

## Effectiveness of Teaching Modules about Hand Hygiene on Staff Knowledge, Compliance and Controlling Health Care Related Infection Rate

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### Abstract:

**Background:** Hand hygiene, defined as any kind of hand washing with water, soap, and alcohol hand rub, is considered as one of the cheapest and most effective methods to prevent the transmission of nosocomial infections in healthcare settings.

**Aim of this study:** The aim of the present study is to determine the effectiveness teaching modules about hand hygiene on staff knowledge, compliance and controlling health care related infection rate.

**Research design:** Quasi- experimental design was used in the present study.

**Setting:** The study was conducted in general and special Surgical Departments at Mansoura University Hospitals.

**Sample:** A sample of convenience of 100 staff nurses who met the inclusion criteria was included.

**Tools:** a) socio-demographic data sheet, b) nurses knowledge regarding hand hygiene and, c) Compliance with hand washing observational checklist.

**Results:** The result of this study indicates that most participants experienced change knowledge about hand hygiene and improve compliance. Also there are reducing in infection rate after implementing the program. Significant association was found between age and knowledge ( $p$ -value = 0.04) & knowledge and compliance ( $p$ -value = 0.01). among association between knowledge and compliance, significant association was found with work experience ( $r = 0.011$  &  $r = 0.263$  respectively)

**Conclusion:** This study concluded that hand hygiene educational program improve knowledge and practice and improve compliance and decrease infection rate after implementation of program.

**This study recommended:** that continuing education programs are needed to increase awareness of hand hygiene in various risk groups in our country. Also replication of them study on a larger probability sample from different geographical areas should be done to achieve more generalizable results.

**Keywords:** Hand hygiene; compliance; patient safety; nursing; knowledge, practice, and nosocomial infections.

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### I. Introduction:

Hand hygiene is a topic at the forefront of patient safety. Hospital acquired infection is one of the leading causes of preventable deaths in health care system. The center for disease control and prevention estimates that there are approximately 1.7 million hospital associated infections that cause up to 99,000 deaths per year. These infections not only cause a significant amount of morbidity and mortality, but they also greatly increase health care costs. Hand hygiene compliance is one of the most effective ways to combat the spread of infection within a hospital.<sup>[1,2]</sup>

Hand hygiene (HH) has been recognized worldwide as a primary and significant measure for controlling health care-related infections, and it is also a key factor in the prevention and control of contagion within health services. With good HH, morbidity and mortality rates fall.<sup>[3]</sup> The World Health Organization (WHO) has made significant investments in awareness campaigns, emphasizing the importance of HH practices.<sup>[4,5]</sup> Use of an effective topical antimicrobial agent, coupled with proper technique, is central to preventing hand transmission of microorganisms.<sup>[6]</sup> Grol and Grimshaw (2003) made an inventory of the most common interventions used to improve HH practices and described that educational interventions have only short term effects, reminders have a sustained but only modest effect, and performance feedback may be effective, but only if feedback is continued.<sup>[7]</sup> They concluded that a comprehensive plan, targeting different problems and barriers to change strategies at different levels (professional, team, patient, and organization) is needed to achieve lasting changes in HH routines.

According to study conducted by Collins & Hampton (2005) illustrate that hand hygiene should be considered before invasive procedures, after contact with contaminated devices or materials, and with high risk, infectious patients.<sup>[8]</sup> Moreover, Kampf & Loffler (2010), claim that hand hygiene should be advocated before beginning work, at the end of work, and after visiting the rest room (toilet)<sup>[9]</sup>. However, Canham (2011) note that hand hygiene requirements depend on the type of procedure, the degree of contamination and the persistence of antimicrobial action on the skin<sup>[10]</sup>.

