

Effects of an Educational Program on the Nurses' performance regarding Vascular Access Infection Prevention

Watanya Kamel Atya Elgazar¹, Marwa Mostafa Raghep², Hanan Gaber Mohamed³
& Rasha Fathy Mohamed⁴

¹ Assist. Lecture of Medical Surgical Nursing, Faculty of Nursing, Benha University. ² professor of Medical Surgical Nursing, Faculty of Nursing, Benha University. ³ professor Medical Surgical Nursing, Faculty of Nursing, Benha University.

⁴ Lecturer of Medical Surgical Nursing, Faculty of Nursing, Benha University.

Abstract:

Vascular access devices are one of the most important causes of healthcare acquired infection. Millions of vascular catheters are used each year, putting large numbers of patients at risk of phlebitis and catheter-related blood stream infection, **Aim** this study aimed to evaluate the effect of implementing an education program on the nurses' performance regarding vascular access infection prevention. **Tool** of the study, three tools for data collection were used as follow: (1) Nurses Structured Questionnaire. (2) Vascular access infection control practices observational checklist. (3) Assessment sheet to assess the incidence of blood stream infection related to vascular access. **Research design** used aquasi experimental. Composed of a convenience sample of nurses in the Critical Care Units who are working Hemodialysis (40 nurses), Intensive Care Units (20 nurses), Coronary Care Unit (20 nurses) and 110 patients from critical care (40 from dialysis, 20 from intensive care unit and 20 from coronary care unit). They are willing to participate in the study. **The result** of present study show that, Concerning nurses' characteristics, the majority of them were female (82.7%), as regard to age nearly half of them (47.3%) their age was from 18 - > 30 old years and 51.8% are married . Concerning to patient ' characteristic at ICU and CCU department, one third of them (38.6%) their age ranged from 30 - < 50 years and 62.9% of them were female, also more than half of them had CVC insertion.. Concerning to patient ' characteristic at **dialysis unit**, approximately more than one third of them (42.0%) felt at age group between 20 - 30 years, an Concerning to patient assessment for sign and symptom on infection ,there there were highly statistically significant differences between mean scores of the pre and post tests . **The conclusion**, There were negative relations between nurses ' knowledge, practice and patient assessment for sign and symptom of infection. There were positive correlation between nurses` practice and nurses' knowledge about vascular access infection prevention pre program intervention while negative correlation post program intervention. **Recommended** that, Nursing managers and the infection control team should plan for periodic educational and training programs.

Keywords: cataract surgery, self care guideline.

Introduction

The majority of patients who are admitted to hospitals require the insertion of an intravascular device (IVD). They permit the infusion of medications into the blood circulatory system, a means to sample blood, for diagnostic purposes and the application of invasive hemodynamic monitoring. IVDs are used across all medical, surgical, palliative and critical care specialties and from hospital to home environments (Jullman, Kleidon, Rickard, 2010).

There are different methods are used to gain access to the blood stream, it may be temporary as, simple IV line, cannula and central venous catheter or permanent device including: an arteriovenous fistula or a synthetic graft. The choice of VADs should be based on the needs of the patient condition (*The National Kidney Foundation*, 2017).

Nosocomial infection is a major public health concern throughout the world, it contribute to elongation of hospital stay, long term or permanent disability and death, each year health systems spend a considerable amount of

resources, including high - end antibiotics, health professional work time and hospital space to treat the consequence of nosocomial infection (Gundlapalli, Jaulent, Zhao, 2018).

VADs are one of the most important causes of healthcare acquired infection. Millions of vascular catheters are used each year, putting large numbers of patients at risk of phlebitis and catheter-related blood stream infection. The attributable mortality of catheter-related blood stream infections is approximately 10%, and catheter-related bloodstream infections have been associated with significant costs (Weinestein & Haggel, 2018).

The incidence of access-related infection is estimated at 0.9–2.0 episodes per one catheter year. The type of vascular access is a critical risk factor for infection. The risk for an access-related infection with a tunnelled catheter is ten times higher than with an arteriovenous (AV) graft and twenty times higher than with an AV fistula. Infection related to VADs can be classified as systemic or local infection. Systemic infections can be life-

threatening; therefore, nurses must be able to prevent infection assess for its signs and symptoms to be implemented in a timely manner. Signs and symptoms of a systemic infection include fever, chills, diaphoresis, hypotension, or mental status changes. Local infections occur at the insertion site, exit site, tunnel, or port pocket. Signs and symptoms of local infection include edema, tenderness, erythema, or drainage ([Matey & Sorrell, 2017](#)).

