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RESEARCH ARTICLE

Evaluation of an educational Program on nurses' knowledge and practice regarding Standard precautions of infection control measures in outpatients clinics

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Abstract

Background: Outpatient care is usually the first level of contact of individuals with the national health system for general health problems or preventive medicine. The study aims to assess nurses' knowledge regarding standard precautions of infection control as well as their practice regarding infection control measures in outpatient setting. In addition to evaluate the effect of an educational program regarding infection control measures on nurses' knowledge and practice. **Methods: Design**: quasi experimental study design was done. **Instruments:** three tools were used in this study and it include questionnaire to assess nurses' knowledge regarding infection control, observational checklists was used to assess nurses' practice regarding infection control in outpatient setting and booklet cover knowledge and practice was done regarding infection control in outpatient setting. **Results**: This study showed significant improvement in nurses' knowledge and practice regarding infection control in outpatient clinics in post and follow up assessment with p value of 0.001, 0.001 respectively. However there was only significant relationship between improve nurses knowledge and their experience P= 0.02. Additionally, there was a significant relationship between improved nurses practice and their training courses P= 0.001. **Conclusion**: This study concluded that nurses' knowledge and practice increased significantly after conducting the educational program about infection control measures. Therefore, continuous education could be effective in improve nurses knowledge and practice regarding infection control measures. However, longitudinal study is needed to assess the impact of applying infection control measures on spread of infection in outpatient health care setting through assessing incidence rate of wound infection and other infection indicators.

INTRODUCTION

Standard precautions combine the major features of Universal Precautions (UP) and Body Substance Isolation (BSI) which are based on the principles that all blood, body fluids, secretions, excretions except sweat, nonintact skin, and mucous membranes may contain transmissible infectious agents. Standard Precautions include a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered. These include: hand hygiene; use of gloves, gown, mask, eye protection, or face shield, depending on the anticipated exposure; and safe injection practices. Also, equipments or items in the patient environment likely to have been contaminated with infectious body fluids must be handled in a manner to

prevent transmission of infectious agents (e.g., wear gloves for direct contact, contain heavily soiled equipment, properly clean and disinfect or sterilize reusable equipment before use on another patient). The application of Standard Precautions during patient care is determined by the nature of the HCW-patient interaction and the extent of anticipated blood, body fluid, or pathogen exposure. For some interactions (e.g., performing venipuncture), only gloves may be needed; during other interactions (e.g., intubation), use of gloves, gown, and face shield or mask and goggles is necessary (Centers for Disease Control, 2002).Basically, they consist of wearing barriers such as gloves when handling bodily fluids, and disposable gowns if they may be splashed, washing the hands when done, proper technique in handling and disposing of needles, use ventilation devices for mouth-to-mouth resuscitation of infected individuals (Centers for Disease Control, 2002).

Outpatient care is usually the first level of contact of individuals with the national health system for general health problems or preventive medicine. A broader range of different or more specialized settings are included also in the concept of outpatient care. Examples of outpatient care settings are hospital outpatient departments, polyclinics, specialized clinics (including ambulatory surgical care), accident and emergency polyclinics, general practitioners' offices, community health posts, physical therapy and rehabilitation centers, diagnostic laboratories, and dental care (WHO, 2012).

It has been estimated that approximately 75% of all operations in the United States will be performed in ambulatory or outpatient operating rooms by the turn of the century (Hecht, 1995). In recommending various sit surgical infection prevention methods, this document makes no distinction between surgical care delivered in such settings and that provided in conventional inpatient operating rooms. This document is primarily intended for use by surgeons, operating room nurses, postoperative inpatient and clinic nurses, infection control professionals, anesthesiologists, healthcare epidemiologists, and other personnel directly responsible for the prevention of nosocomial infections (Mangram et al. 1999). Members of the surgical team who have direct contact with the sterile operating field or sterile instruments or supplies used in the field wash their hands and forearms by performing a traditional procedure known as scrubbing (or the surgical scrub) immediately before donning sterile gowns and gloves (Mangram et al. 1999). Factors influence the effectiveness of the surgical scrub is scrubbing technique, the duration of the scrub, the condition of the hands, or the techniques used for drying and gloving. (O'Shaughnessyet al. 1991, Hingst et al. 1992, Wheelock & Lookinland 1997, Deshmukh, Kramer & Kjellberg 1998 and Masterson 1996).

