



Research Article

Impact of CLABSI Bundle on Nursing Knowledge and Practice

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Abstract

Despite the benefits of central venous catheters, they serve as a medium for bloodstream infections that could be life-threatening. Incomplete adherence to safe insertion and maintenance guidelines by nurses and healthcare professionals increases the risk of central line-associated bloodstream infections. Due to the increasing rate of morbidity and mortality associated with Central Line-Associated Bloodstream Infections (CLABSIs), quality improvement projects need to be implemented to maintain patient safety and improve the well-being of patients and healthcare professionals [1]. For this project, K cards were successfully used over a period of three months, as a compliance protocol by nurses at a Medical Intensive Care Unit (MICU) to ensure that all components of the CLABSI prevention bundle are being followed consistently. After nursing education and the implementation of K cards at the MICU of a metropolitan hospital, there was a statistically significant difference between the pre-intervention group ($M = 68.75$, $SD = 17.0$) and the post-intervention group ($M = 90.00$, $SD = 12.88$) on the central line maintenance/compliance scores, $t(58) = -5.46$, $p < 0.001$, mean difference 21.25, 95% CI 13.46 – 29.04. In addition, no new CLABSI cases were reported during the three months implementation period and two months post implementation.

Keywords: Central lines; CLABSI; Infection; Compliance; Safety; Quality; Nurses; Intensive care units; Hospitals; Patients

Introduction

Central line Associated blood-stream infections (CLABSIs) refer to bloodstream infections in patients with central venous catheters who have no apparent secondary medium for bacterial infection [2]. Examples of central lines include peripherally inserted central catheters, subclavian lines, internal jugular lines, and femoral [2]. In most cases, central lines are used in critically ill patients to safely administer medications and intravenous fluids [2]. Despite the benefits of central venous catheters, they serve as a medium for bloodstream infections that could be life-threatening [2]. Due to the increasing rate of morbidity and mortality associated with CLABSIs, quality improvement projects need to be implemented to maintain patient safety and improve the well-being of patients and healthcare professionals [1].

PICOT Question

In ICU nurses, what is the impact of an education program on the CLABSI practice bundle versus no education on knowledge and practice over three months?

Problem Statement

While the CLABSI bundle is an established evidence-based practice for infection prevention, challenges persist in achieving consistent nursing adherence to its components.

Purpose Statement

The purpose of this project is to increase nursing knowledge and compliance to the central line-associated bloodstream infection prevention bundle by 20 % in three months, through education and protocol development.

Needs Assessment

Some of the issues that drive CLABSIs at the medical intensive care unit (MICU) of a large metropolitan hospital include many basic care components not being fully or promptly completed, including tubing changes, dressing changes, lack of curo caps, and not doing daily chlorhexidine baths on the skin around the site of the catheter. Incomplete adherence to safe insertion and maintenance guidelines by nurses increases the risk for CLABSIs [3].

Search Strategy

The databases used for the literature search were Pubmed, CINAHL, and EBSCOhost.

Keywords: Bloodstream infection; CLABSI; Catheter-Related Bloodstream Infection (CRBSI); Diagnosis; Treatment; Central line; Central venous catheter; Costs and cost analysis; Cross infection; Healthcare infection; Length of stay; line surveillance; quality improvement; Bundle care; Infection control, Central venous catheter Pediatric, Central venous catheter contamination, compliance protocol, Antimicrobial, PICC; Bacteremia; Bloodstream infection; Neonate; Nicu.

Inclusion Criteria: Published in the past 5 to 6 years; registered nurse; working as a full-time nurse in the ICU or hospital in some studies, nurses providing care to patients with central lines, at least one year of experience, nurses with 3 to 35 years of nursing experience in one article

Exclusion Criteria: Published longer than 10 years ago, Information, not relevant to the subject (CLABSIs), foreign language, nurses not providing care to patients with central lines, nurses with less than one year of experience were excluded in one article, and nurses with less than 3 years of nursing experience in one.

Synthesis of Literature

CLABSIs are among the leading causes of hospital deaths in the United States of America and are a significant factor in increased sickness, death, and healthcare costs [1-6]. Approximately 15 to 30% of all hospital-acquired bacteremia are linked with intravascular devices, and Healthcare-Associated Infections (HAI) among ICU adult patients have extended the length of hospitalization, the cost of care, and in some cases increased the risk of hospital death [7-9].

Not performing CLABSI prevention bundle components like daily chlorhexidine (CHG) baths on the skin around the side, hand hygiene, use of tubing caps, timely dressing changes, keeping dressings intact, labeling tubings, and not practicing other CLABSI prevention strategies increases the risk for CLABSIs [3,6,8-10].

