0.0			
	Hand washing	8	22.9	6	75.0		17	48.6	2	25.0			
		Hand rub	16	45.7	0	0.0	1	2.9	0	0.0			
Opp2	Before touching patient	Missed	3	8.6	3	37.5	0.043*	17	48.6	6	75.0	0.032*	
		Improper	1	2.9	1	12.5		0	0.0	1	12.5		
		Hand washing	23	65.7	2	25.0		18	51.4	1	12.5		
			Hand rub	8	22.9	2	25.0	0	0.0	0	0.0		
	Before clean/aseptic technique	Missed	4	11.4	0	0.0	0.118	15	42.9	7	87.5	0.055*	
		Improper	2	5.7	0	0.0		1	2.9	0	0.0		
		Hand washing	18	51.4	8	100.0		19	54.3	1	12.5		
			Hand rub	11	31.4	0	0.0	0	0.0	0	0.0		
	After body fluidexposure risk	Missed	3	8.6	1	12.5	0.233	4	11.4	1	12.5	<0.001	
		Improper	1	2.9	0	.0		3	8.6	7	87.5		
		Hand washing	20	57.1	7	87.5		26	74.3	0	0.0		
			Hand rub	11	31.4	0	.0	2	5.7	0	0.0		
	After touching patient	Missed	2	5.7	1	12.5	0.095	2	5.7	1	12.5	0.098	
		Improper	2	5.7	1	12.5		2	5.7	1	12.5		
		Hand washing	18	51.4	6	75.0		18	51.4	6	75.0		
		Hand rub	13	37.1	0	0.0	13	37.1	0	0.0			
After touching patient surrounding	Missed	8	22.9	4	50.0	0.337	12	34.3	8	100.0	0.004*		
	Improper	1	2.9	0	0.0		7	20.0	0	0.0			
	Hand washing	12	34.3	3	37.5		16	45.7	0	0.0			
		Hand rub	14	40.0	1	12.5	0	0.0	0	0.0			
Opp3	Before touching patient	Missed	3	8.6	1	12.5	0.423	8	22.9	6	75.0	0.046*	
		Improper	2	5.7	0	0.0		8	22.9	0	0.0		
		Hand washing	22	62.9	7	87.5		18	51.4	2	25.0		
			Hand rub	8	22.9	0	0.0	1	2.9	0	0.0		
	Before clean/aseptic technique	Missed	4	11.4	2	25.0	0.148	17	48.6	8	100.0	0.013*	
		Improper	1	2.9	0	0.0		0	0.0	0	0.0		
		Hand washing	18	51.4	6	75.0		18	51.4	0	0.0		
			Hand rub	12	34.3	0	0.0	0	0.0	0	0.0		
	After body fluidexposure risk	Missed	6	17.1	1	12.5	1.000	8	22.9	3	37.5	0.013*	
		Improper	1	2.9	0	0.0		2	5.7	2	25.0		
		Hand washing	19	54.3	5	62.5		25	71.4	2	25.0		
			Hand rub	9	25.7	2	25.0	0	0.0	1	12.5		
	After touching patient	Missed	4	11.4	3	37.5	0.065	14	40.0	3	37.5	0.008*	
		Improper	1	2.9	0	0.0		2	5.7	3	37.5		
		Hand washing	17	48.6	5	62.5		19	54.3	1	12.5		
		Hand rub	13	37.1	0	0.0	0	0.0	1	12.5			
After touching patient surrounding	Missed	10	28.6	2	25.0	0.015*	21	60.0	7	87.5	0.220		
	Improper	1	2.9	2	25.0		4	11.4	1	12.5			
	Hand washing	9	25.7	4	50.0		10	28.6	0	0.0			
		Hand rub	15	42.9	0	0.0	0	0.0	0	0.0			

MC p<0.001\*

**Table (2):** Distribution of compliance perception of internship nurses regarding HH practice in the 5 indications throughout evening shift post strategy one and three months in Pediatric and Obstetric & Gyne at Elshatby hospital. (n =43)