Patient safety and quality of care are global health care concerns resulting in the proliferation of quality indicators (Lena Gunningberg et al, 2012). However, not only scientific knowledge needs to be incorporated, but also the particular context highlighted and accurate and powerful measurements used to illustrate what is happening in the clinical setting (Batalden& Davidoff, 2007, Rycroft-Malone et al. 2002). A prerequisite for evidence-based practice and quality improvement is regular feedback of results to encourage and track best practice improvements and related outcomes (Stetler, 2003, Jamtvedt, et al. 2006).

Sterilization describes a process that destroys or eliminates all forms of microbial life and is carried out in health-care facilities by physical or chemical methods. Steam under pressure, dry heat, hydrogen peroxide gas plasma, and liquid chemicals are the principal sterilizing agents used in health-care facilities. Sterilization is intended to convey an absolute meaning; unfortunately, however, some health professionals and the technical and commercial literature refer to "disinfection" as "sterilization" and items as "partially sterile." When chemicals are used to destroy all forms of microbiologic life, they can be called chemical sterility. These same germicides used for shorter exposure periods also can be a part of the disinfection process (i.e., high-level disinfection). Disinfection describes a process that eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects in health-care settings, objects usually are disinfected by liquid chemicals or wet pasteurization. Each of the various factors that affect the efficacy of disinfection can be limit the efficacy of the process (Rutala, Weber and the Healthcare Infection Control Practices Advisory Committee /HICPAC, 2008).

Factors that affect the efficacy of both disinfection and sterilization include prior cleaning of the object; organic and inorganic load present; type and level of microbial contamination; concentration of and exposure time to the germicide; physical nature of the object (e.g., crevices, hinges, and lumens); presence of biofilms; temperature and pH of the disinfection process; and in some cases, relative humidity of the sterilization process (e.g., ethylene oxide)Rutala , Weber and the Healthcare Infection Control Practices Advisory Committee/ HICPAC, 2008).

Although reports and scientific data are limited and many research questions remain unanswered, it is clear that hand and environmental contamination play a significant role in microbial transmission and determine the risk of infection in outpatient care. In addition, there has recently been a significant shift in health-care delivery and an increasing number of procedures are now performed in ambulatory or home-based settings, especially in high-risk patients (e.g. patients in dialysis and oncologic patients) (WHO 2012).Therefore this study Evaluate the effect of implementation of an educational program for nurses about infection control measures in outpatient setting based on their pre-requisite knowledge and practice regarding infection control.

Study Objectives:

1. Assess nurses' knowledge regarding infection control in outpatient setting.
2. Assess nurse s' practice regarding infection control in outpatient setting
3. Evaluate the effect of an educational program regarding infection control measures on nurses' knowledge and practice.

Statistical analysis of the data

Data were fed to the 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 and standard deviation for normally distributed data. Comparison between different groups regarding categorical variables was tested using Chi-square test. For normally distributed data, comparison between two independent population were done using independent t-test while more than two population were analyzed F-test (ANOVA) to be used. Significance test results are quoted as two-tailed probabilities. Significance of the obtained results was judged at the 5% level (Leslie, Geoffrey & James 1991 and Kirkpatrick & Feeney, 2013)

Methodology

Design

Quasi experimental study was done

Setting and sample

All available nurses working in surgical outpatient clinics working in Damietta and Port Said general hospitals were invited to participate in the study through leaflet. The total number of participated nurses was (60)