Nurses constitute the largest percentage of the health care workers (HCW),<sup>[11]</sup> and they are the “nucleus of the health care system”<sup>[12]</sup>. Because they spend more time with patients than any other HCWs, their compliance with hand washing guidelines seems to be more vital in preventing the disease transmission among patients. Hand hygiene is the most important and easy way for the control of hospital infections.<sup>[13,14]</sup> Due to the critical role of nurses in patient care, there is more emphasis on the role of them in the control of hospital acquired infections.<sup>[15]</sup> Hence, nurses should have sufficient knowledge and skills in the field of infection control. Additionally, Kampf, & Loffler (2010), argue that nurses’ hands come into close contact with patients and are frequently contaminated during routine patient care: e.g. auscultation and palpation or while touching contaminated surfaces, devices or materials such as changing of dressing<sup>[16]</sup>. Therefore, hand hygiene is considered an essential, cheap and most effective means of preventing cross. This method is designed to save lives and provide a safe treatment atmosphere for all patients and HCWs, regardless of the setting.<sup>[17]</sup>

Boyce and Pittet (2002) reported that education is one of the cornerstones for improvement with hand hygiene practices. Effective training is essential to ensure that these concepts are understood and put into practice wherever health care is provided.<sup>[18]</sup> Nursing staff must be educated about basic principles of infection control and acquire knowledge about guidelines for hand hygiene, potential risks of transmission of microorganisms to patients, as well as potential risks of HCW colonization or infection acquired from the patient, knowledge about indications for hand hygiene during daily patient care, awareness of the very low average compliance with hand hygiene practices of most HCWs, and recognition of opportunities for hand hygiene associated with high risk for cross transmission. Therefore, it is absolutely essential to investigate and know nurse’s knowledge, attitudes, and practices about hand hygiene so that appropriate strategies can be developed to promote patient safety and reduce infection rates.<sup>[19]</sup>

The nurse’s role in hygiene practice has been emphasized a long time. Globally, even today the nurse has an important role in the preventive work against HCAI. The nurse has the most extensive competence in nursing and therefore becomes the natural leader for the co-workers in the daily care of the patient, including the hygiene practice.<sup>[20]</sup> An effective infection control relies on nurses’ ability to inform and motivate the staff to keep a good compliance to hygiene practice.<sup>[21]</sup>

### **Significant of the study:**

Hospital associated infection are an important health problem because they occur frequently, cause morbidity and mortality and represent a significant burden among patients, health care workers and health systems. Proper hand hygiene is the single most important, simplest, and least expensive means of preventing hospital acquired infections. In addition, there is convincing evidence that improved hand hygiene can reduce infection rates. Failure to perform appropriate hand hygiene is considered the leading cause of Health-care-associated infections. The recommended of multimodal hand hygiene compliance programs within a healthcare facility in order to increase awareness about importance of hand hygiene practices and its impact on control infections among staff nurses thereby reducing the mortality rate, morbidity rate in patients and also greatly decrease health care costs and promote patient safety.

## **II. Aim of the Study:**

The present study was aimed to determine the effectiveness teaching modules about hand hygiene on staff knowledge, compliance and controlling health care related infection rate..

## **III. Research Hypothesis:**

The following research hypotheses were formulated to achieve the aim of the study:

- Staff nurses exposed to teaching modules about hand hygiene exhibit improved total knowledge mean score post teaching modules implementation.

## **IV. Subjects and Methods:**

### **4.1. Research design:**

A quasi-experimental research design was utilized.

### **4.2. Research Setting:**

The study will be conducted at selected different surgical wards (surgery, neurosurgery, orthopedic, and burn) of Mansoura University Hospital, which is affiliated with Mansoura University in Egypt.

#### **4.3. Subjects:**

A convenience sample of 100 staff nurses in selected settings during the study was selected. The nurses had been selected according to the following criteria: a) both sexes (male & female), b) age 20-60 years old, c) Staff nurses have experience at least 6 months in selected wards and willingness to participate in the study. Staff nurses who have already attended any programme on hand hygiene practices were excluded.

#### **4.4. Tool:**

It consisted of staff nurses' socio-demographic, knowledge and compliance assessment.

**4.4.1. Part 1: Sociodemographic characteristics:** This was designed by the researchers to collect demographic variables such as age, gender, education, and occupation, marital status, and experience.

**4.4.2. Part 2: Knowledge assessment** was used to assess the level of the knowledge regarding hand hygiene practices and infection. It was developed by the researcher based on review of literature.<sup>[22-26]</sup> It entailed questions about nurses' knowledge, 15 multiple questions were formulated. It consists of four domains including: hand hygiene situations (4 items), infection control (4 items), antiseptic solutions (4 items), and definitions of hand hygiene (3 items). Each item was given a score. One mark was given to correct answer, and a zero for the incorrect one or unknown. The scores were summed up and the total score was calculated by adding the score of all correct answers and ranged from 0 to 15. Then, the score of each participant was divided to low level of knowledge (scores between 0 and 5), moderate level of knowledge (scores between 6 and 10), and high level of knowledge (scores between 11 and 15), with higher scores indicating a higher knowledge level. In addition, 2 items for assess infection rate. One mark was given to correct answer, and a zero for the incorrect one or unknown.

