

Bundle of Care for Improving Nurses' Performance Related to Central Line Associated Blood Stream Infection

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Received March 19, 2019; Revised May 04, 2019; Accepted May 18, 2019

Abstract Health care associated infections, particularly CLABSI, contributes to the greatest threat to patient safety in critical care units (CCUs) which lead to increase mortality, morbidity and hospital coast. **The aim** of this study was to assess the effect of implementation of bundle of care related to central line associated blood stream infection on nurses' knowledge and practice. **Design:** A quazi experimental research design was used in this study. **Setting:** The study was carried in intensive care unit, coronary care unit and cardiothoracic intensive care unit at Suez Canal University Hospital, in Ismailia. **Sample:** A convenience sample of 70 nurses was used. **Tools :** The tools were used for data collection including nurses' questionnaire sheet which include demographic characteristics, knowledge about central line, knowledge BSI and knowledge about component of CLABSI bundle of care and observational check list regarding central line insertion , care and maintainece of central lin. **Results :**There were highly statistical significant difference in total mean scores of nurses knowledge and practice about bundle of care related to CLABSI between pre- post and follow up of implementation of bundle. **Conclusion:** Implementation of bundle of care related to CLABSI improved nurse's performance. **Recommendations:** Importance of upgrading nurses' knowledge and practice about CLABSI prevention through workshops, seminars, conferences, group discussion, up to date scientific journals, books and posters.

Keywords: bundle of care, central line associated blood stream infection, nurses 'performance

Cite This Article: Asmaa Ghreeb Abbady, Samia Gaballah, Amr Kamal Abotakia, and Wafaa Ismail Sherif, "Bundle of Care for Improving Nurses' Performance Related to Central Line Associated Blood Stream Infection." *American Journal of Nursing Research*, vol. 7, no. 4 (2019): 465-470. doi: 10.12691/ajnr-7-4-8.

1. Introduction

A central line is a catheter inserted into a large vein, it can be inserted in subclavian vein in chest, internal jugular vein in neck, axillary vein, femoral vein or peripheral vein in the arms. It is also known as a central venous line, central venous catheter or central venous access catheter. CVCs are widely used for measurement of central venous pressure(CVP), admiration of medication, transfusion of blood and blood products, used for patients who need long term parenteral nutrition, and in case of inappropriate use of peripheral venous route [1].

Central line associated blood stream infection are associated with considerable morbidity, mortality, and increase costs [2]. Risk factors for CRBSI include the entrance of bacteria into the circulation through invasive central venous and arterial catheter, tunneled central catheters, and peripherally inserted central lines and intravenous lines. Additionally, various factors can lead to primary infection with secondary bacteremia involving

head injury, sedation, malnutrition, immune-suppression, mechanical ventilation and surgery [3].

The incidence of central-line associated blood stream infection among adult ICUs patients varied from 1.6 to 44.6 cases per 1,000 central line days, while neonatal ICUs patients ranged from 2.6 to 60.0 cases per 1,000 central line days, in addition the mortality rate ranging from 2.8 to 9.5 [4].

Patients in intensive care units (ICUs) are at an increased risk for CRBSIs because 48% of ICU patients have indwelling central venous catheters (CVC), accounting for 15 million central catheter days per year in United States ICUs The nurse who has a thorough understanding of the benefits and risk of central venous access devices should be able to minimize and accurately recognize catheter related problem ensuring safer and improved outcome for the patient [5].

A central line insertion bundle consisting of hand hygiene and maximum barrier precautions by physician inserting and the nurses assist in insertion of the CVC, use of a 2% chlorhexidine gluconate (CHG) in 70% ethanol disinfection of the insertion site, head-to-toe sterile drape

of the patient during insertion, avoidance of insertion in femoral site and avoid replacement of central line routinely and regimen of changing the dressing covered catheter site [6].

2. Aim of the Study

Evaluate the effect of implementation of bundle of care related to central line associated blood stream infection on nurses' performance.

