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Application of the Health Belief Model -Based Educational Intervention on Hand Hygiene Performance of Intensive Care Units' Nurses

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Abstract
Background: Practicing hand hygiene is a simple yet effective way to prevent infections. Cleaning hands can prevent the spread of germs, including those resistant to antibiotics and are becoming difficult, if not impossible, to treat. On average, healthcare providers clean their hands less than half of the times they should.**Aim of the study**: This study aimed to apply the health belief model based educational intervention on hand hygiene performance among nurses working in adults and pediatric intensive care units.**Materials and methods**: A quasi experimental research design was used in this study. The study was conducted at pediatric and adult intensive care unit; at Tanta University Hospital. All available nurses 262who are working in the previously mentioned settings as the following: 118 nurses working in pediatric intensive care unit nurse and 144nurse working in adult intensive care unit. **Tools of the study**: Four tools were used to collect the data **Tool I:** Nurses' knowledge regarding Hand Hygiene Structured Questionnaire: it consisted of two parts: **Part1**: Socio demographic data of the nurses **Part II**: Nurses' Knowledge Regarding Hand Hygiene Performance. **Tool II**: Assessment of Nurses Barriers of Hand Hygiene Performance Questionnaire, **Tool III: Hand** Hygiene Perception Survey and **Tool IV:** Hand Hygiene Performance Observational Checklist**. Result;** the mean score of total hand hygiene performance using soap and water of nurses working in pediatric ICUs were 8. 85±1.02 and 10.10±1.84, while among adult ICUs nurses were 8.37±1.75and10.20±0.80 pre and post the educational intervention respectively. There was a significant difference of both groups in the; five Health Belief Model Construct in addition to nurses' identified barriers of hand hygiene pre and post the intervention.**Conclusion and recommendations**: Total hand hygiene performance level and HBM construct regarding hand hygiene performance were higher among nurses working in pediatric and adult ICUs nurses post than pre application of the HBM educational intervention. Also, higher mean scores of the barriers of hand hygiene performance among all nurses in both ICUs pre compared to post intervention. Periodic and refreshment educational intervention related to hand hygiene is recommended for adult and pediatric ICUs nurses to improve their hand hygiene performance and further study for barriers in other ICUs is recommended.
Keywords: Health Belief Model -Based Educational intervention, Hand Hygiene Performance

Introduction

Healthcare associated infections cause 75,000 to 80,000 deaths a year, many are preventable with proper hand hygiene adherence [1]. . Hand hygiene (HH) is one of the most important factors in controlling and prevention of hospital acquired infections. Nasocomial infection is one of the crucial problems of world public health. The hand hygiene refers to groups of activities and practices that aimed to clean the hands; it involves hand washing, using of antiseptics or alcohol hand rub. Alcohol hand rubs usually in the form of gel that contain in its structure emollients and alcohol [2-4].

Healthcare-associated infection (HAI) is an infection that patients acquire during their presence in the health care setting and receiving their treatment for other medical or surgical conditions [2]. Nosocomial infection (NI) is another term used instead of HAI. Health care-associated infection is one of the major sources of disability and death in the world [4].

The first development of guidelines regarding hand hygiene (HH) in the health care setting was developed by the Centers for Disease Control and Prevention (CDC) in 1975 which have been updated and modified many times by different authors. Many studies prove that HH reduces the occurrence of hospital-acquired infection, thus decrease the costs and incidence of mortality and disabilities and decrease the length of patient' hospital stay. There is an evidence that the level of compliance with guidelines of HH among the health care workers is poor [3,4] .So, in the health care setting a lot of efforts have been made in order to identify factors and barriers that influence the compliance of health care professionals with HH guidelines, and many strategies have been used in order to facilitate the adherence to HH. However; many research studies have illustrated that HH compliance between nurses is higher than physicians [3].

Health care-associated infection (HAI) can be avoided based on the fact that infection can be resided and multiply on the hand surface with potentially pathogenic organisms. So, HH practices can reduce the

contamination of health care workers' hands and the transfer of those pathogens between patients and to the nurses themselves [4,5].

The Health Belief Model (HBM) is a psychological health behavior change model which was developed in order to explain and predict health-related behaviors, in relation to health services [1]. The health belief model was developed in the 1950s by American social psychologists at Public Health Service[1,2] and is consider one of the common and most used theories in health behavior studies[3,4].The health belief model main concern on; people's beliefs about health problems, perceived benefits and barriers to action, and self-efficacy that explain the engagement or the lack of engagement in health-promoting behavior[1,2].

Perceived severity is a subjective assessment of the severity of a health problem and its potential consequences[1, 5].Perceived susceptibility is a subjective assessment of the risk which may lead to developing a health problem [1,2,5].Health- related activities are influenced by the perceived benefits of action taking[5].Perceived benefits are an individual's assessment of the value or efficiency of the engagement in health-improving activities to decrease the risk of diseases or health problem[1].Perceivēd Barriers Health-related behaviors are also a function of perceived barriers to carry out the action [5]. Perceived barriers are an assessment of the obstacles or barriers aimed to behavior change [7].

Cues to action can be divided into internal (physiological cues as pain) or external (information from close others as the media and health care givers)[1,3, 5].Self- efficacy was added to the four components of the health belief model (i.e., perceived susceptibility, seriousness, benefits, and barriers) in 1988[5, 6].Self-efficacy is an individual's perception of the competence to successfully perform activities [8].

Cost-benefit analysis may be changed leads to engagement in a health- promoting activities by increasing perceived benefits and decreasing perceived barriers, this activities can be achieved by providing data about the efficacy of various activities leads to reduce risk of disease, recognize the most common perceived barriers, and providing incentives to be included in health-promoting activities. In addition, the health belief model based management may provide cues to action [9].

