Effectiveness of an Education Program on Nurses' Practices toward Preventing Central Venous Catheter Related Infection in Al-Nasiriya Hospitals

Muntadher A. Thamer[1], Khalida M Khader[2*]

1. *Adult Nursing Department, College of Nursing / University of Baghdad / Iraq.*

2. *Adults Health Nursing, Collage of Nursing/ Baghdad University / Iraq.*

*Corresponding Author: Khalida M Khader

Abstract

Background: Central venous catheters are routinely used in Intensive Care Units (ICU) to provide vascular access. They are used to access a large vessel (internal jugular, subclavian or femoral) to monitor central venous pressure (CVP), administer fluids, blood products, total parental nutrition (TPN), and medications. Patients in Intensive Care Units are at a higher risk for infection due to multiple factors such as age, severity of illness, and underlying disease conditions combined with a critical illness. So, educational programs concerning this essential subject can be of imperative benefit for both patient and nurse. Objective: To evaluate the effectiveness of an educational program on nurses' practices toward preventing central venous catheter related infection in ICU. Methodology: A quasi experimental study design is carried out at AL-Nasiriyah hospitals from 19th of October 2017 to the 6st of June 2018 and a probability (Random) sample of (60) nurses who have been working in the ICU .those nurses are divided into two groups, study and control groups, each group consisted of (30) nurses. To measure the effectiveness of nursing educational program through the use of practice checklist includes (46) items concerning preventing central venous catheter related infection in ICU. Reliability of instrument was determined through the use of test and retest and the instrument validity was determined through a panel of (14) experts. Results: The results showed a positive effectiveness of educational program. It also shows that there are highly significant differences in the study group between pre and post-tests at significance level $P \leq 0.05$. Conclusion: The study concluded that the nurses working at ICU have the minimum level of experience in preventing central venous catheter related infection and need educational program and sessions. Recommendation: The study recommended that providing an educational program should be ongoing for nurses to enhance their skills about the preventing central venous catheter related infection.

Keywords: *Effectiveness, Education Program, Nurses' Practices, Prevention, Central Venous Catheter, Infection.*

Introduction

Over the most recent 60 years, venous access by means of catheter addition has turned into a common practice in the healing facility and outpatient settings for different purposes, including monitoring of hemodynamics, hemodialysis, maintenance of nutritional status, and administration of drugs.

Forssmann presented the first methods of insert the catheter in central veins in 1929 and joint the Nobel Prize designed for Medicine in 1956 together with two partners for pioneering effort in Medicine [1]. From that point forward, methods of CVC insertion and placement indications have developed and at this time approximately 150 million venous access devices are used each year in the United States [2].

Central Venous Catheter has a vital part in the management of patients who admitted in hospital, particularly critical ill patients [3]. ICU employs actions for example investigative measures isnd invasive procedures which can cause problems like nosocomial-infections [4].

The difficulties forced to the avoidance of nosocomial diseases are much more notable in an ICU because of the different of

microorganisms, frequently resistant, that need the utilization of broad-spectrum antibiotics agents. ICUs are described by acting procedures which associated with skin break down proposed for investigative goals or to empower the patients' cure, but they complicate the infection control [5].

Central venous catheter related bloodstream infection is the common problem of central venous devise [6]. In the United States only, about five million central venous lines are implanted each year [7]. In spite of technological developments, an estimated 250,000 venous catheter associated blood stream infections occur every year [8]. In the United States, central venous lines are the important cause of nosocomial bloodstream infections, leading 2,400 to 20,000 deaths.

These nosocomial contaminations are very expensive. It is assessed that in the USA only, intravenous line associated blood stream infections report around 2 billion dollars per annum [9]. This number breaks down to a range of approximately $4000 to $56,000 for each episode [10]. The study aims to evaluate the effectiveness of an educational program on nurses' practices toward preventing central venous catheter related infection in ICU.