Instrument

Three tools were used in the current study. First one is questionnaire used to assess level of nurses' knowledge before and after attending an education program regarding infection control measures in outpatient setting. This questionnaire consists of two parts; first one assess demographic characteristic of participated nurses e.g. age, marital status, years of experience, and professional qualifications. Second part assessed Nurses knowledge regarding infection control which includes definition of sterilization, proper isolation, types of sterilization, equipment that may be sterilized in autoclave (6 questions). In addition to Knowledge about wound care e.g. cleansing the blood, the presence of abrasions or superficial wounds, the method of sending linens from the ward to the laundry (9questions), aim of dressing and types of antiseptic solutions (10 questions). Moreover, Knowledge about hand washing was assessed e.g. the importance of drying hands. Knowledge also regarding health hazards which nurses may be exposed during working in surgical outpatient clinic and reception of hospitals (3 questions). This questionnaire was validated using nine jury experts from nursing and medical staff and a little modification was done. Second one was observational check-list based on reviewing nursing fundamental **(WHO, 2006)** which used for assessing nurses' performance. This tool was used before and after the program to evaluate to what extent the training program affected the nurses' performance. The observation check-lists included hand washing, wearing gloves, face mask, and plastic apron. Methods of disposing wastes after wound dressing were also assessed. The third one was a booklet developed by the researchers based on reviewing literature **(WHO, 2006) references**) regarding infection control measures in surgical outpatient clinics and reception. The booklet include question regarding infection control e.g. definition of infection, types of sterilization, mode of infection transmission, universal precaution related to infection control and puncture of the skin. Check-lists regarding hand washing, wearing and removing personal equipment's e.g. Gloves, mask and plastic apron were included. In addition to method of disposing wastes after wound dressing and universal precaution related to deal with blood and body fluid, and get rid of sharps disposal and needle stick injury. The booklet was given for all participated nurses.

Data collection

The data was collected by the researchers three times. First one was before applying the educational program regarding infection control. Second one was immediately after application of the program regarding infection control and third one was three months after program application. The educational program was conducted through educational sessions for participated nurses two times weekly for a period of four weeks.

Results

The study was conducted on total sample of 60 nurses from three hospitals, each hospital from one city. All nurses working in surgical outpatients of each hospital. Study sample demographic data showed that the mean age of study sample was 24.6 years old and 56.7% of them are married however 40% were single. Additionally, 70% of study sample have diploma nursing degree. On the other hand, one third of sample their experience ranged from 5 to 10 years and a little bit more than one third of the sample their years of experience were less than five years. Whereas, 41.7% of study sample have training courses regarding infection control (see table 1).Nurses knowledge and practice were assessed three times; before conducting the educational program, immediately after conducting the educational program (post) and last one three months later (follow up).

Table 2 Showed significant improvement in nurses knowledge regarding infection control in post and follow up assessment (P= 0.001). The nurses knowledge covered infection, infection proper care in hospital, methods of infection transmission, infection chain, prevention from spread of infection, types of most frequent infection in hospitals, persons who are susceptible to infection, factors affecting degree of human resistance to infection and standard precautions to prevent infection transmission. Moreover, table three revealed a significant improvement in nurses practiceregarding infection control in post and follow up assessment (P= 0.001). Nurses practice including more than one procedure as hand washing, applying and removing gloves, applying and removing gown, applying and removing surgical mask, dressing technique, dealing with solid linen and sterilization.

Additionally, table 4 shows that nurses practice score regarding nursing skills as disinfection, different types of injection (e.g. Intramuscular, subcutaneous, and intradermal), inserting intravenous line and fluid administration was significantly higher (P= 0.001) immediately and three months later after (follow up) conducting the educational program. Regarding relationship between nurses knowledge and their demographic characteristics, there was only a significant relationship between nurses knowledge and their years of experience (P= 0.01). Furthermore, there was also only relationship between nurses practice and their training courses regarding infection control (P= 0.02).

Finally, figure one shows an increase in total nurses knowledge in post program assessment regarding infection control in outpatient clinics in all study setting however, it was a little bite decreased in the follow up assessment from 90.08% to 80.17%. Moreover, figure two shows increasing in total nurses practice in post program assessment regarding infection control in outpatient clinics in all study setting while it also decreased in the follow up assessment slightly from 95.74% to 90.18%.

Table (1): Comparison between two studied groups according to their demographic data

	El Amery general hospitals (n = 40)		El Azher university hospital (n = 20)		Total (n = 60)	
	No.	%	No.	%	No.	%
Age						
<20	2	5.0	5	25.0	7	11.7
20 – 29	28	70.0	14	70.0	42	70.0
30 – 39	9	22.5	1	5.0	10	16.7
≥40	1	2.5	0	0.0	1	1.7