Admission in an intensive care unit (ICU) increases the incidence of HAIs. Compliance with hand hygiene guidelines and infection control practices in hospitals, especially in ICUs, considers one of the very important effective and preventable causes of HAIs. Health care workers' (HCWs) hands in many ICU are the main cause of infections, and outbreaks of infections as the cross-transmission are common and frequent[10].The factors that increase the incidence of infection in ICUs include; the intensity of patient care, complexity of the diagnosis, low patient' immune system, continuous contacts between ICU patients and HCWs, and the nature of the procedures in ICUs[11]. Device-associated healthcare-associated infections (DA-HAIs) in the ICUs in Egypt have major threats to the patient safety than in highly industrialized countries, therefore infection control programs, including surveillance and guidelines, must be applied. There were 22.8, DA-HAIs per 1000 ICU days. The rate of the central line-associated blood stream infection was 22.5 per 1000 line in the respiratory intensive care unit and 18.8 in the pediatric intensive care units; in the respiratory intensive care unit the rate of the catheter-associated urinary tract infection was 34.2 per 1000 catheter, and the ventilator-associated pneumonia (VAP) rate was 73.4 per 1000 ventilator in the respiratory intensive care unit and 31.8 in the pediatric intensive care units[12].

Aim of the study: this study aimed to apply the Health Belief Model –Based Educational intervention on Hand Hygiene performance of adult and pediatric Intensive Care Units' Nurses

Materials &Method

Materials

Research design

The study was a quasi-experimental research study.

Setting:

The study was conducted at Pediatric and Adult Intensive Care Units at Tanta University Hospital.

Subjects

All available nurses 262 who are working in the previously mentioned settings as the following:

118 nurses at Pediatric Intensive Care Units (Neonates, High risk, Medical and Surgical pediatric ICUs), 144 nurses at Adult Intensive Care Units (Anesthesia, Emergency, Medical, Neurology and Cardiac adult ICUs).

Criteria of nurses' selection:-

All nurses working in the previously mentioned settings who agree to participate in the study and who are on duty regardless of their ages, years of experience, levels of education, residence and any previous conference or training related to hand washing are involved in the study.

Tools of data collection:

Four tools were developed in order to obtain necessary data for the study.

Tool (I): Nurses' knowledge regarding Hand Hygiene Structured Questionnaire: It was developed by the

researchers after review the related literature to assess; socio- demographic data of nurses and their knowledge about hand hygiene; it consisted of two parts:-

Part (1): Socio-demographic data of the nurses which include

Age, sex, marital status, educational level, Job title , marital status, residence, years of experience, workplace, previous participation in conference, workshops or training program related to hand washing and the source of their information about the performance of hand hygiene techniques.

Part (II): Nurses' Knowledge Regarding Hand Hygiene Performance: This part is adapted from World Health Organization (WHO) Guidelines on Hand Hygiene in Health Care[3].It was translated to Arabic language for easy use and used to assess nurses knowledge regarding the duration of time should be spend in the five moments of hand hygiene namely; Before touching a patients(Shaking hands, helping a patient to move, taking pulse, blood pressure, chest auscultation, abdominal palpation, Before clean/Aseptic procedure (Oral care, secretion aspiration, wound dressing, subcutaneous injection; catheter insertion, medication administration), After body fluid exposure risk(Oral care, secretion aspiration; skin lesion care, wound dressing, subcutaneous injection; drawing and manipulation any fluid sample, opening draining system, endotracheal tube insertion and removal; clearing up urines, faces, vomit; handling waste :bandages, napkin, incontinence pads; cleaning of contaminated and visibly soiled material, areas or instruments), After touching a patient(as before touching a patient) and After touching Patient surroundings (Changing bed linen, perfusion speed adjustment, monitoring alarm, holding a bed rail, clearing the bedside table).For each procedure; nurses' response was recorded by nurses as follow; less than 20 second, from 20- < 30 second, and from 30 - < 40 second , and >40 seconds. **Tool (II): Assessment of Nurses Barriers of Hand Hygiene Performance Questionnaire :** This tool is a self-reported sheet which was adopted from WHO hand hygiene barriers [3],it was modified and translated to Arabic language, it comprises 20 statement which assess nurses' barriers of hand hygiene and categorized as follow; resource availability (lack of soap, towel), personal factors (Hand hygiene agent cause skin dryness and irritation, lack of knowledge of guidelines), interpersonal factors (patient's need take priority, interference with patient relationship) and system factors (too busy, insufficient time, working in weekends), nurses' response of 20 statement was measured using a 5-point Likert scale where;

1=strongly disagree, 2= disagree 3=neutral 4=agree 5=strongly agree) and the last statement was reverse coded, minimum total nurses' score is 20 while the maximum is

100. Total scores of the barrier were calculated, and the mean scores were obtained.. **Tool (III): Hand Hygiene Perception Survey:** This survey was adopted from Lewis and Thompson Infection Control Survey [13], it was adapted to fit the constructs in the Health Belief Model as they relate to hand hygiene. It composed of 36 items which incorporated 6 subscales which adapted from the Health Belief Model namely; Perceived severity of poor hand hygiene (6 items), Perceived Susceptibility to infection from poor hand hygiene (8 items), Perceived benefits of proper hand hygiene (5 items), Cues Action to hand hygiene (4 items), Perceived barriers of hand hygiene (7items), and Self-Efficacy of hand hygiene (6 items). Nurses' response were measured using a 5-point Likert scale where; 1=strongly disagree, 2= disagree 3=neutral 4=agree 5=strongly agree).Total score for each subscale item was calculated, and the mean scores of the subscale were obtained.

Tool (IV): Hand Hygiene Performance Observational Checklist:

This tool was adopted from WHO guidelines on hand hygiene in health Care (2010) [3] to assess nurses' Hand Hygiene Technique using Alcohol-Based Formulation (Duration of the entire procedure 20-30 seconds) & Soap and Water (Duration of the entire procedure: 40-60 seconds). A scoring system was created, allocating one point to each correctly and completely done step, while zero score was given to incomplete, wrong or not done steps with 0 being the lowest and 11 the highest possible score for

Soap and Water while 0 being the lowest and 8 the highest possible score for Alcohol- Based Formulation hand hygiene technique. A total score was given to each participant; the mean score for hand hygiene practices was calculated and the level of performance was categorized as poor (0-4), fair (5-6) and good (7-8) for Alcohol-Based Formulation while poor (0-5), fair (6-8) and good (9-11) for Soap and Water hand hygiene technique.