Material and Methods

A quasi-experimental study has been applied in Al-Nasiriya hospitals with the use of pre-post-test approach for two groups of samples (study and control) during the period 19th of October 2017 to the 6st of June 2018. The 60 nurses divided into two groups of (30) nurse each. One group did not expose to the program was considered as the "control group".

The other thirty nurses who were participated to the program, considered as the "study group". To accomplish the study, a skill checklist is used the content of the format based on the review of related literature and subjective experiences of the skills checklist of the researcher. The

checklist is consisting of (2) parts: part 1 includes self-administrated sheet related to the demographic characteristics of the nurses (age, gender, level of education, years of experience in hospital, years of experience in ICU, work shift, training sessions, number of training session). Part 2 includes a 46 items skill checklist sheet related to the nurses practices toward preventing central venous catheter related infection. Items are rated according to the Likers' scale; always (2); sometimes (1); never (0), the level of scale which is scored as a total of three episodes of events is observed for each respondent three correct practices out of three episodes are rated as always; 2-1 correct practices out of (3) episodes are rated as sometimes and uncorrected practices are rated as never.

Data were collected through direct observation and each observation takes about 90-120 minute. The educational program was carried out in a continuing education hall in study sitting as 3 sessions given in 3 weeks (2 days per week), each session lasted one hour. Posttest applied immediately after the end of the program as same as pretest.

Validity of the program and the study instruments (practice checklist) are determined by the panel of (14) experts, who had more than five years' experience in their fields in order to achieve study objectives. Reliability Coefficient for (Inter Examiners, Intra Examiner) revealed that (96.09(18:460), 97.39(12:460)) respectively of the practice test for pilot study are obtained.

They are obtained by evaluating 10 nurses selected from AL-Nasiriya hospitals. Data were analyzed through the use of SPSS application version 22.0. Descriptive data analysis including (frequency, percentage, Mean of score, Relative Sufficiency (RS %) and standard deviation). Inferential data analysis includes (Contingency Coefficients (C.C.) test, Independent-Samples t-test, Matched Paired-Samples t-test and ANOVA).

Results

Table 1: Distribution of the studied groups according to (SDCv.) with comparisons significant

(SD Cv.)	Groups	Control		Study		C.S. (*)
		No.	%	No.	%	P-value
Gender	Male	14	46.7	13	43.3	C.C.=0.033
	Female	16	53.3	17	56.7	P=0.795
	Total	30	100	30	100	(NS)
Age	20 _ 25	11	36.7	13	43.3	C.C.=0.143

	26 _ 30	13	43.3	10	33.3	P=0.739 (NS)
	31 _ 35	3	10	5	16.7	
	36 _ 40	3	10	2	6.7	
	Total	30	100	30	100	
Level of education	School nursing	8	26.7	3	10	C.C.=0.277 P=0.083 (NS)
	Diploma	12	40	9	30	
	Baccalaureate	10	33.3	18	60	
	Total	30	100	30	100	

(*) NS: Non Sig. at P>0.05; Testing based on a Contingency Coefficient (C.C.) test

Table (1) revealed that the majority (43.3%) of nurses in the study group are within the age group (20-25 years) while (43.3%) of nurses in the control group are within the age group (26-30 years) and (56.7%) of nurses in the study group were female and (53.3%) of nurses in the control group were female. Concerning to the educational level, majority of nurses at study groups were Baccalaureate in nursing (60%) while the control group were diploma in nursing (50%). Respect to subjects of studied (SD Cv.), results shows that studied groups recorded no significant differences at P>0.05, and that is reflecting validity of the selected subjects due to their similarity status in light of that variables, as well as preceding results indicating that two studied groups are thrown from the same population in light of (SD Cv.), and that are more reliable for this study, since any meaningful deviation between the studied groups should be interpreted due to effectiveness of applying the suggested program.