Evening shift			El Shatby								MC p	
			Month 1				MC p	Month 3				
			Pediatrics (n= 35)		Obstetric (n= 8)			Pediatrics (n= 35)		Obstetric (n= 8)		
Oppo.	Indications	Action	No.	%	No.	%	No.	%	No.	%	MC p	
			Oop1	Before touching patient	Missed	4	11.4	3	37.5	14		40.0
Improper	0	0.0			1	12.5	1	2.9	1	12.5		
Hand washing	25	71.4			4	50.0	20	57.1	4	50.0		
Hand rub	6	17.1			0	0.0	0	0.0	0	0.0		
Before clean/aseptic technique	Missed	4		11.4	0	0.0	5	14.3	0	0.0	0.420	
	Improper	0		0.0	0	0.0	0	0.0	0	0.0		
	Hand washing	16		45.7	6	75.0	28	80.0	8	100.0		
After body fluid exposure risk	Missed	7		20.0	0	0.0	16	45.7	0	0.0	0.023*	
	Improper	0		0.0	0	0.0	9	25.7	3	37.5		
	Hand washing	16		45.7	8	100.0	4	11.4	5	62.5		
	Hand rub	12		34.3	0	0.0	6	17.1	0	0.0		
After touching patient	Missed	6		17.1	1	12.5	14	40.0	1	12.5	0.833	
	Improper	2		5.7	0	0.0	3	8.6	2	25.0		
	Hand washing	18		51.4	6	75.0	15	42.9	4	50.0		
	Hand rub	9		25.7	1	12.5	3	8.6	1	12.5		
After touching patient surrounding	Missed	5	14.3	2	25.0	8	22.9	6	75.0	0.250		
	Improper	2	5.7	0	0.0	3	8.6	2	25.0			
	Hand washing	13	37.1	5	62.5	23	65.7	0	0.0			
	Hand rub	15	42.9	1	12.5	1	2.9	0	0.0			
Oop2	Before touching patient	Missed	2	5.7	3	37.5	18	51.4	5	62.5	0.014*	
		Improper	2	5.7	1	12.5	12	34.3	1	12.5		
		Hand washing	22	62.9	1	12.5	3	8.6	2	25.0		
		Hand rub	9	25.7	3	37.5	2	5.7	0	0.0		
	Before clean/aseptic technique	Missed	3	8.6	2	25.0	14	40.0	8	100.0	0.101	
		Improper	0	0.0	0	0.0	0	0.0	0	0.0		
		Hand washing	21	60.0	6	75.0	21	60.0	0	0.0		
	After body fluid exposure risk	Missed	5	14.3	0	0.0	5	14.3	0	0.0	0.018*	
		Improper	0	0.0	0	0.0	2	5.7	6	75.0		
		Hand washing	16	45.7	8	100.0	24	68.6	2	25.0		
		Hand rub	14	40.0	0	0.0	4	11.4	0	0.0		
	After touching patient	Missed	4	11.4	0	0.0	6	17.1	0	0.0	0.568	
		Improper	4	11.4	0	0.0	5	14.3	7	87.5		
		Hand washing	19	54.3	7	87.5	23	65.7	1	12.5		
		Hand rub	8	22.9	1	12.5	1	2.9	0	0.0		
After touching patient surrounding	Missed	5	14.3	3	37.5	9	25.7	6	75.0	0.004*		
	Improper	0	0.0	2	25.0	0	0.0	2	25.0			
	Hand washing	15	42.9	3	37.5	26	74.3	0	0.0			
	Hand rub	15	42.9	0	0.0	0	0.0	0	0.0			
Oop3	Before touching patient	Missed	1	2.9	4	50.0	10	28.6	8	100.0	0.001*	
		Improper	1	2.9	1	12.5	7	20.0	0	0.0		
		Hand washing	22	62.9	3	37.5	15	42.9	0	0.0		
		Hand rub	11	31.4	0	0.0	3	8.6	0	0.0		
	Before clean/aseptic technique	Missed	3	8.6	1	12.5	8	22.9	8	100.0	0.150	
		Improper	1	2.9	0	0.0	1	2.9	0	0.0		
		Hand washing	19	54.3	7	87.5	26	74.3	0	0.0		
	After body fluid exposure risk	Missed	7	20.0	0	0.0	14	40.0	1	12.5	0.483	
		Improper	1	2.9	0	0.0	3	8.6	4	50.0		
		Hand washing	17	48.6	6	75.0	17	48.6	2	25.0		
		Hand rub	10	28.6	2	25.0	1	2.9	1	12.5		
	After touching patient	Missed	7	20.0	0	0.0	8	22.9	4	50.0	0.148	
		Improper	1	2.9	0	0.0	2	5.7	4	50.0		
		Hand washing	17	48.6	6	75.0	20	57.1	0	0.0		
		Hand rub	10	28.6	2	25.0	5	14.3	0	0.0		
After touching patient surrounding	Missed	3	8.6	3	37.5	17	48.6	7	87.5	0.040*		
	Improper	0	0.0	0	0.0	5	14.3	1	12.5			
	Hand washing	21	60.0	5	62.5	9	25.7	0	0.0			
	Hand rub	11	31.4	0	0.0	4	11.4	0	0.0			

MC p<0.001\*



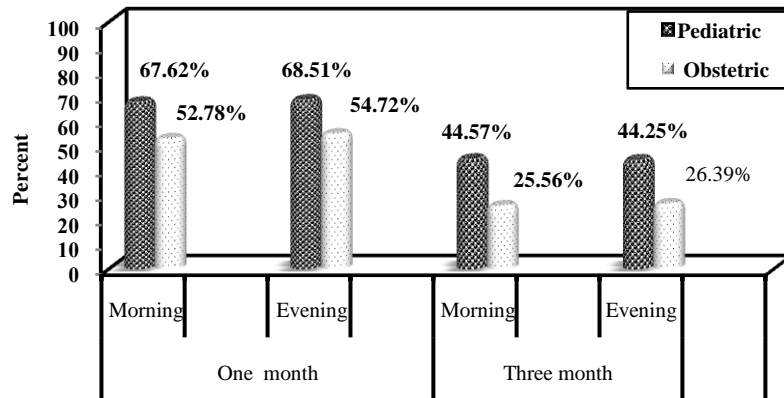


Figure (1): Comparison between the mean value of the compliance perception to HH action in the 5 indications throughout the morning and evening shift post strategy one and three months in pediatric and obstetric departments at el shatby hospital.