Method

The study was accomplished through the following steps:

1. Administrative process

a. An official permission to conduct the study was obtained from the responsible authorities.

b. Nurses consent to participate in the study was obtained after explaining the aim of the study and their right to withdraw any time during the study period.

c. Data were collected over a period of five months starting from September to January2015.

2- Development of the study

The tools of the study were adopted and modified by the researchers after extensive review of related literature to collect the data; questionnaire sheet was tested for content validity for clarity and applicability by 8 experts in

medical surgical and critical care nursing department and infection control nursing specialist, accordingly necessary modifications and suggestions were done.

3-Pilot study: A pilot study was carried out before starting the data collection. It was done on a sample of ten and fifteen nurse representative pediatric and adult ICUs respectively to test reliability of the study tools. There was no major modification in the questionnaire and the nurses were included in the main study. Test-retest was measured at two weeks interval, and consistency level was .82.

4-The actual study: The actual study was conducted through four phases:

a. Assessment phase: Each nurse of the sample in different departments (pediatric and adult ICU) was met individually by the researchers in the morning or afternoon shifts to explain the purpose, and distribute the tools of the study (I, II&II) and to assess their hand hygiene performance using tool IV prior to implementation of HBM– based educational intervention using tools.

b. Planning phase: In this phase; the HBM based educational intervention was developed based on the results of the assessment phase and the HBM framework by using two strategies: **Educational session** which was include: identifying the main barriers of hand hygiene performance in ICUs, nurses knowledge and performance of hand hygiene, the five moment of hand hygiene and more emphases was given to; poor hand hygiene threats and severity as well as the benefits of good hand hygiene, barriers, cue to action and self-efficacy of hand hygiene based on HBM subscale**.**

Training session which includes preparation of illustrated handout of the steps of hand hygiene performance using water and soap and alcohol based formulation.

c. Implementation phase: the two strategies of the educational intervention was given to all adult and pediatric ICUs nurses, it was held at the designated ICUs during morning or afternoon shifts, theoretical part lasts for 45-60 mints, each session comprises 10-12 nurses using lecture, discussion, and handout about HH knowledge and performance, while in the practical part demonstration was given to all nurses following the educational session of hand hygiene, it lasts from 30-45 minutes, demonstration was done by the researchers and each nurse re-demonstrates the steps individually.

d. Evaluation phase: The evaluation of the educational intervention was carried out immediately post the application using tool I part two, tools II,III &IV.

Statistical analysis: The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 13. For qualitative data, comparison between two groups was done using Chi-square test (X2). For comparison between means of two groups of parametric data; Student t-test was used and paired t-test was used for comparing means of one group before and after intervention. Correlation between variables was evaluated using Pearson's correlation coefficient. Significance was adopted at $p<0.05$ for interpretation of results of tests of significance [14].

Result

Table 1demonstrated that less than half of the adult ICUs nurses (41.7%) and nearly three quarters of the pediatric ICU nurses (72.9%) were in age group from 20- to <29 years, the majority (85.4%) and (96.6%) of adult and pediatric ICU nurses respectively were females and nearly three quarters (72.9%) of the adult ICU nurses and less than half (44.1%) of the pediatric ICU nurses have Bachelor degree. In relation to job title, more than half (56.3%) of the adult ICU nurses were nursing supervisors while (61.0%) of the pediatric ICU were nurses as a job title, only small percent (6.3%) of the adult ICU nurses compared to (25.4%) of pediatric ICU nurses have more than ten years of experience, about half (52.1%) and (54.2%) of adult and pediatric ICU nurses attended and didn't attend previous training courses or workshops related to HH respectively. Moreover (74.6%) of pediatric ICU nurses gain their knowledge from infection control unit while internet was the source of information of more than quarter (27.1%) of adult ICU nurses.

Table 2 Illustrated that almost half (48.6%) compared to almost third (32.2%) of adult and pediatric ICU nurses respectively stated that the proper time for HH performance is > 40 second after body fluid exposure risk post the intervention. Same table presents that almost half and same percent (49.3%) of adult and pediatric ICUs nurses mentioned that the time for HH is > 40 seconds after touching the patient post the educational intervention, while the highest percent of adult and pediatric ICUs nurses (43.7%) and (50%) respectively stated that the time should be 30-<40 second after touching patient' surroundings post the intervention, there were a significant differences for both groups related to their knowledge of duration of HH performance pre and post HBM based educational intervention except after body fluid exposure risk where P= 0.05 and= 0.51 for adult and pediatric ICUs nurses respectively.

Table 3 demonstrated that; the mean score of the barriers of HH performance for adult and pediatric ICU nurses; was (67.63)and (73.94) which has been decreased to (40.17) and (38.79) respectively pre and post Health Belief Model Based Educational intervention.

As regards to HBM subscales; the same table presented that for adult ICUs, the mean score of perceived severity and perceived susceptibility of infection was(14.03)and(19.02) respectively pre which has been

increased dramatically to (24.10) and (31.6) post the Educational intervention, moreover the mean of Self-Efficacy of hand hygiene has been increased from(13.89) to (22.2) pre and post Educational intervention respectively with highly significant differences in all items of health belief model construct for adult ICUs nurses where p= 0.00 each.

As related to HBM subscales of pediatric ICU nurses; the same table showed that; the mean of perceived benefits and cues action of hand hygiene was(12.42) and(9.95)which has been increased to(20.53) and (15.81) pre and post Health Belief Model Based Educational intervention respectively, in addition perceived barriers was (23.92) which has been decreased dramatically to (13.98) pre and post Health Belief Model Based Educational intervention respectively with highly significant differences in all items of health belief model construct for pediatric ICUs nurses where P= 0.00 each.

Table 4 illustrated that the mean score of hand hygiene performance using alcohol based formulation was 6.35 which has been increased to (7.63) for adult ICU nurses pre and post Health Belief Model Based Educational intervention respectively and also; the mean score of hand hygiene techniques using Soap and Water was (8.58) which has been increased to (10.10) for Pediatric ICU nurses pre and post Health Belief Model Based Educational intervention respectively with highly significant differences in both methods of hand hygiene for the studied groups where P= 0.00.