Mean	24.6					
Marital status						
Single	12	30.0	12	60.0	24	40.0
Married	27	67.5	7	35.0	34	56.7
Divorced	1	2.5	1	5.0	2	3.3
Education						
Diploma	25	62.5	17	85.0	42	70.0
Institute	8	20.0	2	10.0	10	16.7
Bachelor	7	17.5	1	5.0	8	13.3
Experience						
<5	14	35.0	10	50.0	24	40.0
5 – 10	16	40.0	4	20.0	20	33.3
≥10	10	25.0	6	30.0	16	26.7
Mean ±SD	8.87 ± 2.68					
Training course						
No	33	57.5	12	60.0	35	58.3
Yes	17	42.5	8	40.0	25	41.7

Table (2): Nurses knowledge regarding infection control in study settings

		El Amery general hospitals (n = 40)						**ElAzher university hospitals (n = 20)**					
		Pre		**Post**		**Follow-up**		**Pre**		**Post**		**Follow-up**	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1. Infection	Don`t know	10	25.0	0	0.0	0	0.0	5	25.0	0	0.0	0	0.0
	Incomplete	22	55.0	2	5.0	8	20.0	15	75.0	2	10.0	4	20.0
	Complete	8	20.0	38	95.0	32	80.0	0	0.0	18	90.0	16	80.0
Mean ± SD.		47.5 ± 33.9		97.5±11.04		90.0 ± 20.3		37.5 ± 22.2		95.0± 13.39		90.0 ± 20.5	
P				<0.001*		<0.001*				<0.001*		<0.001*	
2.Infection proper care in the hospital	Don`t know	19	47.5	0	0.0	0	0.0	10	50.0	0	0.0	0	0.0
	Incomplete	14	35.0	3	7.5	8	20.0	10	50.0	1	5.0	4	20.0
	Complete	7	17.0	37	92.5	32	80.0	0	0.0	19	95.0	16	80.0
Mean ± SD.		35.0 ± 37.9		96.25± 13.3		90.0 ± 20.3		25.0 ± 25.7		97.5± 11.18		90.0 ± 20.5	
P				<0.001*		<0.001*				<0.001*		<0.001*	
3. Methods of transmission	Don`t know	5	12.5	0	0.0	0	0.0	2	10.0	0	0.0	0	0.0
	Incomplete	32	80.0	3	7.5	6	15.0	17	85.0	2	10.0	5	25.0
	Complete	3	7.5	37	92.5	34	85.0	1	5.0	18	90.0	15	75.0
Mean ± SD.		32.50±18.8		85.8±15.8		80.4±18.4		32.5±19.1		80.0±16.8		74.2±19.1	
P				<0.001*		<0.001*				<0.001*		<0.001*	
4. Infection Series consists of six elements	Don`t know	16	40.0	0	0.0	0	0.0	14	70.0	0	0.0	0	0.0
	Incomplete	21	52.5	3	7.5	10	25.0	6	30.0	3	15.0	4	20.0
	Complete	3	7.5	37	92.5	30	75.0	0	0.0	17	85.0	16	80.0
Mean ± SD.		22.9# ±27.1		85.83± 15.4		75.0± 18.87		8.33# ± 15.8		84.17± 19.9		74.17± 20.6	
P				<0.001*		<0.001*				<0.001*		<0.001*	