Table (3): Conveys comparison among the different departments according to compliance perception at the Main University, Smouha, Student, and El-Moassat Alexandria University Hospitals. (n=123)

Month	Shift	Critical				Nursing Administration (N=4)	Medical -Surgical						p	
		Recovery (N=48)	Emergency (ICU) (N=5)	Thoracic (ICU) (N=4)	ICU (N=16)		Medical (ICU) (N=9)	O.R (N=5)	Neuro (ICU) (N=7)	Burn (ICU) (N=13)	Urology (ICU) (N=3)	Dialysis (N=9)		
One Month	Morning													
	Oop1	52.36 ± 24.68	62.67 ± 18.62	33.33 ± 14.40	37.92 ± 24.35	51.67 ± 6.38	37.04 ± 17.36	70.67 ± 16.06	40.95 ± 20.16	33.33 ± 21.43	55.56 ± 10.18	43.93 ± 19.85		0.604
	Oop2	60.0 ± 20.63	62.67 ± 25.21	31.67 ± 13.74	72.92 ± 13.87	50.0 ± 8.61	37.04 ± 14.95	40.0 ± 16.33	37.14 ± 12.68	41.03 ± 13.01	33.33 ± 6.67	43.70 ± 17.36		<0.001*
	Oop3	57.08 ± 26.36	56.0 ± 17.38	33.33 ± 13.40	70.0 ± 10.33	45.0 ± 6.38	42.96 ± 13.38	46.67 ± 28.67	39.05 ± 15.60	47.69 ± 19.22	46.67 ± 11.55	40.0 ± 27.69		0.028*
	Evening													
	Oop1	63.06 ± 24.98	58.67 ± 12.82	61.67 ± 16.67	80.0 ± 8.78	65.0 ± 12.62	60.0 ± 14.14	72.0 ± 15.20	40.95 ± 17.82	51.28 ± 20.80	48.89 ± 7.70	44.44 ± 19.72		0.001*
Oop2	59.03 ± 23.38	66.67 ± 20.0	50.0 ± 11.55	75.42 ± 6.76	65.0 ± 12.62	45.19 ± 24.67	52.0 ± 24.68	29.52 ± 12.68	43.08 ± 20.11	48.89 ± 3.85	45.93 ± 16.81		<0.001*	
Oop3	61.67 ± 25.38	56.0 ± 21.40	33.33 ± 16.33	77.50 ± 9.07	63.33 ± 11.55	40.0 ± 11.06	52.0 ± 30.33	37.14 ± 20.68	52.31 ± 19.41	60.0 ± 11.55	53.33 ± 24.49		0.002*	
Three Month	Morning													
	Oop1	41.81 ± 18.18	40.0 ± 18.86	18.33 ± 18.36	39.58 ± 14.29	15.0 ± 11.39	31.85 ± 22.55	17.33 ± 18.62	35.24 ± 19.52	23.08 ± 19.55	37.78 ± 10.18	13.33 ± 13.33		0.033*
	Oop2	41.81 ± 19.29	18.67 ± 11.93	21.67 ± 22.03	57.50 ± 16.31	25.0 ± 17.53	52.59 ± 13.92	30.67 ± 23.85	45.71 ± 18.23	23.59 ± 10.75	46.67 ± 6.67	19.26 ± 11.28		<0.001*
	Oop3	35.56 ± 18.77	22.67 ± 16.73	26.67 ± 18.86	52.08 ± 17.42	18.33 ± 10.0	38.52 ± 10.42	10.67 ± 23.85	38.10 ± 13.72	13.33 ± 9.81	28.89 ± 19.25	22.22 ± 5.77		<0.001*
	Evening													
	Oop1	50.97 ± 21.72	56.0 ± 12.11	30.0 ± 27.49	60.42 ± 13.44	18.33 ± 10.0	51.11 ± 12.47	30.67 ± 16.06	8.57 ± 11.36	17.44 ± 16.90	42.22 ± 10.18	7.41 ± 7.78		<0.001*
Oop2	47.36 ± 20.32	46.67 ± 9.43	43.33 ± 20.0	50.0 ± 21.50	21.67 ± 10.0	45.19 ± 17.57	33.33 ± 20.0	13.33 ± 16.78	12.31 ± 9.75	33.33 ± 13.33	14.07 ± 11.28		<0.001*	
Oop3	49.58 ± 25.80	24.0 ± 5.96	31.67 ± 27.42	52.08 ± 14.85	20.0 ± 10.89	33.33 ± 14.53	29.33 ± 17.38	10.48 ± 14.84	15.38 ± 14.24	62.22 ± 21.43	17.78 ± 12.91		<0.001*	

\*: Statistically Significant At P ≤ 0.05

Table (4): Comparison among the different departments according to compliance perception at El hadara Hospital: (n=24)