Table 2: Distribution of the studied groups according to Experiences and Developmental Characteristics variables with comparisons significant

EDCv.	Groups	Control		Study		C.S. (*) P-value
		No.	%	No.	%	
Years of Experience in Hospital	1 _ 5	16	53.3	20	66.7	C.C.=0.246 P=0.276 (NS)
	6 _ 10	8	26.7	6	20	
	11 _ 15	3	10	4	13.3	
	16 - 20	3	10	0	0	
	Total	30	100	30	100	
Years of Experience in ICU	1 _ 5	21	70	21	70	C.C.=0.250 P=0.135 (NS)
	6 _ 10	4	13.3	8	26.7	
	11 _ 15	5	16.7	1	3.3	
	Total	30	100	30	100	
Work Shift	Morning	18	60	17	56.7	C.C.=0.034 P=0.793 (NS)
	Evening	12	40	13	43.3	
	Total	30	100	30	100	
Number of Training Sessions	1	13	43.3	17	56.7	C.C.=0.314 P=0.162 (NS)
	2	4	13.3	3	10	
	3	6	20	5	16.7	
	≥ 4	7	23.3	5	16.7	
	Total	30	100	30	100	

(*) NS: Non Sig. at P>0.05; Testing based on a Contingency Coefficient (C.C.) test

In relation to the years of experience in employment table (2) shows that the most of nurses have (1-5 years) in both groups (66.7%) in the study group and (53.3%) in the control group .Regarding to the years of experience in ICU were (70.0%) in both groups. Work Shift of nurses (56.7%) in the study group and (60%) of nurses in the control group were morning shift, Table above revealed that the majority of nurses in both study group and control group have participate one time in training sessions (56.7%) in study group and (43.3) in control group. Respect to subjects of studied EDCv. Results shows that studied groups recorded no significant differences at P>0.05, and that is reflecting validity of the selected study and control subjects due to their similarity concerning of that variables.

Table 3: Descriptive statistics and testing significant of studied Nurse's Practices toward Preventing Central Venous Catheter Related Infection main domains in pre and post periods

		Group	No.	GMS	SD	SE	t-test	P-value
	Groups Statistics (Pre X Pre).. (Post X Post)							
	Main Domains							
Pre	Before The Procedure	Control	30	46.57	5.08	0.93	0.421	0.675 NS
		Study	30	46.05	4.49	0.82		
	During procedure	Control	30	63.79	5.40	0.99	1.813	0.075 NS
		Study	30	60.91	6.82	1.24		
	After Procedure	Control	30	28.06	14.92	2.72	0.219	0.827 NS
		Study	30	27.22	14.50	2.65		
	Administration of Drugs and Fluids	Control	30	19.17	10.53	1.92	-0.095	0.924 NS
		Study	30	19.45	12.05	2.20		
	Management of CVC	Control	30	80.48	8.16	1.49	0.645	0.522 NS
		Study	30	79.05	8.98	1.64		
Post	Before The Procedure	Control	30	44.48	7.19	1.31	-9.19	0.000 HS
		Study	30	62.92	8.32	1.52		
	During procedure	Control	30	64.85	5.59	1.02	-4.04	0.000 HS
		Study	30	73.33	10.04	1.83		
	After Procedure	Control	30	39.17	16.25	2.97	-5.35	0.000 HS
		Study	30	63.61	19.01	3.47		
	Administration of Drugs and Fluids	Control	30	24.72	10.38	1.89	-10.7	0.000 HS
		Study	30	64.72	17.60	3.21		
	Management of CVC	Control	30	79.52	6.95	1.27	-4.34	0.000 HS
		Study	30	88.33	8.70	1.59		

(*) HS: Highly Sig. at P<0.01; NS: Non Sig. at P>0.05; Testing based on two independent t - test. GMS: Grand Mean of Score/ or Global Mean of Score

Table (3): Results showed that two groups in light of main domains has a highly congruent status, as there no significant differences at P>0.05 are accounted for all studied main domains in pre period of time. As well as comparisons significant of testing hypotheses at the post period are calculated to be ensure that the two groups are corresponded due to studied questionnaire after accomplished the suggested program between studied groups. Results showed that two groups in light of main domains are recorded highly significant differences at P<0.01.