Table5 presented that most of the adult and pediatric ICU nurses (93.8%) and (89.8%) respectively had good level of hand hygiene technique using alcohol based formulation post the education compared to more than half (56.3%) and (62.7%) of them who have good level of hand hygiene performance using soap and water pre the education and the difference was highly significant in both methods of HH performance for adult and pediatric ICUs nurses where P= 0.00 each.

Table 6 showed that, only small percent of adult ICU nurses (4.9 %) and (6.3%) who have good level of soap and water hand hygiene performance have more than 10 years of experience pre and post the educational intervention respectively and there was no significant difference between years of experience and level of hand hygiene technique pre and post the educational intervention. For pediatric ICUs nurses same table demonstrated that; about third (33.1%) and less than half (47.5%) who have good level of Soap and Water hand hygiene performance have less than 5 years of experience pre and post the educational intervention respectively and there was a significant difference between years of experience and level of soap and water hand hygiene technique post the educational intervention since P= 0.013.

Regarding Training courses; same table presented that there was no significant difference between attendance of training courses and level of hand hygiene technique pre and post the educational intervention for both groups since P> 0.05.

Table 7 illustrated that; only small percent (2.1%) and (2.8%) of adult ICU nurses who have poor and fair level of Alcohol-Based Formulation hand hygiene performance have< 5 years of experience pre and post the educational intervention respectively while of pediatric ICU nurses same percent (11.9%) who have fair and good level of Alcohol-Based Formulation hand hygiene performance have >10 years of experience.

Regarding Training courses; same table presented that there was no significant difference between attendance of training courses and level of Alcohol-Based Formulation hand hygiene performance for both group pre and post the educational intervention since P> 0.05.

Table (1): Distribution of the studied groups according to their socio-demographic data:

Socio demographic	The studied sample (n=262)			
	Adults (n=144)		Pediatric (n=118)	
	N	%	N	%
Age (in years)				
From 20 to less 29	60	41.7	86	72.9
From 29 to less 39	48	33.3	24	20.3
From 39 to less 49	30	20.8	8	6.8
From 49 and more	6	4.2	0	0.0
Gender				
Male	21	14.6	4	3.4
Female	123	85.4	114	96.6
Qualifications				
Diploma	21	14.6	52	44.1
Diploma above average	18	12.5	14	11.9
Bachelor Degree	105	72.9	52	44.1
Marital status				
Married	69	47.9	80	67.8
Single	63	43.8	32	27.1
Divorced	0	0.0	4	3.4
Widow	12	8.3	2	1.7
Job title				
Nurse	45	31.3	72	61.0
Nursing Supervisor	81	56.3	42	35.6
Head Nurse	18	12.5	4	3.4
Years of Experience				
< 5 years	69	47.9	62	52.5
5-10 years	66	45.8	26	22.0
>10	9	6.3	30	25.4
Training courses				
Yes	75	52.1	54	45.8
No	69	47.9	64	54.2
Residence				
Rural	39	27.1	84	71.2
Urban	105	72.9	34	28.8
Information source				
Ward Manager	24	16.7	4	3.4
Educational workshop	6	4.2	0	0.0
Infection Control Unit	18	12.5	88	74.6
Ward Supervisor	42	29.2	4	3.4
Optical Media	15	10.4	12	10.2
Internet	39	27.1	10	8.5

Significant at level P< 0.05

Table (2): Comparison between the studied groups according to their knowledge regarding duration of time for hand hygiene performance in five moment pre and post Health Belief Model Based Educational intervention

Duration of hand hygiene in different procedures	The studied sample (n=262)									
	Adults(n=144)				χ^2 P	Pediatric(n=118)				χ^2 P
	Pre		Post			Pre		Post		
	N	%	N	%		N	%	N	%	
1. Before touching the patient										
less than 20 second	29	20.1	3	2.1		14	11.9	1	0.8	
20-< 30 second	55	38.3	66	45.8		41	34.7	60	50.9	
30 -< 40 second	30	20.8	43	29.8	**31.95**	28	23.7	33	28.0	**26.63**
> 40second	30	20.8	32	22.3	**0.00***	35	29.7	24	20.3	**0.00***
2. Before cleaning/ sterilization procedures										
less than 20 second										
20-<30 second	37	25.6	1	0.7		28	23.7	2	1.7	
30 -<40 second	39	27.1	64	44.4		33	28.0	26	22.0	**61.75**
> 40second	42	29.2	43	29.9	**50.76**	37	31.4	42	35.6	**0.00***
	26	18.1	36	25.0	**0.00***	20	16.9	48	40.7	
3. After body fluid exposure risk										
less than 20 second	4	2.8	3	2.1		0	0.0	4	3.4	
20-< 30 second	33	22.9	22	15.3		32	27.1	36	30.5	
30 -< 40 second	52	36.1	49	34.0	11.09	48	40.7	40	33.9	11.02
>40second	55	38.2	70	48.6	0.05	38	32.2	38	32.2	0.051
4. After touching patient										
less than 20 second	8	5.6	4	2.8		8	6.8	4	3.4	
20-< 30 second	39	27.1	28	19.5		36	30.5	14	11.9	
30 -< 40 second	51	35.3	41	28.5	**16.79**	43	36.4	42	35.5	**26.33**
> 40second	46	32.0	71	49.2	**0.005***	31	26.3	58	49.2	**0.00***
5. After touching patient surroundings										
less than 20 second	25	17.4	6	4.2		24	20.3	3	2.5	
20-< 30 second	46	31.8	37	25.7	**30.92**	16	13.6	20	16.9	**49.75**
30 -< 40 second	44	30.6	63	43.7	**0.00***	21	17.8	59	50.0	**0.00***
> 40second	29	20.2	38	26.4		57	48.3	36	30.6	

Significant at level P< 0.05

Table (3): Mean scores of the Health Belief Model Subscale of hand hygiene performance in the studied group pre and post Health Belief Model Based Educational Intervention.