Follow Up	Shift	EL Hadara Hospital			F	P
		Orthopedic (ICU) (N=8)	Critical & Epilepsy Medicine (ICU) (N=4)	Neuro-Psichiatry (ICU) (N=12)		
Initial	Morning					+
	Oop1	67.50 ± 17.97	73.33 ± 9.43	61.67 ± 9.48	1.355	0.280
	Oop2	69.17 ± 6.11	63.33 ± 6.67	58.33 ± 9.48	4.287*	0.027*
	Oop3	72.50 ± 10.35	73.33 ± 9.43	61.11 ± 10.57	3.826	0.038*
	Evening					
	Oop1	69.17 ± 10.65	75.0 ± 10.0	66.11 ± 13.77	0.795	0.465
Oop2	70.0 ± 11.82	81.67 ± 10.0	63.33 ± 12.23	3.706*	0.042*	
Oop3	77.50 ± 10.65	65.0 ± 16.67	63.89 ± 11.18	3.329	0.055	
Later	Morning					
	Oop1	37.50 ± 18.49	37.22 ± 17.63	33.33 ± 23.09	0.076	0.927
	Oop2	12.50 ± 5.56	37.22 ± 13.77	36.67 ± 17.64	10.464*	0.001*
	Oop3	20.0 ± 20.16	42.78 ± 14.90	33.33 ± 19.63	4.061*	0.032*
	Evening					
	Oop1	31.67 ± 19.44	45.0 ± 27.95	30.0 ± 15.70	0.952	0.402
Oop2	11.67 ± 11.68	30.0 ± 19.25	36.11 ± 20.59	4.545*	0.023*	
Oop3	20.0 ± 18.86	33.33 ± 18.05	28.33 ± 17.09	0.888	0.426	

F: F Value for ANOVA Test

\*: Statistically Significant At P ≤ 0.05

Table (5): Distribution of studied sample according to the percentage of compliance to HH action in all 5 indications through the morning shift in the Main University/Elhadara hospital after one month and three months post HH intervention. (n=147)

O PP	Morning Shift	Indications	Action	Main University / El-Hadara Hospital												Sig		
				Month 1				Month 2				Month 3						
				Critical Care (N= 83)		Administration (N= 4)		Medical/Sur. (N= 60)		Critical Care (N= 83)		Administration (N= 4)		Medical/Sur. (N= 60)				
				No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
O op 1	Before Touching Patient	Mixed		28	33.7	2	50.0	24	40.0	0.903	46	55.4	3	75.0	31	51.7	0.56	2
		Impover		13	15.7	0	0.0	6	10.0		8	9.6	1	25.0	8	13.3		
		Hand Washing		28	33.7	1	25.0	21	35.0		26	31.3	0	0.0	16	26.7		
		Hand Rub		14	16.9	1	25.0	9	15.0		3	3.6	0	0.0	5	8.3		
	Before Clean/ Aseptic Technique	Mixed		4	4.8	0	0.0	12	20.0	0.026	23	30.1	3	75.0	23	38.3	0.05	1
		Impover		3	3.6	0	0.0	6	10.0		3	3.6	1	25.0	12	20.0		
		Hand Washing		37	68.7	2	50.0	31	51.7		47	56.6	0	0.0	22	36.7		
		Hand Rub		19	22.9	2	50.0	11	18.3		3	3.6	0	0.0	3	5.0		
	After Body Fluids exposure Risk	Mixed		6	7.2	0	0.0	16	26.7	<0.001	23	27.7	1	25.0	23	38.3	0.14	2
		Impover		2	2.4	1	25.0	11	18.3	1*	19	22.9	3	75.0	16	26.7		
		Hand Washing		48	57.8	1	25.0	20	33.3		30	36.1	0	0.0	19	31.7		
		Hand Rub		27	32.5	2	50.0	13	21.7		11	13.3	0	0.0	2	3.3		
After Touching Patient	Mixed		21	25.3	2	50.0	21	35.0	0.693	32	38.6	3	75.0	38	63.3	0.04	9*	
	Impover		12	14.5	1	25.0	7	11.7		16	19.3	1	25.0	9	15.0			
	Hand Washing		37	44.6	1	25.0	22	36.7		29	34.9	0	0.0	12	20.0			
	Hand Rub		13	15.7	0	0.0	10	16.7		6	7.2	0	0.0	1	1.7			
After Touching Patient Surrounding	Mixed		9	10.8	2	50.0	18	30.0	0.001	38	45.8	2	50.0	38	63.3	0.25	8	
	Impover		40	48.2	1	25.0	10	16.7		30	36.1	1	25.0	17	28.3			