5. To prevent the spread of infection to be cut chain	Don`t know	18	45.0	0	0.0	0	0.0	11	55.0	0	0.0	0	0.0
	Incomplete	22	55.0	3	7.5	12	30.0	9	45.0	3	15.0	9	45.0
	Complete	0	0.0	37	92.5	28	70.0	0	0.0	17	85.0	11	55.0
Mean ± SD.		21.7 ± 22.1		96.7 ± 12.6		86.7± 22.4		15.0 ± 17.0		93.3 ± 17.4		78.3 ± 27.1	
p				<0.001*		<0.001*				<0.001*		<0.001*	
7. Types of most frequent infections in hospital	Don`t know	13	32.5	0	0.0	0	0.0	11	55.0	0	0.0	0	0.0
	Incomplete	27	67.5	2	5.0	10	25.0	9	45.0	1	5.0	4	20.0
	Complete	0	0.0	38	95.0	30	75.0	0	0.0	19	95.0	16	80.0
Mean ± SD.		20.0± 16.96		88.75± 13.8		71.67± 18.6		13.33± 16.8		85.83± 13.6		75.83± 18.3	
p				<0.001*		<0.001*				<0.001*		<0.001*	
8. Most important sources of infection within the hospital	Don`t know	15	37.5	0	0.0	0	0.0	10	50.0	0	0.0	0	0.0
	Incomplete	23	57.5	2	5.0	4	10.0	9	45.0	1	5.0	7	35.0
	Complete	2	5.0	38	95.0	36	90.0	1	5.0	19	95.0	13	65.0
Mean ± SD.		18.75± 19.7		88.75± 13.3		78.3#± 14.2		16.67± 21.6		89.17± 14.6		62.5#± 17.8	
p				<0.001*		<0.001*				<0.001*		<0.001*	
9. Persons who are most susceptible to infection	Don`t know	9	22.5	0	0.0	0	0.0	4	20.0	0	0.0	0	0.0
	Incomplete	29	72.5	2	5.0	4	10.0	16	80.0	1	5.0	3	15.0
	Complete	2	5.0	38	95.0	36	90.0	0	0.0	19	95.0	17	85.0
Mean ± SD.		32.9#± 21.5		91.25± 12.5		79.2#± 14.9		20.0#± 14.9		88.33± 13.4		70.8#± 11.9	
p				<0.001*		<0.001*				<0.001*		<0.001*	
10. Factors that affect the degree of human resistance to infection	Don`t know	20	50.0	0	0.0	0	0.0	10	50.0	0	0.0	0	0.0
	Incomplete	19	47.5	2	5.0	4	10.0	10	50.0	1	5.0	3	15.0
	Complete	1	2.5	38	95.0	36	90.0	0	0.0	19	95.0	17	85.0
Mean ± SD.		18.33± 21.3		85.0± 14.52		80.42± 16.8		14.17± 18.2		90.0± 14.7		75.83± 16.6	
p				<0.001*		<0.001*				<0.001*		<0.001*	
11. Standard precautions to prevent the transmission	Don`t know	15	37.5	0	0.0	0	0.0	10	50.0	0	0.0	0	0.0
	Incomplete	22	55.0	2	5.0	4	10.0	10	50.0	0	0.0	1	5.0
	Complete	3	7.5	38	95.0	36	90.0	0	0.0	20	100.0	19	95.0
Mean ± SD.		27.50± 24.6		87.08± 13.9		83.75± 15.8		19.17± 22.5		93.33± 8.38		82.50± 13.8	
p				<0.001*		<0.001*				<0.001*		<0.001*	
Total knowledge		27.7#± 12.1		90.29± 5.08		81.54#± 6.9		20.17#± 9.2		89.67± 4.88		77.42#± 6.7	
% of improvement				376.80%		324.16%				482.09%		411.50%	
p				<0.001*		<0.001*				<0.001*		<0.001*	

#: Significant with El Azher hospital, P value for comparing between pre and post, pre and follow up in each hospital and total sample, *: Statistically significant at $p \leq 0.05$

Table (3): Nurses practice regarding infection control in study settings

		El Amery general hospitals (n = 40)						**ElAzher university hospitals (n = 20)**					
		Pre		**Post**		**Follow-up**		**Pre**		**Post**		**Follow-up**	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1.Hand Washing	Not done	20	50	4	10	12	30	10	50	4	20	6	30
	Done	20	50	36	90	28	70	10	50	16	80	14	70
Mean ± SD.		38.4± 13.2		91.5± 3.9		87.1± 4.7		35.0± 15.9		92.4± 2.8		89.4± 4.9	
p				<0.001*		<0.001*				<0.001*		<0.001*	
2.Applying and gloves	Not done	29	72.5	2	5	10	25	15	75	2	10	5	25
	Done	11	27.5	38	95	40	75	5	25	18	90	15	75
Mean ± SD.		33.1± 18.1		82.1± 7.7		75.4± 6.2		28.8± 16.8		85.8± 5.5		77.5± 6.11	