Items	Range Mean ± SD					
	Adults		t P	Pediatric		t P
	Pre	Post		Pre	Post	
Barriers of hand hygiene performance.	67.63±7.472	40.17±6.075	33.25 0.00*	73.94±6.388	38.79±3.896	55.06 0.00*
HBM Subscale						
1. Perceived Severity of infection.	14.03±2.869	24.10±2.419	31.69 0.00*	14.54±2.710	24.09±2.375	26.89 0.00*
2. Perceived susceptibility of infection.	19.02±3.361	31.60±2.893	34.38 0.00*	19.86±3.536	31.94±2.747	30.31 0.00*
3. Perceived Benefits of hand hygiene.	12.36±2.747	20.06±1.769	20.57 0.00*	12.42±3.011	20.53±1.668	24.75 0.00*
4. Cues Action to hand hygiene	9.90±2.156	15.64±1.549	26.62 0.00*	9.95±2.171	15.81±1.780	23.59 0.00*
5. Perceived Barriers of hand hygiene.	24.10±3.219	14.06±2.456	28.32 0.00*	23.92±3.236	13.98±2.456	23.83 0.00*
6. Self-Efficacy of hand hygiene	13.89±2.580	22.20±2.901	25.93 0.00*	14.02±2.736	22.50±2.637	24.38 0.00*

Significant at level P< 0.05

Table (4): Mean scores of hand hygiene performance pre and post Health Belief Model Based Educational intervention using different methods.

Method of hand hygiene	Range / Mean + SD					
	Adults		t P	Pediatric		t P
	Pre	Post		Pre	Post	
1. Alcohol Based Formulation	6.35±1.220	7.63±0.623	11.10 0.00*	6.18±1.210	7.42±1.842	6.10 0.00*
2. Soap and Water	8.37±1.745	10.20±0.798	11.54 0.00*	8.58±1.015	10.10±2.262	6.81 0.00*

Significant at level P< 0.05

Table (5): Distribution of studied groups according to their levels of hand hygiene performance pre and post Health Belief Model Based Educational intervention using different methods

Method of Hand Hygiene	The studied sample (n=262)									
	Adult(n=144)				χ^2 P	Pediatric(n=118)				χ^2 P
	Pre		Post			Pre		Post		
	N	%	N	%		N	%	N	%	
1. Alcohol Based Formulation										
▪ Poor	6	4.2	0	0.0	**66.86**	13	11.0	8	6.8	**67.22**
▪ Fair	65	45.1	9	6.3	**0.00***	56	47.5	4	3.4	**0.00***
▪ Good	73	50.7	135	93.8		49	41.5	106	89.8	
2. Soap and Water										
▪ Poor	3	2.1	0	0.0	**73.94**	0	0.0	6	5.1	**51.39**
▪ Fair	60	41.7	2	1.4	**0.00***	44	37.3	2	1.7	**0.00***
▪ Good	81	56.3	142	98.6		74	62.7	110	93.2	

Significant at level P< 0.05

Table (6): Relation between: level of Soap and Water hand hygiene performance and years of experience and training courses among the studied groups pre and post Health Belief Model Based Educational intervention

		Level of Soap and Water hand hygiene technique											
		Pre						Post					
		Poor		Fair		Good		Poor		Fair		Good	
		N	%	N	%	N	%	N	%	N	%	N	%
Years of experience Adult (n=144)	< 5 years (n=69)	3	2.1	24	16.7	42	29.2	0	0.0	2	1.4	67	46.5
	5-10 years (n=66)	0	0.0	34	23.6	32	22.2	0	0.0	0	0.0	66	45.8
	>10 (n=9)	0	0.0	2	1.4	7	4.9	0	0.0	0	0.0	9	6.3
	χ^2 & P	8.11 &0.088						2.205&0.332					
Years of experience Pediatric (n=118)	< 5 years (n=62)	0	0.0	23	19.5	39	33.1	6	5.1	0	0.0	56	47.5
	5-10 years (n=26)	0	0.0	12	10.2	14	11.9	0	0.0	2	1.7	24	20.3
	>10 (n=30)	0	0.0	9	7.6	21	17.8	0	0.0	0	0.0	30	25.4
	χ^2 & P	1.556&0.459						**12.70 &0.013***					
Training courses Adult (n=144)	Yes (n=75)	2	1.4	31	21.5	42	29.2	0	0.0	0	0.0	75	52.1
	No (n=69)	1	0.7	29	20.1	39	27.1	0	0.0	2	1.4	67	46.5
	χ^2 & P	0.262&0.877						FE &0.228					
Training courses Pediatric(n=118)	Yes (n=54)	0	0.0	21	17.8	33	28.0	2	1.7	2	1.7	50	42.4
	No (n=64)	0	0.0	23	19.5	41	34.7	4	3.4	0	0.0	60	50.8
	χ^2 P	FE 0.849						2.748 0.253					

Significant at level P< 0.05

Table (7): Relation between level of Alcohol-Based Formulation hand hygiene performance and years of experience and training courses among the studied groups pre and post Health Belief Model Based Educational intervention

		Alcohol-Based Formulation											
		Pre						Post					
		Poor		Fair		Good		Poor		Fair		Good	
		N	%	N	%	N	%	N	%	N	%	N	%
Years of experience Adult (n=144)	< 5 years (n=69)	3	2.1	29	20.1	37	25.7	0	0.0	4	2.8	65	45.1
	5-10 years (n=66)	3	2.1	31	21.5	32	22.2	0	0.0	4	2.8	62	43.1
	>10 (n=9)	0	0.0	5	3.5	4	2.8	0	0.0	1	0.7	8	5.6
	χ^2 P	1.07 0.90						0.391 0.822					
Years of experience Pediatric (n=118)	< 5 years (n=62)	9	7.6	28	23.7	25	21.2	6	5.1	2	1.7	54	45.8
	5-10 years(n=26)	2	1.7	14	11.9	10	8.5	2	1.7	2	1.7	22	18.6
	>10 (n=30)	2	1.7	14	11.9	14	11.9	0	0.0	0	0.0	30	25.4
	χ^2 P	2.03 0.73						5.75 0.219					
Training courses Adult (n=144)	Yes (n=75)	2	1.4	32	22.2	41	28.5	0	0.0	7	4.9	68	47.2
	No (n=69)	4	2.8	33	22.9	32	22.2	0	0.0	2	1.4	67	46.5
	χ^2 P	1.54 0.462						FE 0.169					
Training courses Pediatric (n=118)	Yes (n=54)	7	5.9	26	22.0	21	17.8	4	3.4	2	1.7	48	40.7
	No (n=64)	6	5.1	30	25.4	28	23.7	4	3.4	2	1.7	58	49.2
	$\chi 2$ P	0.519 0.771						0.097 0.953					

Significant at level P< 0.05

Discussion

Hand hygiene is one of the most important aspects of infection control behaviors. As a consequence of the growing severity of illness, difficulty of treatment, and presence of multi-drug resistant organisms, simple measures of infection control as hand hygiene become the first and best choice of the health care professionals. Many research results emphasize that the proper practice of hand hygiene decrease the incidence of cross-contamination in healthcare settings [1, 14].