Numerous risk factors have been cited to increase a patient's risk of VAD infection including prolonged neutropenia, older age, prolonged intensive care unit stay, increased VAD dwell time, low absolute neutrophil count (ANC), poor nutritional status, or device erosion([Chesshyre , et al , 2019](#)).

To improve patient outcomes and reduce healthcare costs, it is essential that everyone involved in caring for patients with a vascular access device is educated about infection prevention. Healthcare workers, patients and their carers need to be confident and proficient in infection prevention practices and to be equally aware of the signs and symptoms of clinical infection and how to access expert help when

difficulties arise. Well-organised educational programmes that enable healthcare workers to provide, monitor, and evaluate care and to continually increase their competence are critical to the success of any strategy designed to reduce the risk of infection(*National institute for health and care excellence, 2014*).

Infection control standard precautions include certain measures such as use of aseptic technique, hand hygiene, use of personal protective equipment (PPE), sharps safety, staff health, safe use and disposal of sharps, safe injection practices, environmental cleaning, reprocessing of equipment, single use policy and waste management. Many infection control measures, such as appropriate hand hygiene and the correct application of basic precautions during invasive procedures are simple and of low-cost, but require staff accountability and behavioral change, in addition to improving staff education, reporting and surveillance systems ([Dawson, 2014](#)).

Vascular access assessment is the most important tasks for nurses and personnel who assisting in the performance of procedure. These tasks

require knowledge, professionalism and special education to be master. So, the nurses and technicians are responsible for day-to-day consistency of the vascular access care process and patient education. The routine maintenance of vascular access devices is a shared responsibility between the nurse and the patient, so that the nurse has an important part to play in the adequate preparation and education of the patient (*Wilson, ۲۰۱۵*).

Nurses serve an important role in preventing the transfer of organism in two ways, first, as the health professionals who often spend the most time with patient: nurse have a greater opportunity for spreading organism. It is imperative that nurse disinfect their hands before and after contact with patient and after performing a potentially hand contaminating activity. The second way that nurses reduce hand to hand spread is to serve as patient advocates. With the number of health care workers involved in patient care each day, there is a significant opportunity for breaks in hand – hygiene technique (*Elneblawy, ۲۰۱۸*).

Significance of the study

Infection is a cause of hospitalization for critical ill patient in the U.S.A, rate of infection about ۳۴%, and the rate of hospitalization for vascular access infections more than doubled. In ۲۰۱۷, there were ۱۰۳ admissions per ۱۰۰۰ patient years with the diagnosis of bacteremia / septicemia and ۱۲۹ per ۱۰۰۰ patient years with the diagnosis of vascular access-associated infection. Infection is reported as the second most common cause of death in critical ill patients ۲۰.۲ % in ۲۰۱۷, after cardiovascular disease (*Bayoumi, Mahmoud, ۲۰۱۷*).

In Egypt at ۲۰۱۶ about ninety-one ICUs in ۲۸ hospitals contributed to ۴۷۴,۵۴۴ patient days and ۲,۶۸۸ Health care-associated infections (HAIs) (*Talat, et al, ۲۰۱۶*). The number of patients enter to the critical care units (ICU, CCU, dialysis and emergency department) in year ۲۰۱۷ were ۱۳۸۲,۸۲۹,۱۹۱,۱۸۷۵۴۸ respectively (*statistics office in Benha Unviarsity hospital, ۲۰۱۷*). Approximately

vascular catheters were used for all patients, large numbers of patients were at risk of catheter-related blood stream infection.

Kadium (٢٠١٥), reported that studies provided evidence of effects of improving nurses' knowledge on reducing cross blood stream infection. The greater part of the studies proposed that the educational intervention could improve or enhance nurses' knowledge in reducing cross blood stream infection rates. Therefore, the current study aims to improve nurses' knowledge and practice as regard VADs infection prevention.

Aim of the study:

This study aims to evaluate the effect of implementing an education program on the nurses' performance regarding vascular access infection prevention.

Research hypotheses

١-The mean score of nurses' knowledge and practice post education program will be higher than before.