#### **4.4.3. Part 3: Observation checklist about nurses' practice:**

These checklists aimed to assess the nurses' practice for hand hygiene. It was adopted by Darawad et al., (2012) and modified for use in this study. [27] It consists of 9 items, designed to monitor the hand washing practices of the health care worker during 30 – minute observation periods at random intervals throughout the day and night to determine compliance of 9 items, designed to monitor the hand washing practices of the health care with hand washing. Each item is scored on a 4-point Likert- scale ranging from 4 (always) to 1 (never) for each category to give total scores ranging from 9 and 36, a higher score indicating good compliance with hand washing practice

#### **4.4.4. Part 4: Teaching program:**

This program was planned to cover knowledge and practice about hand hygiene for aiming to improve compliance. The content of program was developed after reviewing the following related literatures; the content was translated into Arabic.

#### **4.5. Content validity and reliability:**

Content validity of tool was confirmed by sending tool for jury (7experts) in same specialty in two universities (4 Fayoum and 3 Mansoura universities) who revised the tool for clarity, relevance, comprehensiveness, understanding and ease for implementation. Modifications were applied according to their opinions. Reliability of the tool was done by test and retest with score 0.83.

#### **4.6. Pilot study:**

A pilot study was carried out on 10% of the subjects (10 nurses) about hand hygiene practices surgical unit for testing applicability and feasibility of the study tool and to determine the time needed to complete the questionnaire sheet for each participant. The needed modifications in the form of omission and addition of some words were made. Patients included in the pilot study were excluded from the study.

#### **4.7. Human rights and ethical consideration**

Permission to conduct the study was obtained from the directors of Mansoura hospital for the initial interview, the researchers introduced themselves to health care worker who met the inclusion criteria; each participant was fully informed with the purpose and nature of the study, and then an informed consent was obtained from participants who accepted to participate in the study. The researchers emphasized that participation in the study is entirely voluntary and participants can be withdrawn from the study and confidentiality was assured through coding the data.

### V. Methods of Data Collection:

- Approval for data collection was obtained from the Director of El-Mansoura University Hospital for conducting the study.
- The tool was developed by the researcher based on reviewing literature.
- Data collection for this study was carried out in the period from August. 2013 to November 2014. The methods of teaching used in the program were lectures, group discussions, demonstration of health practice, in addition to posters.
- The teaching modules will cover 4 hours per weeks (2/days) for each group. The lectures were focus on general knowledge about infection control such as definition, risk factor, prevention, mode of transmission. Also information's about universal precautions to prevent blood prone infection and indication for hand washing and procedure of hand washing. In addition to videotaped demonstration, poster, and written instruction.
- Teaching modules program was provided for the subjects. The nurses were approached three days a week by the investigator. The teaching session was organized during the morning shift and care or after the visiting hours. The study group were divided into subgroup including 2 to 4 nurses. Also teaching done beside the nurses or waiting room.
- The study subjects were exposed to the teaching modules activities which are 7 consecutive sessions over two weeks (3 sessions practical & 4 session theory). Each session lasted from 30 - 45 minutes. The first two sessions were designed to equip subjects with the necessary basic information related to the hand hygiene and infection control. The lectures were focus on general knowledge about infection control such as definition, risk factor, prevention, mode of transmission. Also information's about universal precautions to prevent blood prone infection. In addition to videotaped demonstration, poster, and written instruction. The total time for program was six hours.
- The observation checklist for hand hygiene was filled by the researcher for subjects, within 20-30 minutes during afternoon shift (after the visiting hours). Also each nurses was observed 3 times per day.
- Nurses Knowledge Assessment filled by researcher for pre-test (T1) and posttest (T2) and follow up (3 months) (T3) for study group, to identify nurses knowledge before and after the teaching modules for study within 15-30 minutes.
- Observation checklist for hand hygiene for monitoring the nurse skills was filled by researcher for subjects, which state that HH must be performed before and after patient contact, after contact with patient surroundings, after body fluid exposure risk, and before aseptic tasks. Compliance rate was assessed by direct observation from the frequency of hand washing by soap or alcohol-based hand rub at T1 (baseline), T2 (post intervention), T3 (3 months post intervention) within 20-30 minutes for assessing improvements in hand hygiene behaviors.