In the present study; more than third of the adult ICU nurses and nearly three quarters of the pediatric ICU nurses was in age group from 20 to less than 29 years and the majority of both groups were females which is attributed to the fact that the greater fraction of the nurses in Egypt is female and may also related to that nursing study in the Egyptian Universities was exclusive for females only till few years ago when males start to be enrolled in the nursing collages. Regarding qualifications, it was observed that near to three quarter of adult ICUs nurses and more than third of pediatric ICU nurses have Nursing Bachelor degree; this may be due to the trend of Tanta University Hospital administration to designate highly qualified staff nurses in intensive care and critical care units.

In relation to job title; more than half of the adult ICU nursing staff were nursing supervisors and about two third of pediatric ICU nursing staff were nurses as job titles. Regarding years of experience; only small percent of the adult ICU nurses and quarter of the pediatric ICU nurses have more than ten years of experience and more

than half of the adult ICU nurses attended training courses related to hand hygiene while more than half of pediatric ICU nurses didn't attend any. This result agreed with the result of the study carried out in Egypt; **Shahin M (2012)[14]**found that three quarters of the study sample were females, the age of more than third of them was between 25>34 years and half of them have diploma in nursing with more than ten years of experience. Also, **Abdullah, M et al(2014)[15]** found that the age of more than third of the study sample were ranged between 26 - 35 years and more than half of them having more than 10 years of working experiences in ICUs.

The result of the present study showed that the majority of the ICUs nurses gain their knowledge related to hand hygiene performance from the nursing supervisor and infection control unit which is allocated in the hospital and conducting conferences and workshops periodically related to infection control measures. This result emphasize the importance of educational programs, also recent studies support the fact that interactive educational programs combined with free availability of hand disinfectants significantly increased the hand hygiene compliance. A single lecture on basic hand hygiene technique had a significant and sustained effect in enhancing hand hygiene **[15-17]**.

The present study proved that HH performance among adult and pediatric ICUs nurses was low pre the intervention, **Emily M (2011)[18]**is in line and found that the HH adherence rate was low 48%; adherence was highest among nurses during weekends and in pediatric units, non adherence was higher in intensive-care units, during procedures that carried a high risk of contamination, and when the intensity of patient care was high, in addition; **Kamp G (2004)[19]** supported these result and stated that the lowest adherence rate was found in intensive care units, while the highest adherence rate was observed in pediatrics wards, where the average intensity of patient care was lower than in other hospital areas.

In relation to ICUs nurses self-report about barriers of hand hygiene performance, it was observed that there was a significant difference of both group pre and post the application of the educational intervention, this may be attributed to the fact that the barriers has been decreased as a result of increasing nurse' knowledge through education and emphasizing the benefits of hand hygiene, and the severity and susceptibility of non compliance of HH performance. In the study conducted by

Gillespie N (2013)[20] reported that the barriers that were most significantly related to HH performance included staffing, workload, and being busy, also **Shalaniski et al(2003)[21]** stated that barriers are the most important aspect to adapt new behaviors, other studies**[22,23]** stated that a lack of the availability of resources of infection control is a major barrier of HH in the developing countries, **Kang J et.al (2009)[24]** added; nurses mentioned that lack of knowledge and shortage of time is the main barriers of non adherence to HH practice.

As regards to perceived severity and susceptibility as subscales of HBM; the present study proved that there were significant differences in perceived severity and perceived susceptibility to infection as a consequence of poor HH performance in both group pre and post the application of the HBM- based educational intervention.

Zare M et al (2016) [25]mentioned that there was a difference between the two studied groups after the intervention in reference of perceived severity, also **Farzaneh Z (2016) [26]**is in line with the present study result and indicated a significant difference between two experimental groups related to the perceived threat and susceptibility. Many other studies have reported that the HBM-based education increases perceived severity and perceived susceptibility **[27-30]**.

As regards perceived barriers, the present study demonstrated that increased perceived barriers for both groups post the intervention which may be attributed to the increased knowledge level and improved performance of ICUs nurses regarding hand hygiene after the intervention, **Karimy M [31]**stated; according to retrospective and prospective studies; perceived barriers is found to be the most potent dimension of HBM in the expression and prediction of health protective behaviors, **Zare M et al., (2016) [25]**supported this result and observed a significant difference between the studied groups regarding the mean score of perceived barriers, likewise other researchers found a significant decrease in the perceived barriers after HBM-based educational intervention in their studies**[32-33]**.

For perceived benefits; the result of the present study showed dramatically increase in both groups post the HBM based educational intervention which is congruent with **Khorsandi M (2016) [34]**who reported; HBM-based educational intervention led to an increase in the score of perceived benefits. Moreover; **Khaste T (2016) [35]** is in accordance and added; scores for all HBM construct variables were significantly increased in intervention group, in contrary**; Ghanbari M (2014) [10]** stated that; most of nurses have good practice concerning the hand hygiene, despite of their positive attitudes and their perceived benefits.

In the present study cues to action for HH performance has been increased post the intervention for both groups which may be explained by the fact that the theoretical lecture and the distribution of illustrated hand out to all nurses helped them to improve their HH performance, this result is agreed with **Ghanbari M**

(2014)[10]who found that the crucial factor is the external action to cues and the effective items on adopting the hand hygiene behavior through holding training workshops and educational seminars also **Rao H et al (2006)[36]** supported the present study and pointed that the training workshops, visual and printed media as two top factors in improving hand hygiene among nurses. **Suleiman I(2015)[37]** added; cues to action such as

printed material, reminder notes, or medication box, text messages, and social media can be used to trigger compliance to hypertension information.