٢-after implementing the program incidence of blood stream infection will be decrease.

To achieve the aim of this study the following research question is formulated.

Subjects and Methods:

Research design

A quasi Experimental - design was utilized to achieve the aim of this study.

١- Study setting

The study will be conducted in the Critical Care Units including (Hemodialysis, Intensive Care Units, coronary Care Unit) at Benha University Hospital.

Subjects

a- nurses

a convenience sample of nurses in the Critical Care Units who are working at the above mentioned setting and are assigned for caring the patients with vascular access insertion which including: Hemodialysis (٤٠ nurses), Intensive Care Units (٥٠ nurses), Coronary Care Unit (٢٠ nurses). They are willing to participate in the study.

b- Patient

١١٠ patients from critical care (٤٠ from dialysis, ٥٠ from intensive care unit and ٢٠ from coronary care unit). Who are assigned for care

Tool for data collection:

Three tools for data collection were used as follow:

Tool 1: Nurses Structured Questionnaire

It aimed to assess nurses' knowledge related to vascular access infection prevent This questionnaire was developed by the researcher in Arabic language after reviewing the recent related literatures. It involved the following two parts:

Part 1: Concerning socio-demographic characteristics for nurses' related to their age, gender, marital status, qualification, years of experience, work place and attendance of training past programs about infection control. It will be attached to the questionnaire, knowledge about vascular access infection prevention.

Part 2: This part concerned with assessment of nurses' knowledge.

It consists of five parts as follow:.. were given zero score. These scores were summed-up and converted into a percent score. Then categorized as follow:

- Score < 50 referred to unsatisfactory.
- Score > 50 referred to satisfactory.

II. Tool (2): Vascular Access Infection prevention Practices observational checklist (Appendix II).

These checklists were adapted from (Center for disease control and prevention (CDC), 2014) and modified by researcher to assess nurses' practice regarding Vascular Access Infection Control including: Insertion of cannula, care of central venous catheter, removal of intravenous cannula, cannulation of arteriovenous fistula or graft, decannulation

Score < 50 referred to Inadequate.

- Score > 50 referred to adequate.

I. Operational design:

▪ Preparatory phase

This phase included reviewing both national and international literatures related vascular access infection prevention to develop the study tools for data collection. During the development of the study tools, the supervisors' guidance and experts' opinions were considered.

▪ Pilot Study

Pilot study was carried out on 10% of studied group in order to test the applicability of the constructed tools and

the clarity of the included questions. The pilot has also served to estimate the time needed for each subject to fill out the questions. According to the results of the pilot, some modifications were performed as needed.

Validity and reliability:

Face and content validity were ascertained by a group of experts from Medical Surgical Nursing department, Faculty of Nursing, Benha University and Ain Shams University. Their opinions were elicited regarding the format, layout, consistency, accuracy and relevancy of the tools.

Testing reliability of the developed tools was done through alpha cronbach test that was 0.870 for total patients' practice observational check lists and 0.904 for the patients' knowledge assessment questionnaire.

▪ Fieldwork

Data collection for this study was carried out through six months, from the beginning of April, 2018 till the end of September, 2019, and the following was done:

The researcher met the patients who were admitted in the previously mentioned setting. Then explained the

Data Collection

Data were collected in the following sequence

- Structured interview was conducted for nurses eligible for the study (fulfilled the inclusion criteria) in order to explain the purpose of the study, assure confidentiality.

Data collection and teaching sessions were conducted in morning and afternoon shifts starting at October 2018 still the end of July 2019.

Assessment phase:

The nurses' knowledge assessment questionnaires were used to assess their knowledge regarding vascular access infection prevention to identify the nurses' educational needs. These tools were filled in by the nurses; it had taken about 20 minutes to be filled.

Nurses were observed by the researcher using observational checklists to assess their practice regarding hand washing, Gloving, Gowning, insertion of cannula, care of CVC, cannulation, decannulation of fistula or graft. It

had taken for ٢٠ minutes for each nurse.

Patients were observed by the researcher using patient assessment sheet to assess presence of blood stream infection. It had taken ١٠ minutes for every patient (pre test).