### VI. Statistical Analysis

Data analysis was performed using SPSS software version 13 according to qualitative or quantitative nature of variables by descriptive statistics including mean, standard deviation, frequency, and percentage and Pearson correlation test, independent samples t-test. The threshold of statistical significance was p-value <0.05.

### VII. Results

**Table 1.** This table showed demographic characteristics of staff nurses', the majority of sample (88%) were female. It can be observed that (40.0%) had working experience from 5– 9 years. As regard to work place, most of study sample (46.6%) had been work in general surgical unit.

**Figure 1.** This figure shows distribution of samples according to age, the highest of the sample (51.0%) were at age group of < 30 years olds, while the lowest percent of them (10.0%) were belongs to the age group 45- 50 years.

**Table 1. Description of socio-demographic characteristics of the study sample (n = 100)**

Variables	Frequency (N)	Percentage (%)
Gender :		
• Male	2	(2.0)
• Female	88	(88.0)
Age in years:		

• < 30	51	(51.0)
• 30 – 35	22	(22.0)
• 36 – 40	17	(17.0)
• 41-45	10	(10.0)
• ≥ 45	0	(0.0)
<b>Marital status</b>		
• Married	68	(68.0)
• Single	20	(20.0)
• Divorced	12	(12.0)
<b>Experience :</b>		
• <5 years	35	(35.0)
• 5 – 9	40	(40.0)
• 10-14	15	(15.0)
• 15+	10	(10.0)
<b>Worked Place :</b>		
• General	36	(36.0)
• Neurosurgery	4	(4.0)
• Orthopedic	30	(30.0)
• Gynecological & obstetric	30	(30.0)