3. Subjects and Methods

A quazi experimental study design was used. The study took place at intensive care unit, coronary care unit and cardiothoracic intensive care unit at Suez Canal University Hospital, in Ismailia, Egypt. The study population was all registered available nurses working in (ICU, CCU and Cardiothoracic Surgery Intensive Care Unit at Suez Canal University Hospital in Ismailia) their number were 70 nurses. Two tools were used for data collection: The first was: Self-Administrated Questionnaire, it contained four main parts which include the following parts: Part I: Nurses Demographic Data: It concerned with demographic data of studied nurses (e.g. age, sex qualification) and it includes 8 questions. Part II: Nurses' Knowledge regarding Central Line: It used to assess nurses' knowledge regarding central line, which was adapted from [7,8] and it include 13 questions for example (site of catheter insertion, indications of central.). Part III: Nurses' Knowledge regarding blood stream infection (BSI): It was adapted from guidelines for the prevention of intravascular catheter- related infections [9]. It included 15 questions for example (source of infection, causes of hospital acquired infection). Part IV: Nurses' knowledge regarding to component CLABSI Bundle of Care: It used to assess the nurses' knowledge regarding component of bundle of care related to CLABSI adapted from [10] and it include 49 questions.

Second tool : An Observational Checklist: It composed of 11procedures covering the following areas: hand washing (13 items), surgical hand washing (23 items), putting on face mask (5items), putting on sterile gown (10 items), putting on sterile gloves (16 items) nurse role before insertion central line (9 items), nurse role during insertion central line (6items), nurse role in handle and maintain central lines (5items), nurse role after insertion central line (6items), procedures of central line care addressing change (17 items)and aspiration blood sample from central line(12items) [11]. Scoring system for knowledge was done by giving a score of one (1) for each correct answer and zero (0) for incorrect answer. Scoring for practice was done in such a way that the step was done giving one score and that not done step was scored zero. The level of knowledge was considered satisfactory when it was equal or exceed 60 % and was considered unsatisfactory when it was less than 60%. The level of practice was considered satisfactory when it was equal or exceed 75% and was considered unsatisfactory when it was less than 75%.

Ethical approval was obtained from the Research Ethics Committee, Faculty of Nursing, and Suez Canal University. Official letters were issued to hospital director and nursing director of Suez Canal University Hospital from Faculty of Nursing explain the aim of the study to obtain permission for collection of data

4. Field Work

The researcher visited the units in morning, after-noon, and evening shift four days/ week. The aim of the study and tools of data collection are explained to nurses at the beginning of collection of data. Data of current study was collected through 6 months.

The researcher interviewed the nurses in critical care departments in room adjacent to the department distributed the questionnaire to the nurses and asked them to fulfil it, which consume about 10-15 minutes (pre – test).

Structurally planed CLABSI bundle of care was implemented in the form of sessions. The total numbers of session were seven sessions divided into four sessions for theoretical part and three sessions for practical part. The nurses were divided into ten groups. The teaching lectures hours scheduled in three days per week, which assigned in two hours per day started from 9 am to 11 am. The time was modified according to the nurses' free time.

The post-test and follow up for nurse's knowledge and practice was done by the same format of pre-test to determine the effect of implemented CLABSI bundle of care.

5. Result

The finding of the present study showed that majority of studied nurses (81.42%) their age range between 25 to 30 years old. More than two third of studied nurses were females (64.3%) and one third were male, more than three quadrant of studied nurses (78.57%) their work hours daily were 12 hr. more than three quadrant of studied nurses (77.14%)reported that the attended infection control course while none of them attended courses regarding prevention of central line infection. More than half of studied sample (57%) have technical nursing institution and more than half of studied sample (56%) their years of experience 6-9 years. (Table 1, Figure 1, Figure 2).

Table 1. Distribution of demographic characteristics of the studied sample (n=70)

Demographic characteristics	N	%
Age		
<25	10	14.28
25-30	57	81.42
>30	3	4.28
Mean±SD	27.02±2.15	
Gender		
Male	25	35.7
Female	45	64.3
Work hour daily		
6hr	10	14.28
12hr	55	78.57
8hr	5	7.14
Attendance of infection control course		
Yes	54	77.14
no	16	22.85