Planning Phase (program development):

Proposed program general and specific objectives were designed based on predetermined subjects' need, relevant recent literature, and opinions of the nursing experts. This program was revised and modified based on the experts' comments, in order to be implemented using various methods including a booklet contained major headlines of the educational program for vascular access infection prevention, which was designed by researcher, and written in a very simple Arabic language, as well as supplemented by photos.

• Statement of objectives used in the program:

Based on the result obtained from assessment tools and review of literature, the program content was developed by researcher in the form of booklet.

Ethical considerations:

The ethical research considerations include the following:

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The ethical research considerations in the study included the following:

- The research approval was obtained from the ethical committee of faculty of nursing before initiating the study work.
- The researcher clarified the purpose and aim of the study to nurses and patients included in the study before data collection.
- Oral consent was obtained from nurses and patients to participate in the study.
- The researcher assured maintaining anonymity and confidentiality of subjects' data.
- The subjects were informed that they are allowed to choose to participate or not in the study and they have the right to withdraw from the study at any time.

IV. Statistical analysis

The data collected from the studied patients was revised, coded and entered into an excel sheet on the computer. Statistical analysis was fulfilled using

the statistical package for social sciences (SPSS) version 20. Data were presented using descriptive statistics in the form of frequencies, percentages. Chi-square test (χ^2) was used for comparisons between qualitative variables to find out relations. Statistical significance was considered as follow:

- P value > 0.05 non significant.
- P value ≤ 0.05 significant.
- P value < 0.01 highly significant.
- **Results:**

Regarding the demographic characteristics of the studied patients, table 1 shows that the distribution of the studied subject according to their demographic characteristics, it revealed that, the majority of the studied subject were female (82.7%), nearly half of them (47.3%) their age was from 18 - > 30 old years with Mean \pm SD (29.82 \pm 7.2) and 71.8% are married. Around one third (36.4%) of studied nurses were graduate from Bachelor in nursing and their work experience in the critical care units were ranged from 1 - > 0 year. Concerning last training and educational program about half of them (50.9%) had attended to courses regard to infection control and the last duration

was from 1-3 years for 66.7% of the studied subject.

Table (1): Number and percentage distribution of the studied subject according to their demographic characteristic (No=100)

Personal data	No.	%
Age		
18 - > 30	52	47.3
30 - > 40	49	44.0
40 - > 50	9	8.2
Mean \pm SD.	29.82 \pm 7.2	
Sex		
Male	19	17.3
Female	91	82.7
Marital status		
Single	28	20.0
Married	79	71.8
Divorced	2	1.8
Widowed	1	0.9
Level of qualification		
Diploma in nursing	30	21.8
Institute of technical health	30	21.8
Bachelor in nursing	40	36.4
Years of work experience		
1 - > 0	51	46.4
0 - 10	37	33.6
More than 10	22	20.0
Past educational program-training program		
No	44	40.0
Courses	56	50.9
Workshops (conference)	10	9.1
Duration of last educational training program (n = 66)		
Less than one year	7	10.6
1 - 3 years	44	66.7
More than three years	15	22.7
Department		
ICU	50	40.0
CCU	20	18.2
Dialysis	40	36.4

Figure (1): Mean % score of nurse knowledge related to vascular access infection prevention (n = 110)

Figure (1) shows mean percent scoredistribution of the subjects' nurses related to their knowledge pre, post educational program intervention. It revealed that the mean percent scoreof the subjects' nurses over all knowledgein pre intervention phases was(58.93) compared to (98.98, 92.9& 87.78) in their overall knowledge in immediate and after 3th month, 6th monthof intervention phasesrespectively with average (93.22).

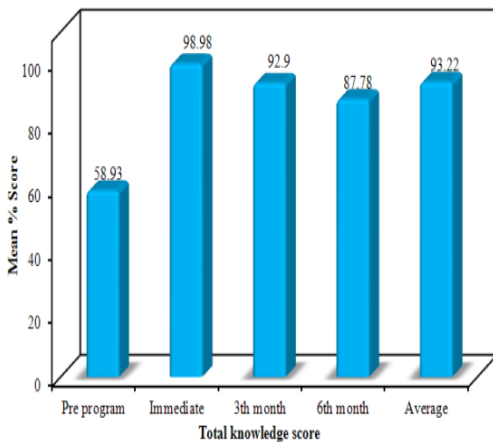


Figure (2): Level of nurse practice related to vascular access infection prevention (n = 110)

Figure (2) shows Frequency distribution of the subjects' related to practice between pre and post

educational program intervention. It revealed that all (100%) of the studied nurses practice were unsatisfactory pre educational program intervention and reached to satisfactory level immediate and post program intervention on 3th and 6th month (83.6% , 79.1 % & 70.9%) respectively .