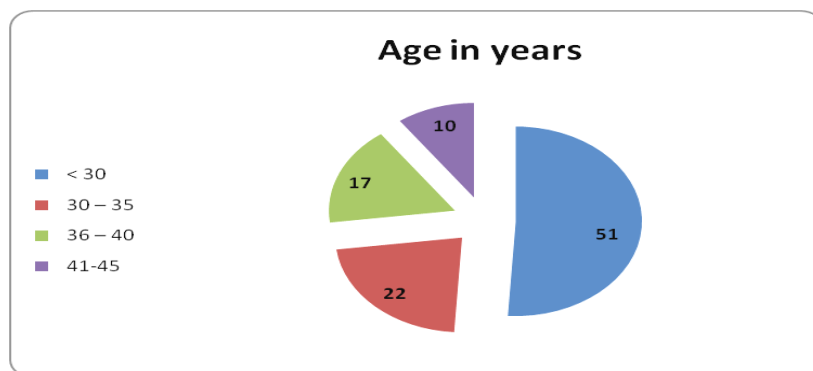


Figure1. Age distribution among study

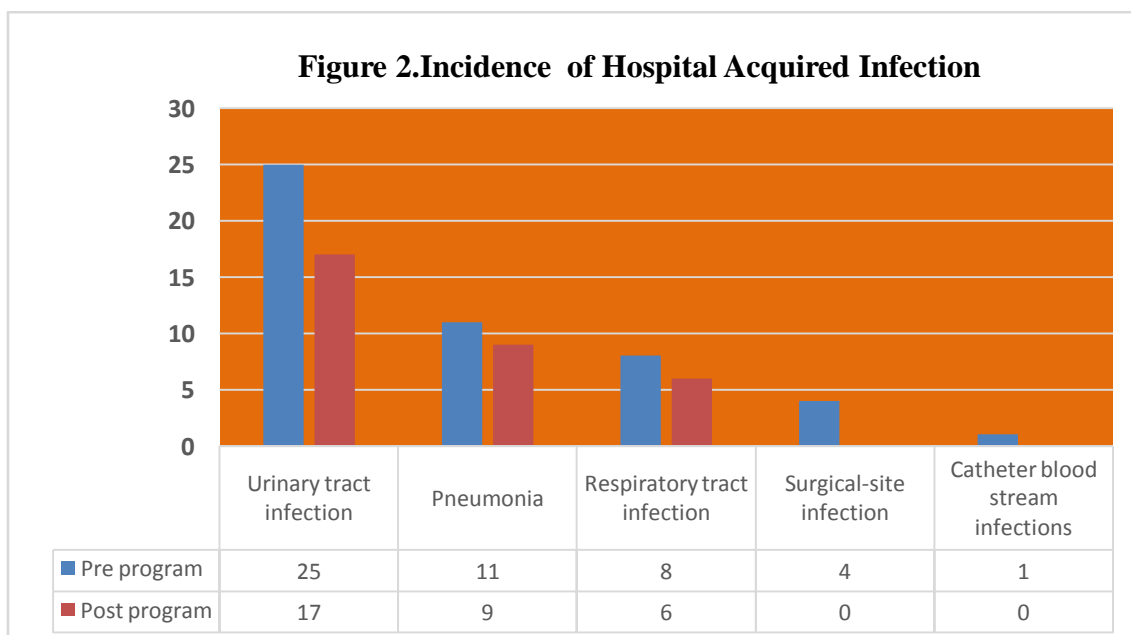


Figure 2. This figure shows that decrease in incidence of hospital acquired infections in pre and post teaching modules implementing ( $p \leq 0.05$ ) regarding urinary tract infection, pneumonia and surgical site infections.

Figure 3. This figure showed that total nurses' knowledge scores about hand hygiene of the study at immediate postimplementation of teaching modules.

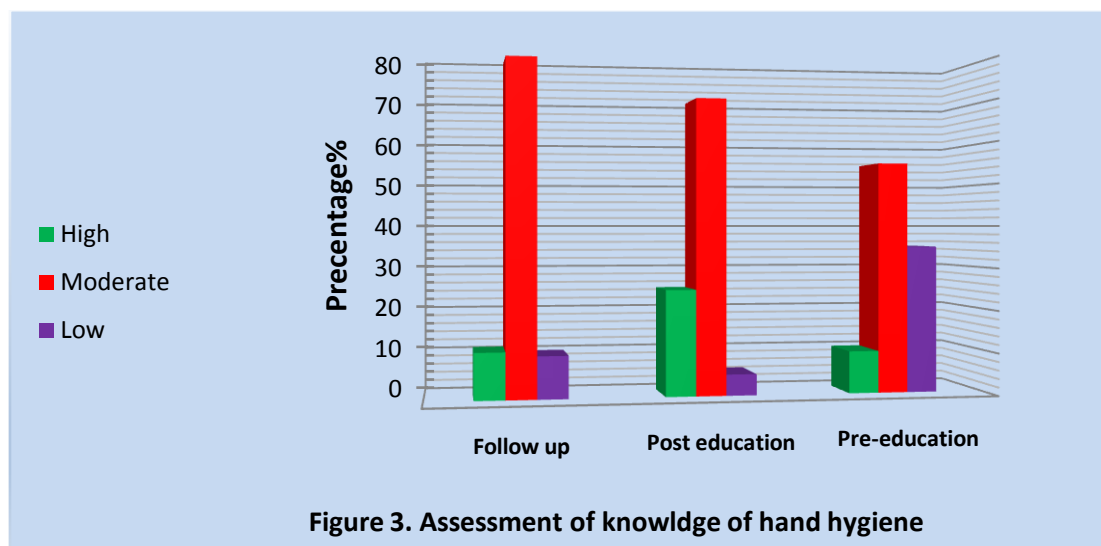


Figure 3. Assessment of knowledge of hand hygiene

Table 2 . Observed hand hygiene compliance pre, post and follow up implementing hand hygiene among staff nurses.

Items	Before	After	Follow up	p- value
	N (%)	N (%)	N (%)	
Before touching patient	4	12	13	P<0.05
Before shaking hand	5	10	5	P<0.05
Before assisting a patient in personal care activities to move, to take a bath, to gate dressed.	7	20	25	P<0.05
Before delivering care and other non invasive treatment: applying oxygen mask, giving a massage	9	18	15	P<0.05
Before performing a physical non invasive examination	8	19	21	P<0.05
Before clean/ Aseptic procedure	8	20	15	P<0.05
Before brushing the patient hygiene	10	15	15	P<0.05
Before dressing wound with or without instrument,	12	26	30	P<0.05

Table 2. Displays that post implementing teaching modules about hand hygiene, nurses in the study group had a highly statistically significant improvement in behavior practice at before vs. immediate after implementing hand hygiene among nurses ( $p < 0.05$ ) respectively.