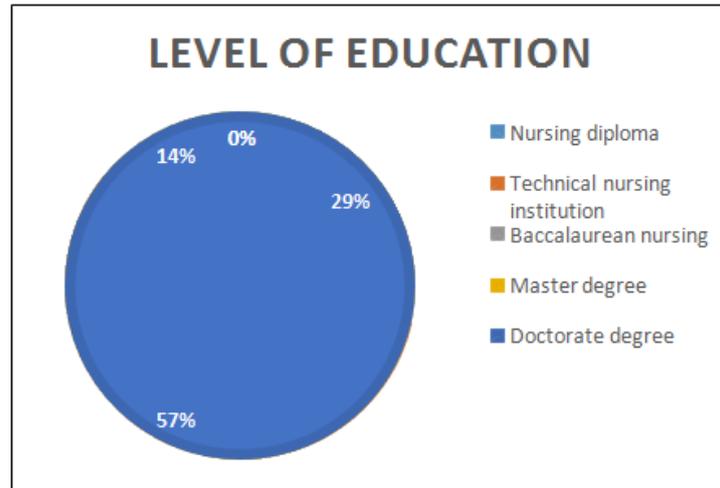


Figure 1. Distribution of studied sample according to their level of education (n=70)

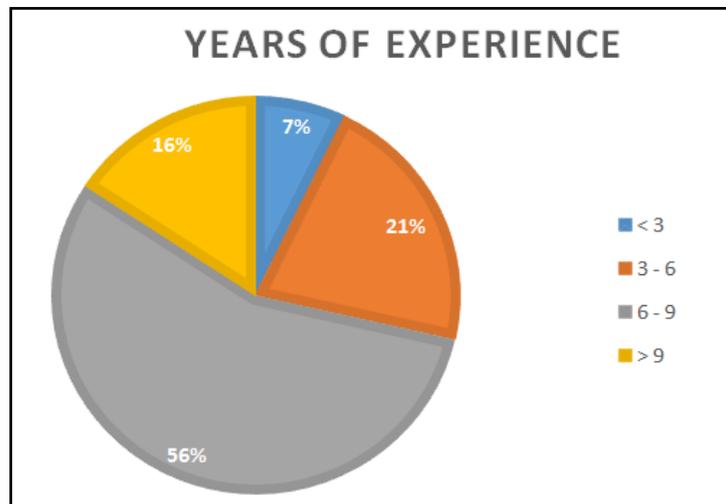


Figure 2. Distribution of studied sample according to their years of experience (n=70)

After implementation of CLABSI bundle of care there was highly statistical significant difference in nurse knowledge between pre-post and follow up of bundle implementation as (p<0.001), (Table 2).

After implementation of CLABSI bundle of care there was highly statistical significant difference in nurse practice between pre-post and follow up of bundle implementation as (p<0.001), (Table 3).

Consider between nurses' performance and their demographic characteristics there were only statistically

significant relation was found between nurses' practice and their qualification as p- value <0.05 and there was only statistically significant relation was found between nurses' knowledge and their year of experience post and follow up of implementation of bundle as p- value <0.05, (Table 4, Table 5).

As regard correlation between nurse's practice and knowledge there was statistically significant correlation between knowledge and practice score pre-post and follow up of bundle implementation. (Table 6).

Table 2. Distribution of total mean score of nurses' knowledge about CLABSI bundle of care pre, post- and follow up of CLABSI bundle of care implementation

Item	Pre-test		Post test		Follow -up		ANOVA(F)	P1	P2
	Mean	SD	mean	SD	Mean	SD			
Knowledge about CLABSI bundle of care	11.25	13.53	23.13	13.77	22.3	14.705	876	0.000**	0.000**

Significant* p-value≤0.05, highly significant ** p value <0.001
P1: between pre and post, p2: between pre and follow.

Table 3. Distribution of total mean score of nurses' practice about CLABSI bundle of care in studied sample (n=70)

Item	Pre-test		Post test		Follow -up		ANOVA (F)	P1	P2
	Mean	SD	mean	SD	Mean	SD			
Practice about CLABSI bundle	17.54	3.039	26.13	7.012	25.87	7.244	833	0.00**	0.00**

Significant* p-value≤0.05, highly significant ** p value <0.001
P1: between pre and post, p2: between pre and follow up.