	Hand Washing		19	22.9	1	25.0	15	25.0		9	10.8	1	25.0	4	6.7			
	Hand Rub		15	18.1	0	0.0	17	28.3		6	7.2	0	0.0	1	1.7			
O op 2	Before Touching Patient	Mixed		8	9.6	0	0.0	25	41.7	<0.001	28	33.7	2	50.0	36	60.0	0.00	3*
		Impover		20	24.1	1	25.0	10	16.7	1*	19	22.9	2	50.0	13	21.7		
		Hand Washing		30	36.1	0	0.0	16	26.7		31	37.3	0	0.0	7	11.7		
		Hand Rub		23	30.1	3	75.0	9	15.0		5	6.0	0	0.0	4	6.7		
	Before Clean/ Aseptic Technique	Mixed		3	3.6	0	0.0	31	51.7	<0.001	19	22.9	3	75.0	36	60.0	<0.001	01*
		Impover		3	3.6	1	25.0	4	6.7	1*	22	26.5	1	25.0	12	20.0		
		Hand Washing		45	54.2	0	0.0	17	28.3		18	21.7	0	0.0	8	13.3		
		Hand Rub		32	38.6	3	75.0	8	13.3		24	28.9	0	0.0	4	6.7		
	After Body Fluids exposure Risk	Mixed		3	3.6	0	0.0	9	15.0	0.007	15	18.1	1	25.0	22	36.7	0.32	0
		Impover		4	4.8	0	0.0	12	20.0		31	37.3	3	75.0	22	36.7		
		Hand Washing		48	57.8	3	75.0	24	40.0		30	36.1	0	0.0	15	25.0		
		Hand Rub		28	33.7	1	25.0	15	25.0		7	8.4	0	0.0	1	1.7		
After Touching Patient	Mixed		15	18.1	2	50.0	20	33.3	0.040	15	18.1	2	100.0	20	33.3	0.03	8*	
	Impover		23	27.7	0	0.0	7	11.7		23	27.7	0	0.0	7	11.7			
	Hand Washing		34	41.0	2	50.0	20	33.3		34	41.0	0	0.0	20	33.3			
	Hand Rub		11	13.3	0	0.0	13	21.7		11	13.3	0	0.0	13	21.7			
After Touching Patient Surrounding	Mixed		7	8.4	0	0.0	24	40.0	<0.001	41	49.4	0	0.0	36	60.0	0.03	6*	
	Impover		30	36.1	2	50.0	8	13.3	1*	18	21.7	3	75.0	17	28.3			
	Hand Washing		31	37.3	2	50.0	17	28.3		17	20.5	1	25.0	5	8.3			
	Hand Rub		15	18.1	0	0.0	11	18.3		7	8.4	0	0.0	2	3.3			
O op 3	Before Touching Patient	Mixed		22	26.5	1	25.0	28	46.7	0.091	46	55.4	3	75.0	38	63.3	0.00	2*
		Impover		14	16.9	0	0.0	4	6.7		6	7.2	1	25.0	11	18.3		
		Hand Washing		27	32.5	1	25.0	18	30.0		28	33.7	0	0.0	5	8.3		
		Hand Rub		20	24.1	2	50.0	10	16.7		3	3.6	0	0.0	6	10.0		
	Before Clean/ Aseptic Technique	Mixed		7	8.4	0	0.0	27	45.0	<0.001	27	32.5	2	50.0	35	58.3	0.01	6*
		Impover		3	3.6	0	0.0	6	10.0	1*	25	30.1	2	50.0	9	15.0		
		Hand Washing		56	67.5	3	75.0	18	30.0		21	25.3	0	0.0	14	23.3		
		Hand Rub		17	20.5	1	25.0	9	15.0		10	12.0	0	0.0	2	3.3		
	After Body Fluids exposure Risk	Mixed		6	7.2	0	0.0	14	23.3	0.029	20	24.1	1	25.0	20	33.3	0.15	5
		Impover		11	13.3	0	0.0	10	16.7		30	36.1	3	75.0	18	30.0		
		Hand Washing		35	42.2	4	100.0	20	33.3		22	26.5	0	0.0	20	33.3		
		Hand Rub		31	37.3	0	0.0	16	26.7		11	13.3	0	0.0	2	3.3		
After Touching Patient	Mixed		20	24.1	2	50.0	18	30.0	0.447	34	41.0	2	50.0	35	58.3	0.03	8*	
	Impover		15	18.1	0	0.0	7	11.7		16	19.3	2	50.0	13	21.7			
	Hand Washing		22	26.5	2	50.0	21	35.0		21	25.3	0	0.0	11	18.3			
	Hand Rub		26	31.3	0	0.0	14	23.3		12	14.5	0	0.0	1	1.7			
After Touching Patient Surrounding	Mixed		10	12.0	1	25.0	26	43.3	<0.001	30	36.1	1	25.0	39	65.0	0.00	1*	
	Impover		27	32.5	1	25.0	3	5.0	1*	27	32.5	3	75.0	16	26.7			
	Hand Washing		16	19.3	2	50.0	17	28.3		7	8.4	0	0.0	4	6.7			
	Hand Rub		30	36.1	0	0.0	14	23.3		19	22.9	0	0.0	1	1.7			