p				<0.001*		<0.001*				<0.001*		<0.001*	
3.remove the gloves:	Not done	31	77.5	5	12.5	9	22.5	10	50.0	3	15	7	35
	Done	9	22.5	35	87.5	31	77.5	10	50.0	17	85	13	65
Mean ± SD.		52.5# ± 19.6		83.0 ± 8.5		96.5± 8.9		37.0# ± 25.4		81.0 ± 10.2		96.0 ± 8.2	
p				<0.001*		<0.001*				<0.001*		<0.001*	
4.Applying A Gown	Not done	21	52.5	7	17.5	9	22.5	15	75	2	10	6	30
	Done	19	47.5	33	82.5	31	77.5	5	25	18	90	14	70
Mean ± SD.		25.0 ± 16.2		90.0 ± 12.8		63.5 ± 19.7		20.0 ± 11.2		93.0 ± 9.8		60.0± 21.5	
p				<0.001*		<0.001*				<0.001*		<0.001*	
5.Remove Gown	Not done	21	52.5	4	10	10	25	13	65.0	2	10	5	25
	Done	19	47.5	36	90	30	75	7	35.0	18	90	17	75
Mean ± SD.		50.3 ± 19.9		95.8 ± 10.6		91.4 ± 7.3		38.3 ± 25.9		100.0 ± 0.0		89.4 ± 7.6	
p				<0.001*		<0.001*				<0.001*		<0.001*	
6.Applying The Surgical Mask	Not done	21	52.5	5	12.5	7	17.5	15	75	3	15	7	35
	Done	19	47.5	35	87.5	33	82.5	5	25	17	85	13	65
Mean ± SD.		46.7# ± 15.2		97.5 ± 8.9		97.9 ± 5.6		24.2# ± 17.5		99.2 ± 3.7		97.5 ± 6.11	
p				<0.001*		<0.001*				<0.001*		<0.001*	
7.Removing The Surgical Mask	Not done	21	52.5	4	10	9	22.5	10	50.0	3	15	7	35
	Done	19	47.5	36	90	31	77.5	10	50.0	17	85	13	65
Mean ± SD.		36.8# ± 9.6		98.2 ± 4.8		83.2 ± 6.4		25.7# ± 16.5		98.6 ± 6.4		84.3 ± 4.4	
p				<0.001*		<0.001*				<0.001*		<0.001*	
8.Dressing technique	Not done	15	37.5	2	5	8	20	11	55	2	10	6	30
	Done	25	62.5	39	95	32	80	9	45	18	90	14	70
Mean ± SD.		41.7 ± 6.3		97.1 ± 3.4		92.9# ± 3.4		37.6 ± 12.7		98.1 ± 6.4		94.5# ± 2.8	
p				<0.001*		<0.001*				<0.001*		<0.001*	
9.Soiled linen	Not done	8	20	1	2.5	2	5	4	20	1	5	2	10
	Done	22	55	39	97.5	38	95	16	80	19	95	18	90
Mean ± SD.		32.78±4.32		98.89±4.21		98.89±4.21		31.11±7.73		100.0±0.0		100.0±0.0	
p				<0.001*		<0.001*				<0.001*		<0.001*	
10.Sterilization	Not done	4	10	0	0.0	0	00.0	2	10	0	0.0	0	0.0
	Done	36	90	40	100.0	40	100.0	18	90	20	100.0	20	100.0
Mean ± SD.		21.07±2.26		98.04±4.85		97.50±5.50		20.36±2.62		99.29±2.20		99.29±2.20	
p				<0.001*		<0.001*				<0.001*		<0.001*	

#: Significant with El Azher hospital, P- value for comparing between pre and post, pre and follow up in each hospital and total sample, *: Statistically significant at $p \leq 0.05$

Table (4): Continuous of nurses practice regarding infection control in study settings

		El Amery general hospitals (n = 40)						**ElAzher university hospitals (n = 20)**					
		Pre		**Post**		**Follow-up**		**Pre**		**Post**		**Follow-up**	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
11.Disinfection	Not done	11	27.5	0	0.0	3	7.5	4	20	0	0.0	1	5
	Done	29	72.5	40	100.0	37	92.5	16	80	20	100.0	19	95
Mean ± SD.		42.92±12.16		97.71±5.33		89.58±4.90		35.0±15.67		97.08±5.59		90.83±2.56	