Table 4: Descriptive Statistics and testing significant of studied main domains a long (Pre – Post) periods in study and Control groups

	Sub & Main Domains	Period	No.	GMS	SD	SE	MP t-test	C.S.
Control	Before The Procedure	Pre	30	46.6	5.1	0.93	1.33	0.194 NS
		Post	30	44.5	7.2	1.31		
	During procedure	Pre	30	63.8	5.4	0.99	-0.72	0.477 NS
		Post	30	64.9	5.6	1.02		
	After Procedure	Pre	30	28.1	14.9	2.72	-3.01	0.005 HS
		Post	30	39.2	16.3	2.97		
	Administration of Drugs and Fluids	Pre	30	19.2	10.5	1.92	-2.34	0.026 S
		Post	30	24.7	10.4	1.89		
	Management of CVC	Pre	30	80.5	8.2	1.49	0.75	0.459 NS
		Post	30	79.5	7.0	1.27		
Study	Before The Procedure	Pre	30	46.0	4.5	0.82	-10.5	0.000 HS
		Post	30	62.9	8.3	1.52		
	During procedure	Pre	30	60.9	6.8	1.24	-5.49	0.000 HS
		Post	30	73.3	10.0	1.83		
	After Procedure	Pre	30	27.2	14.5	2.65	-8.20	0.000 HS
		Post	30	63.6	19.0	3.47		
	Administration of Drugs and Fluids	Pre	30	19.4	12.1	2.20	-13.0	0.000

		Post	30	64.7	17.6	3.21		HS
		Pre	30	79.0	9.0	1.64	-4.28	0.000
	Management of CVC	**Post**	**30**	**88.3**	**8.7**	**1.59**		HS

(*) HS: Highly Sig. at P<0.01; NS: Non Sig. at P>0.05; Testing based on two independent t - test. GMS: Grand Mean of Score/ or Global Mean of. MP t-test: Matched Paired t-test

Table (4) shows that along pre-post periods studied main domains are accounted highly significant differences at P<0.01 in the study group, and no significant differences at P>0.05 in controlled group, except after procedure, and administration of drugs and fluids, since significant results are accounted in at least at P<0.05, rather than simply stating that meaningless improvements are occurred along pre – post periods of times.

Table 5: Distribution and Association of Nurses' practice with Their Demographic Characteristics and Experiences and Developmental Characteristics of study group

SD Cv. & ED Cv.	Overall Assessment		Nurses' Practices			
			Pre		Post	
	Classes	No.	Mean	SD	Mean	SD
Age Groups Yrs.	20 _ 25	13	46.34	2.91	71.26	8.62
	26 _ 30	10	47.64	4.86	70.87	7.73
	31 _ 35	5	44.68	4.92	71.06	14.74
	36 _ 40	2	46.87	3.12	63.55	23.43
	Total	30	F=0.618 P=0.610 (NS)		F=0.326 P=0.807 (NS)	
Gender	Male	14	45.50	4.26	68.95	12.66
	Female	16	47.32	3.61	71.83	7.79
	Total	30	t = - 1.265 P=0.216 (NS)		t =-0.768 P=0.449 (NS)	
Educational Levels	School nursing	3	43.08	1.42	80.97	6.82
	Diploma	9	46.25	4.53	66.15	12.24
	Baccalaureate	18	47.25	3.73	71.07	8.25
	Total	30	F=1.527 P=0.235 (NS)		F=2.782 P=0.080 (NS)	
Years of Experience in ICU	1 _ 5	21	46.74	3.73	70.83	9.49
	6 _ 10	8	47.06	3.73	72.93	8.69
	11 _ 15	1	38.03	.	46.51	.
	Total	30	F=2.715 P=0.084 (NS)		F=3.623 P=0.040 (S)	
Number of Training Sessions	1	17	46.04	3.90	72.16	8.57
	2	3	48.63	2.57	67.54	11.70
	3	5	47.62	4.39	69.17	13.62
	≥ 4	5	45.86	4.77	68.45	12.84
	Total	30	F=0.520 P=0.672 (NS)		F=0.313 P=0.816 (NS)	
Work Shift	Morning	17	46.94	4.21	70.35	9.92
	Evening	13	46.00	3.65	70.89	10.71
	Total	30	t = 0.645 P=0.524 (NS)		t =-0.143 P=0.888 (NS)	