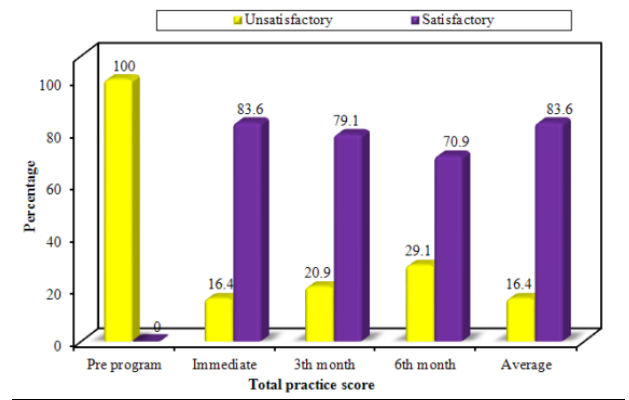


Table (16):Correlation between nurses` practice and nurses' knowledge about vascular access infection

Nurses' knowledge about vascular access infection	Nurses` practice	
	r	P
Pre	.246*	.001**
Post program		
Immediate	-.110	.204
3 th month	.118	.180
6 th month	.000	.906
Average	.112	.190

This table reveals that there is positive correlation between total nurse's

knowledge and their practice related vascular access infection prevention pre educational program, at $p \leq 0.05$ while, there was no significant correlation between knowledge and practice post program.

Discussion:

Regarding age: the current study revealed that, nearly half of them (47.3%) their age were from 18 - > 30 old years. This, perhaps, reflects the demanding nature of critical care unit service, so that older nurses may find it difficult to cope with the load of work required and prefer the newly graduate to work in the critical care units as they had the ability to acquire knowledge and change their behaviors based on submission of up to date knowledge. This is in line with *Fayed, Elbahnasawy, Omar* (2016), who study about "Effect of Instructional Program on Nurses Compliance with Universal Precautions of Infection Control" stated that most of the respondents (72.0%) were age ranged between 20 to 39 years old.

On the other hand this finding disagree with **Mahmood, Khudur** (2016), who study about "Assessment of Nurses' Knowledge toward Vascular

Access Devices for Patients with Hemodialysis at Baghdad Teaching Hospital" Illustrates that more than half of the studied nurses (54.2%) were 30 > 40 years

As regard to gender, the current study result revealed that the majority of the studied subjects were female (82.7%). The higher percentage of female nurses may be due to the increased in the number of female nurse as compared with males. This finding was agree with *Firoozjayi, Hajbaghery, Adib* (2016), who study about "Frequency of nursing care of vascular access in hemodialysis patients" and stated that the majority of the studied subjects were female (80%), but this finding disagree with *Alrubaiee, Baharom Shahar Daud* (2016), who study about "Knowledge and practices of nurses regarding nosocomial infection control measures in private hospitals in Sana'a City, Yemen" , stated that the highest percentage of nurses were males (61.2%).

In relation to educational level, the current study illustrated that, one third (36.4%) of studied nurses were graduate from Bachelor in nursing. This

could be due to hospital policy as they prefer to their highly qualified nurses in the critical care units rather than other graduates to be able to carry up their responsibility. This result is in agreement with *Eskander, Morsy, Elfeky* (2013) who study about "Intensive Care Nurses' Knowledge & Practices regarding Infection Control Standard Precautions at a Selected Egyptian Cancer Hospital", mentioned that more than half (66.2%) Levels of Education were Baccalaureate.

Also this finding disagreement with *Moursy & Sharaf* (2014), who study about "vascular access care at hemodialysis unit; nurses' compliance to infection prevention and control practice", who reported that more than two third 66.7% of the studied nurses the educational level are diploma.

Regard to marital status, the result revealed that, three fourth (75%) of the subjects are married. This finding was agreement with, *Mahmood, Khudur* (2014) who study about "assessment of nurses' knowledge toward vascular access" who reported that four fifth (80%) of the study subjects are married.