Table 3. Shows opinion of the staff nurses, majority (54%) opined that there were relationship good hand hygiene practices and hospital acquired infection.

Table 4. This table describes the relationship between knowledge score and some variables in the study group post program implementation. It reveals that statistically significant correlation between post program knowledge score and age ( $r = 0.385$ ,  $p = 0.004$ ). Also, there was positive statistically correlation between knowledge and year of experience ( $r = 0.011$ ,  $p = 0.035$  respectively), While there was no significant statistically differences were existed between knowledge score and education level.

Table 5. This table shows that the correlation between compliance and some variables in the study group post program implementation. It reveals that statistically significant correlation post program between knowledge and compliance ( $t = 0.562$ ,  $p = 0.01$ ). Also, there was statistically correlation between compliance and year of experience ( $t = 0.263$ ,  $p = 0.001$  respectively), While there was no significant statistically differences between compliance and education level and age.

Table 3. Distribution of staff nurses according to the opinion about the relationship between good hand hygiene practices and hospital acquired infection

Opinion	Frequency	Percentage
Very weak	0	0%
Weak	16	16%
Neither weak nor strong	26	26%
Strong	58	58%

**Table 4. Pearson Correlations of nurses' knowledge score and some variables (age, education and experience) post teaching modules implementing (n = 100)**

Research Variables	Knowledge score	
	Pre	Post
Age	r- value	0.349
	p- value	0.056
Education	r- value	0.231
	p- value	0.405
Experiences	r- value	.115
	p- value	0.405

\*Significant p <0.05

**Table 5. Association between predictors of self-reported hand hygiene compliance and some variables post implementing hand hygiene program (n = 100)**

Variables	T	P-value
Knowledge	0.562	0.01*
Age	1.251	0.217
Level of nursing education	1.431	0.310
Work experience	0.263	0.001*

### VIII. Discussion

Healthcare-associated infections affect over one million people in the US each year, costing patients and hospitals large amounts of resources and time. Hand hygiene is one of the most effective ways to prevent the spread of these costly infections. However, hand hygiene compliance rates among healthcare workers remain startlingly low. Many institutions have been searching for interventions that will increase the compliance rates of their healthcare staff.<sup>[28]</sup>

Hand hygiene has long been regarded as the cornerstone of infection control efforts and an essential measure for prevention of healthcare-associated infections (HCAIs).<sup>[29]</sup> Despite the importance of hand hygiene in the healthcare setting, adherence to hand hygiene standards remains universally low. In the United States, rates of adherence have been shown to be as low as 36% but there has been substantial attention paid to increasing adherence based on patient safety concerns and regulatory and accreditation agency requirements.<sup>[30]</sup> Limited data from low and middle-income countries suggest that hand hygiene adherence rates are very low in resource limited areas, with baseline reports as low as 5% of all opportunities for hand hygiene.<sup>[31]</sup>

Hand hygiene practice among HCWs is considered to be the single most clinical and cost effective measure to prevent HAI, a view recognized internationally.<sup>[32-34]</sup> The World Health Organization (WHO) strongly emphasize the essential need for hand hygiene during healthcare delivery, to avoid possible infection and subsequent complications.<sup>[35]</sup>

The present study revealed that the most of study subjects have an age that less < 30 years old. This supported with study of Shinde1, and Mohite (2014) which found that majority 44% of staff nurses were belonging to the age group 19-25 years, 36% of staff nurses were belonging to the age group 26-35 years, 12% of staff nurses belonging to the age group 36-45 year and 8% age group 45-65 year.<sup>[36]</sup> These in contrast with Darawad, et al.,(2012) Study among 280 nurses, found that the mean age 28.41 years with an age ranged from 22 to 47 years old. The majority of sample were female and most period of work experience between 2 and 5 years.<sup>[27]</sup> This result disagree with Shanu,<sup>(2011)</sup> who shows that distribution of data according to professional experience about 38% of samples having to 1-5 years of experience.<sup>[37]</sup>

The present study revealed that the opinion of the staff nurses had majority opined that there are relationship good hand hygiene practices and hospital acquired infection. This study in line with Wendt et al.,(2001) and Lee et al., (2001) clearly demonstrate that hands are responsible for transmitting infection and that effective hand decontamination can significantly reduce infection rates.<sup>[38, 39]</sup>