NS: Non Sig. at P>0.05; Testing based on two independent t - test, and one-way ANOVA

Table (5): this table shows that there is no statistical significant association between nurses' practice and their demographic characteristics and experiences and developmental characteristics at (pre and post-tests) for study group regarding education program at p value > 0.05, except Years of Experience in ICU (P=0.040) since significant results are accounted in at least at P<0.05

Discussion

This study tests the efficacy of skill building training program in preventing central venous catheter. The study sample contain of (60) nurses who are consecutively assigned to either the control group (30) nurses or the study group (30) nurses. Table (1) shows distribution of studied groups concerning "Socio-Demographical Characteristics" variables (SDCv.) in each group, such that "age groups, gender, and educational levels", with comparisons significant to be sure that two independent groups are thrown from the same population in light of that variables.

The table shows that the mean age of the nurses in study group is (27.34±0.937) years and in control group is (27.64±0.944) which ranged from (21 to 39) years, the major of

nurses (43.3%) in the control group are within the age group (26-30 years) despite the fact (43.3%) of nurses in the study group are within the age group (20-25 years). These results are consistent with a study that reported that the majority of the sample 70 % were in the age group of (21-30) years [11] , but disagree with the result of other study who indicated that the highest percentage (59.09%) of nurses at the age (29-34) years [12].

Throughout the courses of the data analysis of present study, the findings showed that the (56.7%) of nurses in the study group and (53.3%) of nurses in the control group were female. These results are consistent with a study who indicated that (83.33%) in the study sample were female [11]. But disagree with another study which revealed that the majority of nurses in the study group 31 (77.5%) were male and the majority of nurses in the control group 34 (85%) were male [13]. Concerning to the educational level, majority of nurses at study groups were Baccalaureate in nursing (60%) while the control group were diploma in nursing (50%).

Respect to subjects of studied (SDCv.), results shows that studied groups recorded no significant differences at P>0.05, and that is reflecting validity of the selected subjects due to their similarity status in light of that variables, as well as preceding results indicating that two studied groups are thrown from the same population in light of (SDCv.), and that are more reliable for this study, since any meaningful deviation between the studied groups should be interpreted due to effectiveness of applying the suggested program. Table (2) shows distribution of "Experiences and Developmental Characteristics variables-EDCv."

With comparisons significant to explore behavior of that variables either randomly or none randomly distributed comparing with their expected outcomes. With respect to years of experience in hospital, the majority of nurses in both study and control groups [(66.7%) and (53.3%) respectively] have 1-5 years. Regarding to years of experiences in ICU most of the nurses in both study and control groups (70%) have (1-5) years. This sample assignment covers two work shifts in the hospital. The most commonly cited work shift was the morning shift (56.7%) for the

study group and (60.0%) for the control group. Thus, working in both morning and evening shifts implies that there is a greater need to know how to prevent central venous catheter related infection. It is noted that all (100%) of nurses claimed to have training sessions in (infection control) one time or more (table 4-1-2). Still, study findings demonstrate that the situation requires more efforts in education and training related to preventing central venous catheter related infection for nurses.

On the other hand, another possible explanation for these results could be attributed to the type of internships in which these nurses have participated. Those who achieved better results after the training program might have succeeded in doing so because of prior experiences in preventing central venous catheter related infection. Respect to subjects of studied EDCv.

Results shows that studied groups recorded no significant differences at P>0.05, and that is reflecting validity of the selected study and control subjects due to their similarity concerning of that variables. More than one study suggested that there is no significant difference between groups related to (age, gender, work shift, education level, years of employment, years of experiences in ICU and number of training session) [11, 13].

The researcher confirms that all training sessions provide that nurses information about practice before, during and after CVC insertion procedure, drugs and fluid administration and management of CVC, as well as knowing and preventing infectious complications caused by catheter inserted through central veins.