The HBM construct of Self efficacy to perform hand hygiene has been improved for all nurses in both ICUs after the implementation of the educational intervention in the present study which is explained by the fact that gaining knowledge and demonstrate proper HH performance will affect self confidence and self efficacy, this result is confirmed with **Ghanbari M (2014)[10]** who mentioned; self-efficacy is crucial for behavior change and the findings of proved a significant relation between self-efficacy and practice, in addition, **Kang J et.al (2009)[24]** showed a statistical relation between self efficacy and compliance with standard precautions, **Chariyeva Z (2012) [38]** indicated that education can improve preventive self-efficacy, other studies have confirmed a direct relationship between perceived self-efficacy and self-care behaviors**[39-41]**

In relation to HH performance using soap and water technique and alcohol based formulation; the level of nurses performance of both groups has been increased significantly post the intervention, these results agreed with **Scheithauer, M. et al 2010[42]**who revealed high nurses compliance and in situations of greatest impact.

Also **Barbara C (2004)[43]**is in line and added; compliance of health care worker for hand hygiene was 40% pre intervention before patient contact and increased significantly to 53% post the intervention, moreover; **Mona F(2013)[44]**is in congruence and stated ;the intervention conducted has a significant influence on the overall HH compliance rate among the nurses.

Regarding the relation between years of nurses' experience and HH performance using alcohol based formulation; that there was no significant relation for both groups while there was a significant relation of HH performance using soap and water and years of experience only for pediatric group post the educational intervention. This result in contrast with earlier studies by **Al-Ahmadi H. (2009)[45]**who study the factors affecting performance of hospital nurses in Riyadh Region, Saudi Arabia and emphasized that years of experience were found to be strong predictors of job performance, indicating that work experience influences performance. Also, **Awases M et al. (2013)[46]**in a study compile the factors affecting the performance of professional nurses in Namibia and emphasizes the importance of developing strategies to promote the performance of nurses; build knowledge and expertise to improve their performance.

Conclusion

Mean scores of HBM subscales was low pre than post the educational intervention for both groups in respect to perceived severity, perceived susceptibility, perceived benefit, cues to action and self efficacy, while the mean scores of HBM subscales was higher pre than post intervention for both groups in respect to perceived barrier of HH performance. In addition, mean score of nurses' barriers of HH performance was higher for both groups pre than post intervention. Mean score of hand hygiene performance was higher post than pre intervention for both groups.

Recommendations: Based on findings of the present study, it can be recommended that;

Conducting of periodical refreshment workshops or conferences to all ICU nurses to improve and increase their knowledge and practices level regarding hand hygiene performance.

Continuing in-service training programs should be introduced to the nurses working in ICU on regular basis by different methods and materials of hand hygiene techniques.

A simple illustrated written booklet and wall posters including hand hygiene techniques should be available on all ICU.

Procedure manual should be provided to all ICU nurses which illustrates the hand hygiene techniques.

Further research study is needed in relation to different barriers in different

ICUs which affect hand hygiene techniques.

Install a gel dispenser in patient rooms, outdoors, main corridor and in the nursing utility room.

References

1. Sharon K. Demographic Factors Associated with Consistent Hand Hygiene Adherence among ICU Nurses. Doctoral Dissertations, Walden University, USA, 2017:4.
2. Guide to implementation of the WHO multimodal hand hygiene improvement strategy. [Accessed on August 24, 2010]. Available from: http://www.who.int/patientsafety/en/
3. WHO Guidelines on Hand Hygiene in Health Care. First Global Patient Safety Challenge. Clean Care is Safer Care. [Accessed on August 24, 2010]. Available from: http://www.who.int/patientsafety/en/
4. Boyce D. Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Morb Mortal Wkly Rep. 2002; 51:1–44.
5. Pittet D. Hand hygiene: improved standards and practice for hospital care. Current Opinion in Infectious Diseases, 2003; 16(4): 327-35.