Table 4. Relation between nurses' practice and their demographic characteristics in studied sample (n=70)

Demographic characteristics	Level of nurse practice						P1	P2	P3
	Pre-test		Post –test		Follow-up				
	N	%	N	%	N	%			
Age									
<25 (n=10)	3	30%	9	90%	9	90%	0.651	0.223	0.890
25-30 (n=57)	12	21%	38	66%	36	63%			
>30 (n=3)	0	0%	1	33%	1	33%			
Year of experience									
<3 (n=3)	1	33%	3	100%	3	100%	0.723	0.546	0.604
3-6(n=15)	10	66%	15	100%	14	93%			
6-9(n=39)	4	10%	25	64%	24	61.5%			
>9(n=11)	0	0%	5	45%	5	45%			
Nursing qualification									
Nursing diploma (n=20)	2	10%	6	30%	5	25%	0.000	0.000	0.000
Technical institution (n=40)	10	25%	33	82.5%	32	80%			
Baccalaurean nursing (n=10)	3	30%	9	90%	9	90%			
Master degree (0)									
Doctorate degree (0)									
Gender									
Male(n=25)	4	24%	17	68%	17	68%	0.608	0.596	0.252
Female(n=45)	11	20%	31	68.8%	29	65%			

P1: between personal characteristics and level of practice pre implementation of bundle, p2: between personal characteristics and level of practice post implementation of bundle and p3 between personal characteristics and level of practice follow up of implementation.

Table 5. Relation between nurses' level of knowledge and their demographic characteristics (n=70)

Demographic characteristics	Level of nurse knowledge						P1	P2	P3
	Pre-test		Post –test		Follow-up				
	N	%	N	%	N	%			
Age									
<25 (n=10)	1	10%	4	40%	4	40%	0.260	0.056	0.128
25-30 (n=57)	4	7.0%	56	98%	55	96%			
>30 (n=3)	0	0%	3	100%	3	100%			
Year of experience									
<3 (n=3)	0	0%	1	33%	1	33%	0.2049	0.004	0.001
3-6(n=15)	1	6%	12	80%	11	73%			
6-9(n=39)	2	5%	39	100%	39	100%			
>9(n=11)	2	18.2%	11	100%	11	100%			
Nursing qualification									
Nursing diploma (n=20)	2	10%	20	100%	20	100%	0.0667	0.617	0.059
Technical institution(n=40)	3	7.5%	36	90%	35	87.5%			
Baccalaurean nursing(n=10)	0	0%	7	70%	7	70%			
Master degree (0)									
Doctorate degree (0)									
Gender									
Male(n=25)	2	8%	22	88%	21	84%	0.544	0.413	0.2459
Female(n=45)	3	6.7%	41	91%	41	91%			

Table 6. Correlation between knowledge and practice score pre-post and follow up CLABSI bundle of care implementation (n=70)

Variable	Time of assessment		Total practice score		
			Pre bundle	Post bundle	Follow up
Total knowledge score	Pre bundle	r-	0.582	0.607	0.149
		p- value	0.000	0.000	0.219
	Post bundle	r-	0.510	0.601	0.153
		p- value	0.000	0.000	0.345
	Follow up	r-	0.520	0.603	0.126
		p- value	0.000	0.000	0.349

P1: between personal characteristics and level of knowledge pre implementation of bundle, p2: between personal characteristics and level of knowledge post implementation of bundle and p3 between personal characteristics and level of knowledge follow up of implementation.

6. Discussion

The current study aimed to evaluate the effect of implementation of bundle of care related to central line associated blood stream infection on nurses' performance.

Nurses' knowledge about CLABSI bundle post intervention:

The finding of current study showed that there was statistically improvement in nurse knowledge about CLABSI bundle of care after implementation of CLABSI bundle of care with highly statistical significant difference between pre-post and follow up of implementation of bundle. In my point of view this reflect positive effect of implementation of bundle and CCNs were enthusiastic to learn more about how prevent infection related central line.

The finding of present study in agreement with [12], in India in study about "Effectiveness of central line bundle care upon the knowledge and compliance staff nurses in the ICU", who reported that the majority of CCNs had an inadequate level of knowledge regarding CVC care pre intervention and after the intervention more than two third of nurses had an adequate level of knowledge.

Also agreed with [4] in Saudi Arabia in study about "The effect of a designed teaching module regarding prevention of central-line associated blood stream infection on ICU nurses' knowledge and practice", who reported that there was considerable difference in the nurses' knowledge before and after the designed teaching module.

In this respect the finding was in conformity with [13] in Alexandria, Egypt in study about "Effect of implementing standard guidelines on prevention of central venous catheter related infection among critically ill patient", who reported that there was a significant improvement in percentages of CCNs knowledge of guidelines of prevention of CLABSI after implementation of guidelines.