Mc p<0.001\*

Table (6): Distribution of studied sample according to the percentage of compliance to HH action in all 5 indications through the evening shift in the Main University/Elhadara hospital after one month and three months post HH intervention.(N=147)

Opp	Indications	Action	Main University / El-Hadara Hospital									Sig				
			Month 1			Month 2			Month 3							
			Critical Care (N= 83)	Administration (N= 4)	Medical/Sur. (N= 60)	Critical Care (N= 83)	Administration (N= 4)	Medical/Sur. (N= 60)	Critical Care (N= 83)	Administration (N= 4)	Medical/Sur. (N= 60)					
			No.	%	No.	%	No.	%	No.	%	No.	%				
Opp1	Before Teaching Patient	Mixed	3	9.6	0	0.0	14	23.3	0.001	17	20.5	3	75.0	23	41.7	0.00
		Improper	6	7.2	0	0.0	5	8.3		16	19.3	1	25.0	16	26.7	6
		Hand Washing	40	48.2	1	25.0	29	48.3		39	47.0	0	0.0	14	23.3	
	Before Clean/Aspic Technique	Mixed	7	8.4	0	0.0	13	21.7	0.007	21	25.3	3	75.0	25	41.7	0.00
		Improper	3	3.6	0	0.0	5	8.3		14	16.9	1	25.0	1	1.3	4
		Hand Washing	39	47.0	2	50.0	33	55.0		21	25.3	0	0.0	19	31.7	
	After Body Fluids/exposarc Risk	Mixed	6	7.2	0	0.0	11	18.3	0.121	16	19.3	2	50.0	24	40.0	0.16
		Improper	3	3.6	0	0.0	7	11.7		20	24.1	2	50.0	14	23.3	8
		Hand Washing	43	51.8	2	50.0	26	43.3		37	44.6	0	0.0	19	31.7	
	After Teaching Patient	Mixed	12	14.5	0	0.0	19	31.7	0.039	17	20.5	2	50.0	39	65.0	<0.0
		Improper	6	7.2	1	25.0	4	6.7		20	24.1	2	50.0	4	6.7	0.1
		Hand Washing	52	62.7	2	50.0	24	40.0		40	48.2	0	0.0	16	26.7	
After Teaching Patient Surrounding	Mixed	13	15.7	1	25.0	13	21.7	0.002	6	7.2	0	0.0	1	1.7	6	
	Improper	3	3.6	1	25.0	16	26.7		27	32.5	2	50.0	38	63.3	0.00	
	Hand Washing	45	54.2	2	50.0	26	43.3		24	28.9	1	25.0	12	20.0	6	
Opp2	Before Teaching Patient	Mixed	7	8.4	0	0.0	15	25.0	<0.001	6	7.2	0	0.0	2	3.3	<0.0
		Improper	9	10.8	0	0.0	7	11.7	1	20	24.1	2	50.0	39	65.0	0.1
		Hand Washing	33	40.0	2	50.0	20	33.3		14	16.9	1	25.0	9	15.0	
	Before Clean/Aspic Technique	Mixed	7	8.4	0	0.0	26	43.3	<0.001	23	27.7	2	50.0	36	60.0	<0.0
		Improper	3	3.6	0	0.0	2	3.3	1	14	16.9	2	50.0	4	6.7	0.1
		Hand Washing	49	59.0	3	75.0	22	36.7		29	34.9	0	0.0	17	28.3	
	After Body Fluids/exposarc Risk	Mixed	7	8.4	0	0.0	10	16.7	0.101	17	20.5	0	0.0	3	5.0	3
		Improper	5	6.0	0	0.0	11	18.3		16	19.3	1	25.0	24	40.0	0.00
		Hand Washing	47	56.6	3	75.0	28	46.7		24	28.9	3	75.0	12	20.0	0.00
	After Teaching Patient	Mixed	15	18.1	1	25.0	15	25.0	0.006	31	37.3	0	0.0	23	38.3	0.09
		Improper	7	8.4	0	0.0	3	5.0		12	14.5	0	0.0	1	1.7	7
		Hand Washing	56	67.3	3	75.0	23	38.3		24	28.9	3	75.0	31	51.7	
After Teaching Patient Surrounding	Mixed	5	6.0	0	0.0	14	23.3	0.001	30	36.1	1	25.0	14	23.3	0.00	
	Improper	10	12.0	0	0.0	22	36.7	1	5	6.0	0	0.0	2	3.3	1	
	Hand Washing	16	19.3	2	50.0	6	10.0		22	26.5	1	25.0	18	30.0		
Opp3	Before Teaching Patient	Mixed	7	8.4	0	0.0	25	41.7	<0.001	8	9.6	0	0.0	0	0.0	<0.0
		Improper	6	7.2	0	0.0	6	10.0	1	27	32.5	2	50.0	39	65.0	0.1
		Hand Washing	49	59.0	1	25.0	19	31.7		8	9.6	2	50.0	8	13.3	
	Before Clean/Aspic Technique	Mixed	3	3.6	0	0.0	3	5.0	0.001	42	50.6	0	0.0	9	15.0	0.00
		Improper	44	53.0	4	100.0	23	38.3	1	6	7.2	0	0.0	4	6.7	1
		Hand Washing	23	28.0	0	0.0	12	20.0		24	28.9	1	25.0	34	56.7	
	After Body Fluids/exposarc Risk	Mixed	4	4.8	0	0.0	11	18.3	0.042	16	19.3	2	50.0	5	8.3	0.16
		Improper	6	7.2	0	0.0	6	10.0		20	24.1	1	25.0	12	20.0	2
		Hand Washing	45	54.2	4	100.0	22	36.7		23	27.7	0	0.0	5	8.3	
	After Teaching Patient	Mixed	11	13.3	0	0.0	21	35.0	0.020	19	22.9	3	75.0	23	38.3	0.01
		Improper	11	13.3	0	0.0	7	11.7		18	21.7	1	25.0	12	20.0	9
		Hand Washing	43	51.8	4	100.0	20	33.3		34	41.0	0	0.0	20	33.3	
After Teaching Patient Surrounding	Mixed	9	10.8	0	0.0	19	31.7	0.005	12	14.5	0	0.0	5	8.3	0.00	
	Improper	15	18.1	2	50.0	6	10.0		30	36.1	2	50.0	36	60.0	1	
	Hand Washing	36	43.4	2	50.0	16	26.7		19	22.9	2	50.0	10	16.7		