6. Pratt J, Pellowe C. National evidence based guidelines for preventing healthcare associated infections in the NHS hospitals in England. Journal of Hospital Infection ;(2007). 65(1), S1 S64.
7. Christina L , Jakob D, Courtney L. The Health Belief Model as an Explanatory Framework in Communication Research: Exploring Parallel, Serial, and Moderated Mediation, Health Commun. 2015; 30(6): 566–576.
8. Glanz K, Rimer K, Lewis M. Health Behavior and Health Education. Theory, Research and Practice. San Fransisco: Wiley &Sons (2002).
9. Hak K, Joo A, Jae K. Applying the Health Belief Model to college students' health behavior Nutr Res Pract. 2012 Dec; 6(6): 551–558.
10. Ghanbari M, Ali A, Mohsen S, Mahboobeh K. Measurement of the Health Belief Model in Nurses Hand Hygiene among the Hospitals, World Applied Sciences Journal 2014, 31 (5): 811-818.
11. Weinstein R, Bonten M, Kluwer J. Infection control in the ICU environment Hosp Infect 2015, 30:24–29.
12. Rasslan O, seliem Z, Ghazi I, Abd-ElSabour M. Device-associated infection rates in adult and pediatric intensive care units of hospitals in Egypt. International Nosocomial Infection Control Consortium (INICC) findings. Journal of Infection and Public Health.2012; 5(6): 394-402.
13. Lewis K, Thompson J. Health care professionals' perceptions and knowledge of infection control practices in a community hospital. 2009; 28(3):230-8.
14. Shahin, M. Impact of a Designed Instructional Program about Enteral Nutrition on the Nurses' Knowledge and Practices at the Critical Care Department of Al-Manial University Hospital. Cairo: Faculty of Nursing - Cairo University, 2012.
15. Abdullah M, Mohammed W, Ismail M. Nurses' Knowledge and Practices about Administration of Medications via Nasogastric Tube among Critically Ill Patients. Faculty of Nursing – Cairo University. Journal of Education and Practice; 20145, (1)147.
16. Dawson B and Trapp R: Reading the medical literature: Basic & Clinical Biostatistics. Lange Medical Book/ McGraw – Hill. 3rded. New York. Medical Publication Division com, 2010; 9: 161- 314.
17. Pittet D. Hand hygiene: it's all about when and how Infect Control Hosp Epidemiol;(2008) 29: 957-95.
18. Emily M. Sydnor A, Trish M. Hospital Epidemiology and Infection Control in Acute-Care Settings. Clin Microbiol Rev, 2011; 24(1): 141–173.
19. Kampf G, Kramer A. Epidemiologic background of Hand Hygiene and evaluation of the most important agents for scrubs and rubs. Clin Microbiol Rev. 2004; 17:863–93.
20. Gillespie M. Exploring Self-Reported Hand Hygiene among Registered Nurses in the Inpatient Hospital Setting using the Health Belief Model, Doctorate Dissertation, Faculty of the Graduate School, University of Texas2013.
21. Shalansky S, Ignaszewski I, Levy A, Health beliefs as predictors of heart failure medication adherence. Can J Cardiol. 2003; 19:164A.
22. Pittet D, Allegranzi B, Storr J. Infection control as a major World Health Organization priority for developing countries. J Hosp Infect, 2008; 68:285–292.
23. Raza M, Kazi B, Mustafa M, Gould K. Developing countries have their own characteristic problems with infection control. J Hosp Infect, 2004; 57:294–299.
24. Kang J, Kim D, Leek P. Hospital nurses' knowledge and compliance on multidrug-resistant organism infection control guideline. Journal of Korean Academy of Nursing, 2009; 39(2): 186-97.
25. Zare M, Fariba G, Ali A, Sareh K. The Effect of Health Belief Model-Based Education on Knowledge and Prostate Cancer Screening Behaviors: A Randomized Controlled Trial. Int J Community Based Nurs Midwifery, 2016;4(1): 57–68.
26. Farzaneh Z, Abbas E, Fatemeh R , Fahimeh G. An investigation into the effect of health belief model-based education on healthcare behaviors of nursing staff in controlling nosocomial infections, Educ Health Promot. 2016; 5: 23.
27. Kamrani A. The Effect of Educational Diet on Nutrition Type 2 Diabetes Based on Health Belief Mode [dissertation]. Isfahan: Isfahan University of Medical Science, 2006.
28. Mohebi S, Sharifirad G, Hazaveyee S. The effect of educational program based on health belief model on diabetic foot care. Int J Diab Dev Ctries. 2007; 27:18–23.
29. Saeedi M. The Survey of Educational Program Based on Health Belief Model on Preventive Osteoporosis [dissertation]. Isfahan: Isfahan University of Medical Science; 2005.
30. Sharifi G, Hazavei M, Hasan Z, Danesh A. The effect of health education based on health belief model on preventive actions of smoking in grade one, middle school students. Arak Med Univ J. 2007; 10:79–86.
31. Karimy M, Hasani M, Khorram R. The Effect of Education Based on Health Belief Model on Breast Self-Examination in Health Liaisons of Zarandieh City. Zahedan Journal of Research in Medical Sciences. 2009; 10:283-91.
32. Taylor K, Williams R, Davis K. Decision Making in Prostate Cancer Screening Using Decision Aids vs Usual Care A Randomized Clinical Trial. JAMA Internal Medicine. 2013; 173:1704-12.

33. Alidosti M, Sharifirad G, Hemate Z. The effect of education based on health belief model of nutritional behaviors associated with gastric cancer in housewives of Isfahan city. Daneshvar Medicine. 2011; 18:35-44.
34. Khorsandi M, Fekrizadeh Z, Roozbahani N. Investigation of the effect of education based on the health belief model on the adoption of hypertension controlling behaviors in the elderly. ClinInterv Aging. 2017 Jan 27; 12:233-240.
35. Khaste T, Hashem H, Reza F, Zeynab G. Effect of Health Belief Model based education on nutritional behaviors of pregnant women referred to health centers in Torbathey dariyeh city. Journal of Health in the Field, 3(4), 2016.
36. Rao H. Knowledge, Attitude and Practice Patterns of Hand washing in Major Public Sector Hospitals of Karachi. Pak J Med Res, 2006; 45(4).
37. Chariyeva Z, Golin C, Earp J, Suchindran C. Does motivational interviewing counseling time influence HIV-positive persons' self-efficacy to practice safer sex? Patient Educ Couns. 2012; 87:101–7.
38. Suleiman I, Abdullahi M, Babangida D, Yusuf S. Using Health Beliefs Model as an Intervention to Non Compliance with Hypertension Information among Hypertensive Patient. IOSR Journal Of Humanities And Social Science,2015; 20(9):11-16
39. Bischoff, W, Reynolds T, Sessler C. Handwashing compliance by health care workers: the impact of introducing an accessible, alcohol-based hand antiseptic. Archives of Internal Medicine, 2000; 160(7): 1017.
40. Liu W, Liang S, Chuang Y. Hand hygiene compliance among the nursing staff in freestanding nursing homes in Taiwan: A preliminary study. International Journal of Nursing Practice2013.
41. Taghdisi M, Nejad E. Assess the knowledge, attitude and behavior of pregnant women with urinary tract infections, based on health belief model. Sci J Nurs Midwifery. 2011; 8:143–151.
42. Scheithauer S, Eitner F, Jennifer M, Helga H. Improving hand hygiene compliance rates in the hemodialysis setting: more than just more hand rubs Nephrology Dialysis Transplantation, 27(2), 2010: 766–770.
43. Barbara C, Lam M, Hand Hygiene Practices in a Neonatal Intensive Care Unit: A Multimodal Intervention and Impact on Nosocomial Infection. Pediatrics, 2004; 114 (5):565-571.
44. Mona F, Wafaa Y, Haifa M. The effect of hand hygiene compliance on hospital-acquired infections in an ICU setting in a Kuwaiti teaching hospital, Journal of Infection and Public Health (2013) 6, 27—34
45. AlAhmadi,H. "Factors affecting performance of hospital nurses in Riyadh Region, Saudi Arabia", International Journal of Health Care Quality Assurance 2009; 22(1): 40-54.
46. Awases, M, Bezuidenhout M, Roos, J. Factors affecting the performance of professional nurses in Namibia, Curationis, 2013, 36(1).