As regard to years of work experience, the result revealed that nearly half (46.4%) of the studied subject had years of work experience ranged from 1- 5 years, this finding agreement with *Fayed, Elbahnasawy, Omar* (2014) who study about "Effect of Instructional Program on Nurses Compliance with Universal Precautions of Infection Control", who reported that more than half of them had less than 5 years of experience (53.3%) years of work experience.

Regarding presence of other eye diseases, the present study revealed that, most of the study patients had previous cataract in the other eye; this finding is not congruent with *El-Sayed* (2013) who reported that nearly about one third of the study patients had previous cataract in the other eye. This may due to presence of risk factor that causes cataract on both eyes e.g. diabetes mellitus.

Also, this finding disagreement with *Moursy, Sharaf* (2014). Who study about "vascular access care at hemodialysis unit; nurses' compliance to Infection prevention and Control Practices" who reported that

half of the study nurses (52.1 %) had years of experience range from 10 < 20 years.

Regard to last training and educational program the result revealed that about half of them (50.9%) had attended to courses regard to infection control. This may be due to the most hospitals become aware with important of learning nurses about infection prevention. This finding agreement with *Moursy, Sharaf* (2014), who reported that the majority of them (93%) attended infection prevention training programs during work,

Also, this finding disagreement with **Abdelsatir** (2013), who conducted "a study to evaluate nurses' awareness and practice of HD access care in Khartoum State, Sudan", focusing on the application of proper hand hygiene and HD access care; he stated that the majority of nurses did not attended training program about infection control.

Regard to duration of last educational training program the result revealed that (76.7%). From the researcher's point of view attending continuing nursing education courses and training programs have the benefits of keeping nurses up-to-date and

refining their practices especially in carrying out procedures that require strict aseptic technique.

Section 2: demographic characteristics of the studied patient

In relation to patients' demographic data in dialysis unit, the present study revealed that approximately one third of the studied subjects (32.0%) fall at age group between 50 - 60 years old. This finding agreement with **Dawood** (2016) who study about "Effect of Implementing a Protocol of Nursing Care on Hemodialysis Patients' Safety Outcomes" who reported that, the majority of the patients were in the age group 50 < 60. In addition, **Laudansk** (2013) mentioned that the most common age groups of patients complaining from end stage renal disease(ESRD) and undergoing AVF were ranging from 50 - 60 years old that may be due to age related changes.

Concerning to gender in dialysis unit the present studied show that half of patients (52.0 %) were male. These were in line with **Mabrouke** (2015) who study about "Assessment of hemodialysis adequacy in patients with

chronic kidney disease in the hemodialysis unit at Tanta University Hospital in Egypt". Who reported that the majority of the studied patients were males. And **Pessoa & Linhares (۲۰۱۵)**, who study about Hemodialysis patients with arteriovenous fistula: knowledge, attitude and practice who reported that most of participants (۵۶.۷%) are being male. On the contrary, **Sawako (۲۰۱۱)** who study about "The association between estrogen receptor a gene polymorphism and mortality in female end-stage renal disease" concluded that the incidence of ESRD among females was higher than males.

As regard to type of vascular access in dialysis unit. The present studied show that the majority of the patient use arteriovenous fistula. **National kidney foundation (۲۰۱۶)**, mention that Health care providers recommend an AV fistula over the other types of access because it provides good blood flow for dialysis lasts longer than other types of access is less likely to get infected or cause blood clots than other types of access. This finding disagree with **Hemachandar (۲۰۱۵)**, who study about "Analysis of Vascular Access in Haemodialysis Patients - Single Center

Experience" who reported that number of cvc inserted about ۵۰% of hemodialysis patient .

Socio-demographic characteristics of patients in CCU and ICU unit the present study revealed that one third of the studied subjects (۴۴.۳%) fall at age group between ۵۰ - ۶۰ years old pre educational program and (۵۲.۹% & ۶۰%) of the studied subjects fall at age group between ۵۰ - ۶۰ years post ۳rd, ۶th month post intervention. this finding agree with **El Nemr, etal (۲۰۱۳)**, who study about an interventional study to decrease central venous catheter related blood stream infection in intensive care units at zagazig university hospital ,who reported that half m of the studied subjects ۵۳.۶% their age more than ۴۰ years old pre intervention while ۵۵.۱% more than ۴۰ years old post intervention.