Mc p<0.001\*

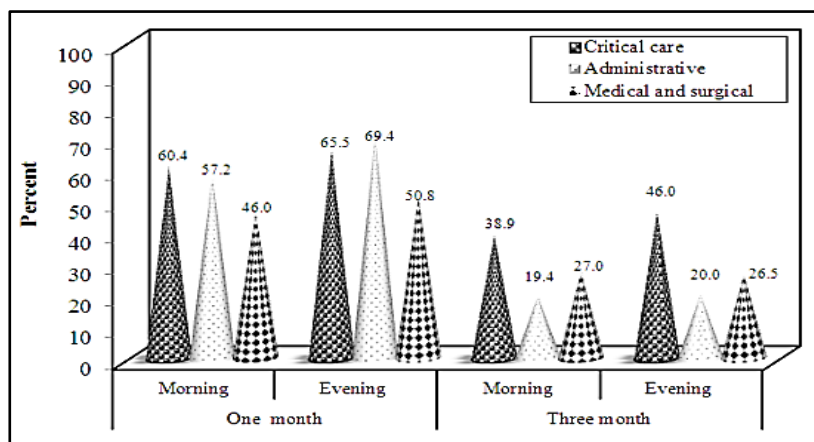
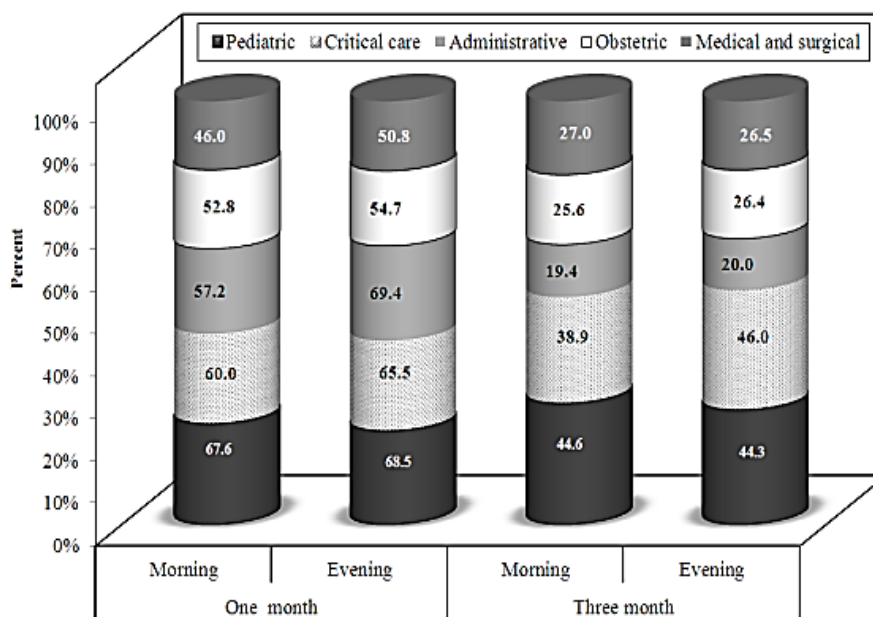


Figure (2) : Comparison between the mean value of the compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning and evening shifts post strategone and three months in Critical, Administration, and Medical- Surgical departments



**Figure (3): Comparison between different departments in the three hospitals according to the compliance perception of internship nurses regarding HH practice in the 5 indications throughout morning and evening shifts post strategy one and three months.**

## V. Discussion

Hand Hygiene at five moments is considered the easiest way to anticipate the dissemination of infection. However, improving hand washing compliance and maintaining this behavioral change is a significant challenge, because of the complexities of the health care environment and changing behavior<sup>(25)</sup>. Numerous studies have documented the pivotal role of healthcare workers' (HCWS) hands in the propagation of micro-organisms within the healthcare environment and ultimately to patients<sup>(26,27)</sup>.

The current study showed a dramatic improvement in hand hygiene practice among the internship students nurses one month post HH interventional strategy. After one month at the morning, the percent of hand washing compliance among more than half of the internship nurses was obvious in Pediatric department. In relation to Obstetric & Gynecology department, the results showed that more than half of the internship nurses were complied to hand washing in some indications, nevertheless more than one third did not comply especially before touching patients and their surroundings.

These findings are supported by a study done by Abdelaziz, and Bakr (2009) to assess knowledge, attitude and practice of hand washing among HCWS in Ain Shams University hospitals in Cairo<sup>(28)</sup>. They found that the percent of compliance to HH in Pediatrics (NICU) was 62.5% and 39.4% in Gynecology. These results were compared with Won (2004) study in a teaching hospital where he found compliance to hand hygiene in NICU was 43%<sup>(29)</sup>. A similar study was conducted by Mahfouz et al (2013) on non-compliance among ICU unit HCWs in Aseer Central Hospital, south-western Saudi Arabia. They found that, higher levels of non-compliance were found before patient contact<sup>(30)</sup>. The WHO indicated poor levels of compliance before aseptic task and suggested that high risk activities have lower compliance<sup>(31,32)</sup>. Also, Allegranzi and Pittet (2009) reported that HCWS compliance was high when hands were visibly dirty or sticky<sup>(33)</sup>.