p				<0.001*		<0.001*				<0.001*		<0.001*	
12.Intramuscular	Not done	18	45	0	0.0	6	15	15	75	2	10	6	30
	Done	22	55	40	100.0	34	85	5	25	18	90	14	70
Mean ± SD.		44.25±10.35		99.50±2.21		89.50±2.21		37.0±15.59		99.0+3.08		89.0±3.08	
p				<0.001*		<0.001*				<0.001*		<0.001*	
13.Intradermal	Not done	15	37.5	0	0.0	4	10	7	35	0	0.0	3	15
	Done	25	62.5	40	100.0	36	90	13	65	20	100.0	17	85
Mean ± SD.		21.67±2.45		97.78±4.50		98.61±3.72		21.67±2.48		98.89±3.42		99.44+2.48	
p				<0.001*		<0.001*				<0.001*		<0.001*	
14.Subcutaneous	Not done	21	52.5	7	17.5	9	22.5	15	75	2	10	6	30
	Done	19	47.5	33	82.5	31	77.5	5	25	18	90	14	70
Mean ± SD.		32.19±8.44		97.50±5.06		84.69±8.25		28.75±10.81		96.25±7.14		81.25±10.34	
p				<0.001*		<0.001*				<0.001*		<0.001*	
15.IV Insertion	Not done	21	52.5	4	10	10	25	13	65.0	2	10	3	15
	Done	19	47.5	36	90	30	75	7	35.0	18	90	17	85
Mean ± SD.		26.92#±5.78		99.42±2.05		91.35±3.11		21.15±10.55		99.62±1.72		89.62±5.16	
p				<0.001*		<0.001*				<0.001*		<0.001*	
16.IV Fluid Administration	Not done	21	52.5	5	12.5	7	17.5	15	75	3	15	7	35
	Done	19	47.5	35	87.5	33	82.5	5	25	17	85	13	65
Mean ± SD.		19.58±6.41		98.33±5.06		94.58±9.54		19.17±8.16		99.17±3.73		96.67±6.84	
p				<0.001*		<0.001*				<0.001*		<0.001*	
Total	**Mean ± SD.**	35.40±5.86		95.41±2.03		90.02±1.67		29.79±8.09		96.38±1.59		90.52±1.98	
% of improvement				179.2%		163.9%				261.2%		240.0%	
p				<0.001*		<0.001*				<0.001*		<0.001*	

#: Significant with El Azher hospital, P- value for comparing between pre and post, pre and follow up in each hospital and total sample, *: Statistically significant at $p \leq 0.05$

Figure1. Relationship between total nurses' knowledge in pre, post and follow up assessment

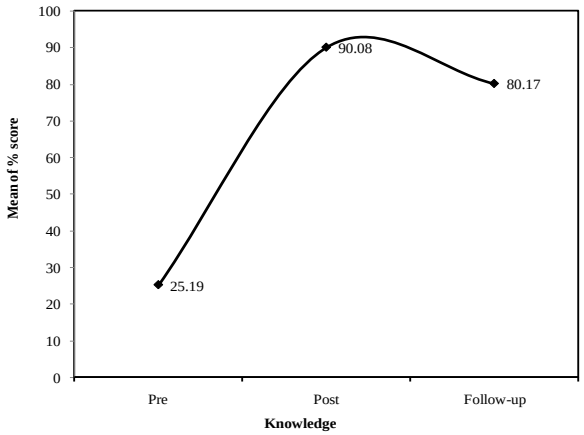
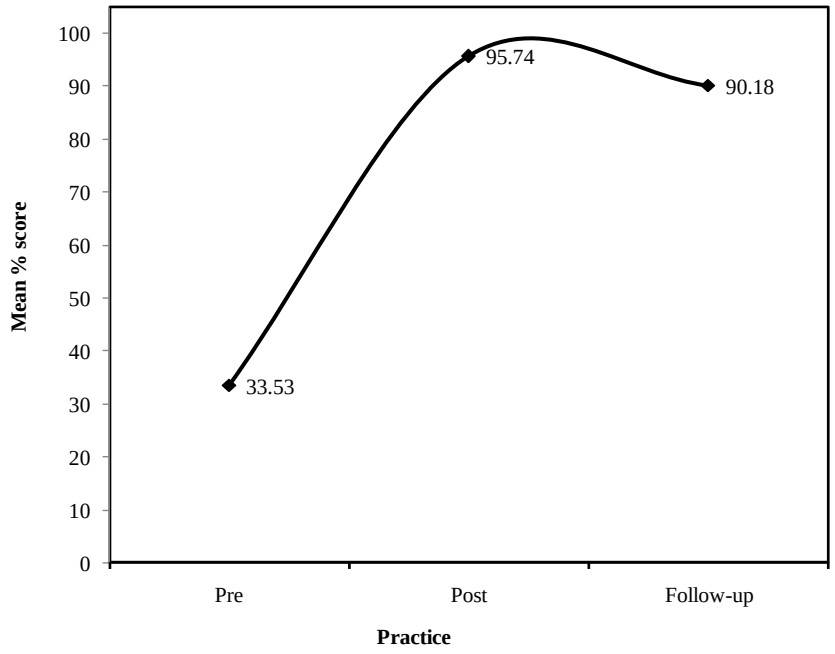