However, health directorate should work harder to provide practical training sessions for nurses about this important health issue. Nurses' training regarding the preventing central venous catheter related infection must be ongoing process for nurses during their work. An importance should be given to practical skills to perform an effective role of nurses in preventing central venous catheter related infection; well designed practical course is a widely accepted solution.

Regarding subjects of part 2, table (3) shows descriptive statistics of studied groups in light of pre and post periods, such that, grand

mean of score, standard deviation, standard error, as well as comparisons significant of testing compound hypotheses for testing equal variances are assumed, and testing equality of mean values are assumed in order to be ensure that the two groups are corresponded due to studied questionnaire before starting the suggested program are thrown from the same population, as well as post outcomes are tested in contrasts of studied groups at the post period of time.

Results showed that two groups in light of main domains has a highly congruent status, as there no significant differences at P>0.05 are accounted for all studied main domains in pre period of time. As well as comparisons significant of testing hypotheses at the post period are calculated to be ensure that the two groups are corresponded due to studied questionnaire after accomplished the suggested program between studied groups.

Results showed that two groups in light of main domains are recorded highly significant differences at P<0.01 between study and control groups at post-test in 5 domains of nurses' practices concerning preventing central venous catheter related infection.

Thus, rejects the null hypothesis, and demonstrates that nurses in the study group achieved considerable benefit from (21) day of education and skill training in the preventing central venous catheter related infection. For summarize preceding results, it could be concludes that applying the suggested educational program had significant effects due to meaningful improvements concerning nurse's practices relating to preventing central venous catheter related infection.

With respect to subjects of testing related matched paired statistical hypotheses which says that grand mean score differences between pre, and post period would be neglected in light of no significant improvements may occurred under assuming that proposed educational program does not effect on the nurse's practices. Table (4) shows that along pre-post periods studied main domains are accounted highly significant differences at P<0.01 in the study group, and no significant differences at P>0.05 in controlled group, except after procedure, and administration of drugs and fluids, since significant results are accounted in at least at P<0.05, rather than simply stating that meaningless improvements are

occurred along pre-post periods of times. The researcher proves that nurses usually forget the information they acquire during training as time progresses. For this reason, hospitals should organize in-service training programs for nurses to update nurses' knowledge and practice. Also nurses should be enabled to conduct research and to follow up-to-date information.

This study is consistent with a study about effectiveness of the preventing central venous catheter related infection training programs. The most important lectures of the program were those covering infectious complication related to CVC, strategies to prevent CVC related infection [12]. This study reveals that the majority of nurses have unsatisfactory practice toward prevent central venous catheter related infection before implementation of the educational program and after applying the educational program, there are improvements.

The results reveal that the study group has a comparable practice with regard to various demographic characteristics and experiences and developmental characteristics (table 5). As a result of the data analysis, there is no statistical significant association between nurses' practice and their demographic characteristics and experiences and developmental characteristics at (pre and post-tests) for study group regarding education program at p value > 0.05, except Years of Experience in ICU (P=0.040) since significant results are accounted in at least at P<0.05.

More than one study agrees with this finding who mentioned that there was no significance between demographic characteristics and experiences and developmental characteristics and nursing practice improving [13, 14].

The researcher confirmed that the study settings' -Al-Hussein teaching hospital- plan in hiring newly graduated nurses due to their open minds and excellent theoretical framework, and there is acceptance and understanding of the educational program prepared by both male and female nurse, and noted that there is much improvement in nursing practices towards the prevention of infections related to central venous catheterization, and therefore health institutions should focus on similar educational programs. He noted that nurses'

practice in both morning and evening shifts implies that there is a greater need to know how to prevent central venous catheter related infection. And also he proposes that the situation requires more efforts in education and training related to preventing central venous catheter related infection for nurses.

Conclusions

- This study demonstrates that the educational and practice intervention is highly effective.

- Nurses disremember the knowledge they obtain throughout training as time advances. Therefore, health agencies must establish in-service teaching programs for nurses to update their information and practice. Moreover, nurses should be enabled to conduct research and to follow up-to-date information.