Unfortunately, this compliance was reduced three months from the educational intervention. The findings showed that the percent of hand washing compliance was decreased in Pediatrics as compared to earlier assessment. This could be explained by work overload, visitors' inflow, and availability of facilities. This is in agreement with a study by Cantrel, et al (2009) on HH compliance by physicians: marked heterogeneity due to local culture? that 81% of hospital hand hygiene compliance rate post-intervention phase, decreased after six months to be 59%<sup>(34)</sup>. The current results showed that the majority of nurses were more likely to use soap and water compared to alcohol-based hand hygiene disinfectant in Pediatric and Obstetric & Gynecologic department. These findings were congruent with the results of a study by Karaaslan, et al. (2014) WHO examined the compliance of HCWS with HH practices in Neonatal and Pediatric ICU and concluded that HCWS preferred to use soap and preferred water instead of alcohol-based hand hygiene disinfectant<sup>(35)</sup>. Alcohol-based disinfectants were not preferred probably because of the unpleasant irritation effects on the hands and lack of knowledge concerning its benefits.

The current results denoted that no marked differences between the morning and evening shifts in relation to HH compliance in both Pediatrics and Obstetric & Gynecologic departments one month and three months post intervention. Chavali, et al. (2014) also noted no difference in compliance rates between day and night times<sup>(36)</sup>. When comparing the mean percent score of nurses' compliance in the Pediatric and Obstetric & gynecologic departments, the results concluded that pediatric nurses' scores were much better than the obstetric one month as well as three months post strategy at both the morning and evening shifts. Cantrell, et al. (2009) postulated that the highest rate of compliance with HH practices was seen in a Neonatal ICU and the lowest rate at Obstetrics and Gynecology<sup>(34)</sup>. This is likely due to multiple factors, as discussed by Pittet et al. (2004) including differences in local culture and role modeling by senior physicians at different sites<sup>(37)</sup>. Sansam, et al (2016) emphasized that HCWS must appreciate that children tend to be easily infected<sup>(38)</sup>.

Unfortunately, compliance to hand hygiene guidelines was the lowest in Critical care areas, though those patient are highly vulnerable to infection. So, asserting HCWS knowledge and awareness grant them efficiently ameliorated compliance with hand hygiene<sup>(39, 40)</sup>. The present study findings showed statistical significant differences among the Critical, Administration, and Medical-Surgical departments at both morning and evening shifts. The mean percent score of the internship nurses compliance to HH action in the Critical care department was much better than the Administration and Medical- Surgical department. For evening shift, the Administration department showed higher mean percent score of compliance than those in the other two departments a study done by Mathai, et al. (2011) in a tertiary level ICU, found that HH compliance between health care workers in the ICU was poor before a HH interventional strategy, but the overall compliance improved significantly following the intervention<sup>(41)</sup>.

After three months of the current studied strategy, there was a significant decline in the mean percent score of nurses' compliance to HH action in the three studied departments. The majority of the internship nurses were less likely compliant to HH. This could be explained by lack of periodic students' observation, guidance, role models, and lack of incentives, and intuitional guidelines that might be contributing factors to these results. These results were in congruent with a study by Silva, et al. (2007) who did not find any effect after three months of education<sup>(39)</sup>. In this regard, Wandel et al. (2010) claimed that enhancing HH compliance was not achieved neither with a high level of knowledge nor with social influence<sup>(40)</sup>. In contrast to these findings, Silmah, et al. (2016), and Ahmed, et al. (2006) reported greatest improvement in HH knowledge and compliance among hcws immediately and three months following a hospital-wide educational intervention<sup>(42,43)</sup>. Average adherence with HH recommendations is usually estimated to be below, but varies between different hospital departments, among professional categories, and according to working conditions<sup>(44)</sup>. The higher the workload, that is the number of opportunities for hand hygiene per hour of patient care, the lower the compliance<sup>(45)</sup>.

In a comparison between the different departments at Elshatby, Main-university, and Elhadara hospitals in which the internship student nurses have trained, the results revealed that one and three months post HH interventional strategy, the highest mean percent score of nurses compliance was in the pediatrics, followed by Critical care, Administrative, and Obstetric & Gynecologic. The Medical- Surgical department had the lowest mean percent score of compliance at both morning and evening shifts. A similar interventional study by Slimah, et al. (2016) to assess HH and health care associated infection, found that (PICU) was more likely to have high HH compliance compared to (ICU) and Medical -Surgical units<sup>(42)</sup>. In contrast to the current study findings, Tomar, et al. (2015) concluded that HH compliance of HCWS in PICU was very poor<sup>(46)</sup>. Prevention and control of HAI remain major priorities for countries around the world. It can effectively be advanced through the simple and inexpensive hygiene practice of proper handwashing between patient contact by doctors, nurses, health assistants and other support staff. Whatever their reason for failing to wash their hands at critical times, health workers who spread HAI stand guilty of violating the Hippocratic oath, *do no harm*, that is sacred to their profession, and should therefore be made accountable in the most appropriate way<sup>(47)</sup>.

## VI. Conclusions

Based on the findings of the present study, it can be concluded that internship nurses compliance was high in some departments after one month, and the percent score of compliance was declined after three months post HH interventional strategy. No marked differences were found between morning and evening shifts in relation to compliance in some departments.

## VII. Recommendations

The following recommendations are forwarded:

1. Implementation of hand washing training strategies for undergraduate students, doctors, and nurses would improve HH practices.
2. Compliance strategies developed should be implemented early in training periodically in the graduation and clinical courses for internship nurses.

3. Continuing monitoring and clinical performance appraisal is beneficial, increase in supplies necessary for hand washing and institutional supports are required.

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