Regard to gender the present studied show that at CCU, ICU about two third of them were female. **This finding disagree with Culshaw,et al (۲۰۱۸)**, who stud about "Healthcare-associated bloodstream infections in critically ill patients: descriptive cross-

sectional database study evaluating concordance with clinical site isolates" who reported that about 60.2% were male

As regard to type of vascular access in patient at CCU and ICU. The present studied show that the majority of them inserted central venous line, **Pulmer (2015)**, mention that CVCs are rapid administration and dilution of large volume of fluid are possible because the catheter tip is in large vessel, additionally rapid dilution reduce risk of phlebitis and venous sclerosis, other advantage of CVC include longer dwelling times of weeks.

Section 4: nurses' knowledge about vascular access infection prevention

As regard to total level of knowledge, this study revealed that the majority (94.0%) of the studied nurse's had unsatisfactory level of knowledge pre educational program intervention and reached to satisfactory level immediate and post program intervention on 3th and 6th month (100% , 96.4% & 91.8%) respectively. This finding came on the same line with

Fayed, Elbahnasawy, Omar (2016), who study about "effect of instructional program on nurses compliance with universal precautions of infection control" who found in their study that nurses knowledge and practice at pre, post and follow-up program implementation that the majority of nurses had poor knowledge pre-program implementation (100%), while 91.8% had good knowledge after program implementation.

As regard to nurse' knowledge about infection, the results of this study showed that there was highly statistically significant difference between mean score of total knowledge related to infection pre and post intervention of education program. This might be attributed to the fact that most of them were educated which allow them to commit to the instructions in the education program and follow it in order to decrease infection.

On the same line, *Qayyum, Sattar, Waqas (2010)* who found in a study on "Hospital acquired infections; Knowledge about it and its prevention" , added that, majority of healthcare providers had adequate knowledge about

nosocomial infection which increased to 97.10% and 97.9% in ICUs respectively after intervention without significant difference.

As regard to knowledge about CVC related (definition, uses and its complication). This study revealed that studied subject aware with the definition of CV

Conclusion:

Based on results of the present study, the following can be concluded:

- The post mean knowledge and practice scores of nurses regard vascular access infection prevention that were exposed to educational program were higher than their pretest knowledge mean scores.
- There were negative relations between nurses' knowledge, practice and patient assessment for sign and symptom of infection.
- There were positive correlation between nurses' practice and nurses' knowledge about vascular access infection prevention pre program intervention while negative correlation post program intervention.

Recommendations:

Based **Results of the current study recommended the following:**

- ❖ Nursing managers and the infection control team should plan for periodic educational and training programs.
- ❖ Educate nursing staff as regards the indications for vascular access use, proper procedures for the insertion and maintenance of intravascular catheters, cannulation and decannulation for fistula and graft and appropriate infection control measures to prevent intravascular catheter related infections.
- ❖ Periodically assess knowledge of and adherence to program for all nurses involved in the insertion and maintenance of intravascular catheters.
- ❖ Strict observation of nurses' performance/ utilization of infection control standard precautions and correction of poor practices by the infection control team are required.
- ❖ Continuing training courses for nurses to demonstrate competence for the insertion and maintenance of peripheral, central venous catheters, cannulation and decannulation of fistula and graft.

- ❖ Providing training programs for newly joined critical care units' nurses about vascular access infection prevention and at regular intervals.
- ❖ Availability of all facilities and equipments required for applying vascular access infection prevention
- ❖ Updating knowledge and performance of critical care units' nurses through continuing in-service educational programs.

Related to future e researches:

- ١- More programs can be designed and implemented on the other department in hospital.
 - ٢- Identification of factors predisposing to lack of compliance with standard precautions in the critical care units.
 - ٣- Replication of the study on a large probability of sample from different geographic areas should be done to achieve more generalizable results. about the disease, postoperative care and prevention of cataract surgery complications.
- Further researches are proposed to investigate the effect of the

implementation of these guidelines on decreasing the incidence of complications after the surgical technique.

- A simplified illustrated and comprehensive Arabic booklet including postoperative self-care guidelines should be provided for patients undergoing cataract surgery.
- Conducting a similar research among larger probability sample of the population to generalize the findings.
- Providing patients undergoing cataract surgery with postoperative self-care guidelines via nurses through different media such as posters.

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