In addition, the finding of present study was on the same line with [14] in Benha, Egypt in a study about "Effect of education program on nurses' knowledge and practice regarding care of central venous line in pediatric hemodialysis: evidence-based practice guidelines", who concluded that most of the nurses in the pediatric HD unit did not have any knowledge about EBP guidelines. There was a highly statistically significant improvement in total knowledge level of nurses immediately after and after 6 months of implementation of teaching guidelines.

This finding was also in conformity with [15] in India in a study about " Impact of structured education on knowledge and practice regarding venous access device care among nurses," who stated that the structured education was effective in increasing the knowledge scores of subjects regarding venous access device care.

Nurses' practice about CLABSI bundle post intervention:

The result of current study showed that there were statistically improvement in nurse practice after implementation of CLABSI bundle of care with highly statistical significant difference in nurses' practice at post and follow up of CLABSI bundle of care phases compared to pre bundle implementation. This reflect positive effect of implementation of CLABSI bundle of care and CCNs were enthusiastic to learn more about how prevent infection related central line.

Agreed with [14] in Benha, Egypt in study about "Effect of education program on nurses' knowledge and practice regarding care of central venous line in pediatric hemodialysis: evidence-based practice guidelines", who reported that here was a highly statistically significant improvement in nurses' practice after implementation of program.

Also Agreed with [12] in India in study about "Effectiveness of central line bundle care upon the knowledge and compliance staff nurses in the ICU ", who reported that the overall pretest practice of nurses regarding the insertion and maintenance of CVC catheter was poor compared to the post-test and showed a significant difference.

Also the results of present study was in harmony with [15] in India in study about "Impact of structured education on knowledge and practice regarding venous access device care among nurses," who concluded that mean score of nurses practice was increased in the post-test after structured education and showed a significant improvement.

Relation between nurses' demographic characteristics and their level of knowledge and practice:

The present study showed that there was a significant relation between year of experience and nurses' level of knowledge, the finding of the present study was in conformity with [16] in china in a study about "Knowledge of Guidelines for the prevention of intravascular catheter-related infections (2011)", A survey of intensive care unit nursing staffs in China", who concluded that ICU nurses' knowledge of evidence based CRBSI prevention guidelines varied significantly with years of experience.

The present study showed that there was a significant relation between (qualification) level of education and nurses' level of practice , the finding of present study was in agreement with [17] in Italy in a study about " Knowledge, attitudes, and practice on The prevention of central line-associated Blood stream infections among nurses in Oncological care: Across-sectional study in an Area of southern Italy", who reported That nurses with a graduate degree perform an appropriate behavior about skin antiseptic and aseptic technique for dressing the catheter insertion site.

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The present study showed that there was no significant relation between age, sex, and qualification of the CCNs with their level of knowledge. The finding o present study was in harmony with [12] in India in study about "Effectiveness of central line bundle care upon the knowledge and compliance staff nurses in the ICU", who stated that no association between demographic variables and the knowledge level of nurses and also the finding in

agreement with [5] in Australia and New Zealand in study about "Prevention of central venous catheter infections: a survey of pediatric ICU nurses' knowledge and practice", reported that nursing knowledge was not significantly related with level of education.

Result of present study showed that there is no significant relation of age, sex, and clinical experience of the CCNs and their level of practice. On the same line the finding of present study agreed with [15] in India in study about "Impact of Structured Education on Knowledge and Practice Regarding Venous Access Device Care among Nurses", who reported that there is no significant association of age, sex and clinical experience of the staff nurses with practice score regarding venous access device care. On other hand disagreed with [18] in Pakistan in a study about "Practice of Nursing Care for Central Venous Catheter Among ICU Nurses in Private Tertiary Care Hospital Peshawar, KP," reported that there was a significant association ($p < 0.05$) between gender and practice.

7. Conclusion

The current study concluded that knowledge and practice of critical care nurses were insufficient at the pre- CLABSI bundle of care implementation, while the improvement of their knowledge and practice occurred after CLABSI bundle of care implementation with highly statically significant difference. On the other hand, it was observed that there was relation between, years of experience and knowledge of nurses and it was relation between level of education and practice of nurse.

8. Recommendations

The study recommended establishing educational programs centers in all hospitals which responsible updating and refreshing the nurses' knowledge and practice; workshops which assert on the evidence-based practices about infection control measures in critical settings within the hospitals, these services must be included the recently graduated nurses, the infection control conduct similar studies by including additional demographic variables.

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