In relation to the knowledge about hand hygiene, results revealed that gained higher scores of hand washing after participation in the program in the study group. This result consistent with the findings of Darawad et al.,(2011) reported improves hand hygiene knowledge and skill post implementation of educational program among Jordanian nurses and 63.8% among Jordanian healthcare professionals.<sup>[40]</sup> According to Smith (2009) who illustrate that the lack of knowledge among nurses concerning hand washing guidelines and

importance. Offering refreshment courses to promote nurses hand washing knowledge in this regard is highly encouraged and was found to promote hand washing compliance.<sup>[41]</sup>

The results showed that the knowledge that nursing exhibited about hand hygiene level of practice were improved at  $p \leq 0.001$ . It was possible to verify greater compliance among nurses regarding the practice of hand hygiene. The results of this study agreed with the results of Abela & Borg (2012) who illustrate that visual material such as posters had to be combined with educational sessions for the staff to impact positively on the compliance to hygiene routines<sup>[42]</sup>. This is supported by Mamhidir et al., (2010) who mean that having information and knowledge about infection transmission is leading to a higher compliance with hygiene practice and routines.<sup>[43]</sup> In other study, Khaled et al., (2008) conducted that a cross sectional descriptive and observational study to assess the knowledge, attitude, and practices of hand. The result of the study was that concluded that compliance to hand washing was low. Implementation of multifaceted interventional behavioral hand hygiene program with continuous monitoring and performance feedback, increase supplies necessary for HW and institutional support is important for improving the compliance of hand hygiene guidelines.<sup>[44]</sup> Rickard (2007) stated that to improve hand hygiene compliance, "one must make cultural changes which makes it easier for health care workers to comply by improving hospitals and their materials and have health care workers to provide feedback on infection rates and areas that should be targeted"<sup>[45]</sup> In the same line study by Creedon (2005) conducted a quasi-experimental study on health care workers decontamination practice from behavioral perspective. A quasi-experimental design with a convenient sample was used. The result of the study was that Implementation of the multifaceted interventional behavioral hand hygiene programme resulted in an overall improvement in compliance with hand hygiene guidelines (51-83%,  $P < 0.001$ ).<sup>[46]</sup>

There were also consistently lower rates of infection post hand washing. Their findings are consistent with those previous studies documenting that enhance a potency of hand hygiene. Massanri and Hierholzer (1984) argue that it is difficult to change hand washing behavior; it can be attributed to infection rates reduced through the use of effective approach to increase compliance by 50 to 100 percent<sup>[47]</sup>. In the same line study by Le et al.,<sup>[48]</sup> which found that hand hygiene programs in developing countries are likely to reduce surgical site infections rates and improve patient outcomes.

The result of the present study explored that there was a statistically significant relationship between age and knowledge of nurses regarding hand hygiene. These findings were similar to those obtained by Ghadamgahi et al., (2011) revealed that significant relationship between age and knowledge of nurses regarding hand hygiene ( $r = 0.25$ ,  $P = 0.001$ ). This means mostly older people who perform hand hygiene at the correct times.<sup>[49]</sup> This finding is inconsistent with the result of another study by Silva and Associates (2014) found that younger people and women have better knowledge about this, but there were no significant differences in age ( $P = .059$ ) and sex ( $P > .05$ ).<sup>[50]</sup>

The current study illustrate that a significant relationship between work experience and knowledge of nurses regarding hand hygiene. These supported by study of Asadollah et al., (2015) showed that work experience and the history of previous training about hand hygiene were important predictors of nurses' knowledge about hand hygiene<sup>[51]</sup>. This means work experience had a significant relationship with the knowledge of nurses regarding hand hygiene. It attributed to increasing work experience in clinical settings and the determination of nurses' employment status, their motivation for further learning and respecting update guidelines will increase.

## **IX. Conclusion and Recommendations:**

From current results of this study, it could be concluded that hand hygiene educational program improved knowledge, practice, compliance and decrease infection after implementation of program. This will help in better adherence to barrier protection such as hand washing, use of gloves and hand disinfection. Thus, it is recommended that continuing education programs need to be conducted more frequently for nurses with continuous monitoring and performance feedback to encourage them to follow correct hand hygiene practices. Also replication of this study with larger sample and multiple settings and the use of combined approach of self-reported and observation methods for data collection are recommended for future research.

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