References

- The findings provide an evidence that the nursing teaching program can be organized as a vital mean for nurses who work in intensive care units in order to improve their understanding and skills about preventing central venous catheter related infection.

Recommendations

- An intensive comprehensive large population-based (national level) studies could be conducted to improve nurses' practices toward preventing central venous catheter related infection.

- Emphasis should be directed toward the educational aspect at intensive care units by providing educational posters, guideline booklets, and manuals.

- Policy should be initiated to provide a special education courses to intensive care units nurses.

1. Sette P, Dorizzi RM, Azzini AM (2012) Vascular access: an historical perspective from Sir William Harvey to the 1956 Nobel prize to André F. Cournand, Werner Forssmann, and Dickinson W. Richards. The journal of vascular access, 13(2): 137-144

2. Mermel LA, Allon M, Bouza E, Craven DE, Flynn P, O'grady NP, Warren DK (2009) Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 Update by the Infectious Diseases Society of America. Clinical infectious diseases, 49(1): 1-45.

3. Passamani RF, SROS S (2011) Infecção relacionada a cateter venoso central: um desafio na terapia intensiva. Med HUPE-UERJ, 10(1): 100-8.

4. Loftus K, Tilley T, Hoffman J, Bradburn E, Harvey E (2015) Use of Six Sigma strategies to pull the line on central line-associated bloodstream infections in a neurotrauma intensive care unit. Journal of Trauma Nursing, 22(2): 78-86.

5. Barros LM, Bento JNDC, Caetano JÁ, Araújo TMD, Moreira RAN, Pereira FGF, Soares E (2012) Prevalência de micro-organismo e sensibilidade antimicrobiana de infecções hospitalares em unidade de terapia intensiva de hospital público no

Brasil. Revista de Ciências Farmacêuticas Básica e Aplicada, 33(3): 429-435.

6. Lopes Gomes Siqueira G, Hueb W, Contreira R, Nogueron MA, Muniz Cancio D, Caffaro R A (2011) Infecção de corrente sanguínea relacionada a cateter venoso central (ICSRC) em enfermarias: estudo prospectivo comparativo entre veia subclávia e veia jugular interna. Jornal Vascular Brasileiro, 10: 3.

7. Maiefski M, Rupp ME, Hermsen ED (2009) Ethanol lock technique: review of the literature. Infection Control & Hospital Epidemiology, 30(11): 1096-1108.

8. Hanna H, Afif C, Alakech B, Boktour M, Tarrand J, Hachem R, Raad I (2004) Central venous catheter–related bacteremia due to gram-negative bacilli: significance of catheter removal in preventing relapse. Infection Control & Hospital Epidemiology, 25(8): 646-649.

9. Lane RK, Matthay MA (2002) Central line infections. Current opinion in critical care, 8(5): 441-448.

10. Opilla MT, Kirby DF, Edmond MB (2007) Use of ethanol lock therapy to reduce the incidence of catheter-related bloodstream infections in home parenteral nutrition patients. Journal of Parenteral and Enteral Nutrition, 31(4): 302-305.

11. Deshmukh M, Shinde M (2014) Impact of structured education on knowledge and practice regarding venous access device care among nurses. International Journal of Science and Research (IJSR), 3(5): 895-901

12. Abeer El-Sol, Amina I Badawy (2017) The Effect of a Designed Teaching Module Regarding Prevention of Central-Line Associated Blood Stream Infection on ICU Nurses' Knowledge and Practice. American Journal of Nursing Science, 6 (1): 11-18.

13. Hassan SMS (2014) Effectiveness of Nursing Education Program on Nurses Practices Toward Arrhythmia in Kirkuk's Teaching Hospitals. Kufa Journal for Nursing Sciences3: 1.

14. HZainel I, Hassan HS (2015) Effectiveness of an Educational Program on Nurses Practice Concerning Adult Cardio-Pulmonary Resuscitation in Talafar General Hospital. Kufa Journal for Nursing Sciences, 4: 2.