Figure 2.Relationship between nurses'practicein pre, post and follow up assessment



Discussion

The current study revealed low level of nurses' knowledge and practice regarding infection control in outpatient setting. However the study results showed obvious improvement in nurses' knowledge and practice after implementing an educational programme regarding infection control measures (knowledge and practice). The interpretation of these results could be referd to the effect of education in improving nurses' performance. Additionally, Personnel are more likely to comply with an infection control program if they understand its rationale. Thus, personnel education is a cardinal element of an effective infection control program. Clearly written policies, guidelines, and procedures ensure uniformity, efficiency, and effective coordination of activities. However, because the risk of infection varies by job category, infection control education should be modified accordingly. In addition, some personnel may need specialized education on infection risks related to their employment and on preventive measures that will reduce those risks (Elizabeth et al. and the Hospital Infection Control Practices Advisory Committee, 1998).

The lack of scientific information of the definitive impact of improved hand hygiene on health-care–associated infection rates is a possible barrier to appropriate adherence with hand-hygiene recommendations. However, evidence supports the belief that improved handhygiene can reducehealth-care associated infection rates. Failure to perform appropriate hand hygiene is considered the leading cause of health-care–associated infections and spread of multi-resistant organisms and has been recognized as a substantial contributor to outbreaks (Centers for Disease Control, 2002). The culture of infection prevention and control, including hand hygiene, does not seem to be well established among the highest priorities in outpatient care settings around the world. No specific international guidelines on this topic available; however, the United States Centers for Disease Control and Prevention recently issued a dedicateddocument accompanied by an implementation checklist.Although it does not include a section reviewing the potential transmission routes or the evidence highlighting the burden of HCAI (health care associated infection) in outpatient settings, hand hygiene is acknowledged to be critical to reduce the risk of spreading infection in these settings (WHO 2012).

The lack of scientific information of the definitive impact of improved hand hygiene on health-care–associated infection rates is a possible barrier to appropriate adherence with hand-hygiene recommendations (Centers for Disease Control, 2002). In-service education, information leaflets, workshops and lectures, automated dispensers, and performance feedback on hand-hygiene adherence rates have been associated with transient improvement (Tibballs, 1996). Several strategies for promotion of hand hygiene in hospitals have been published .These strategies

require education, motivation, or system change. Certain strategies are based on epidemiologic evidence, others on the authors' and other investigators' experience and review of current knowledge. Some strategies may be unnecessary in certain circumstances, but may be helpful in others. In particular, changing the hand-hygiene agent could be beneficial in institutions or hospital wards with a high workload and a high demand for hand hygiene when alcohol-based hand rubs are not available (Perz et al. 2010 and Harbarth et al 1999).

A recent study highlights interesting findings on infection control practices in 68 ambulatory surgical centers in the USA. Observations focused on five areas of infection control: hand hygiene; injection safety and medication handling; equipment reprocessing; environmental cleaning; and handling of blood glucose monitoring equipment. Overall, 67.6% of centers had at least one lapse in infection control and 17.6% had lapses in greater than or equal to three of the five infection control categories. Common lapses were handling of blood glucose monitoring equipment (46.3%), using single-dose medication vials for more than one patient (28.1%), and failing to adhere to recommended practices for equipment reprocessing (28.4%). The proportion of lapses in hand hygiene performance before and after the surgical procedure was 17.7%, which is relatively high considering that hand hygiene is a cornerstonefor the prevention of surgical site infection (Schaefer et al. 2010).

Conclusion

The study results showed significant increase in nurses' knowledge and practice after conducting the educational program about infection control measures. Therefore, continuous education could be effective in improve nurses knowledge and practice regarding infection control measures. However, longitudinal study is needed to assess the impact of applying infection control measures on spread of infection in outpatient health care setting through assessing incidence rate of wound infection and other infection indicators.

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