Effectively implementing protocols in preventing CLABSIs is a major challenge in the ICU, and this is due to the absence of a CLABSI prevention team, and baseline risk assessment, which increases the risk of CLABSIs in most hospitals [5,6,10].

The use of a tool such as Kamishibai cards (K cards) by nurses in some hospital settings during nursing handoff at the bedside has helped to ensure that all components of the CLABSI prevention bundle are being followed consistently and can also serve as a reminder for nurses to perform the required interventions [11]. Frequently accessing and monitoring adherence to the CLABSI bundle at the bedside helps to pinpoint areas where compliance may be lacking, giving room for specific interventions to improve overall compliance, significantly reduce CLABSIs rates, and reduce the risk of CLABSIs [11,12].

The use of CLABSI prevention bundles and the development of other standardized Central Venous Access Device (CVAD) pathway for all patients with a CVAD has helped to prevent CLABSIs and eventually reduces the length of hospitalization [5,10]. In addition, CLABSI prevention teams need to guarantee the sustainability of CLABSI prevention endeavors by incorporating them into standard ICU practices, sharing success stories, and spreading best practices to other ICUs within the healthcare organization [5,13,14].

Theoretical/conceptual framework

The Quality Health Outcome Model (QHOM) is a middle-range theory, that provides a structure to choose variables that can be used to access and compare healthcare quality drives [15]. QHOM suggests an interconnection between the system or context, healthcare interventions, patient attributes, and client outcomes [15]. An analysis of the QHOM following interventions for adherence to central line bundles in a hospital system showed that there was a direct relationship between high levels of adherence to the central line bundle interventions and high levels of organizational context [15].

Project Planning/Setting

The participants for the project were nurses at a large metropolitan hospital that provides care to patients with central venous access devices (CVAD).

- Setting: medical-surgical intensive care unit (MICU)
- The MICU nurses volunteered to participate.
- Demographic survey of participants before implementation with the use of a questionnaire (Appendix A)

Measurement

- Pretest for nursing compliance with the CLABSI bundle.
- Implementation

- Post-test for nursing compliance to the CLABSI bundle
- Independent t-test for data analysis

Methodology/Intervention

During staff meetings and safety huddles, education was provided to the MICU nurses through presentations on the gaps in central line maintenance practices, and the consequences of the loopholes to patient safety. The nurses also received education on the cost of CLABSIs, safe practices for line insertion and maintenance, and the importance of adhering to the CLABSI prevention bundle.

K cards were used as an educational tool and a peer compliance protocol for nurses at the MICU, to ensure that all CLABSI prevention bundle components are followed consistently. The k cards consisted of all the components of the CLABSI bundle at a large metropolitan hospital. The components of the CLABSI bundle included hand hygiene, daily review of line necessity, daily CHG baths, standardized dressing change, standardized tubing cap change, standardized administration set, tubing changes (per the protocol and as needed), and labeling of tubing. Every day during nursing handoff at the bedside, the nurses providing care to patients with central lines communicated and verified the completion and documentation of CLABSI bundle components listed on the k cards. After safety huddle, the k cards were turned in for review by management.

The k cards were also used by nursing leadership to perform daily audits with nurses caring for patients with central lines. Areas of improvement were discussed with the nurse respectively and interactively to promote learning.

The k cards served as a great reminder for nurses to perform the required interventions for line maintenance, and increased peer accountability for compliance with the CLABSI bundle components.

Instruments Related to the Intervention

Folloing the collection of demographic data of the nurses, a central line maintenance checklist (Appendix B) was used to carry out a pre-test for nursing compliance with CLABSI care bundles before the implementation of k cards (Appendix C). Elements on

the checklist included date, room number, days of line duration, daily review of line necessity, the date for the last dressing change, labeling of tubing, type of central venous catheter, was hand hygiene practiced before all line maintenance/access procedures, was chlorhexidine (CHG) bath wipes used to clean the skin around the site daily, was alcohol used to disinfect the hub before each access, CHG? Is there a cap on all the tubings? Was dressing changed using an aseptic technique? Were administration sets replaced per policy and labeled? Is dressing changed every 7 days and as needed?

The data collection and implementation instruments for the project were a questionnaire for a demographic survey of participants (Appendix A), a central line maintenance checklist (Appendix B), and k cards for central line maintenance (Appendix C)

Questionnaire for a demographic survey of participants (Appendix A)

Q1. Gender

- Male
- Female
- Other

Q2. Employment

- Full time
- Part Time
- PRN
- Travel Assignment

Q3. Type of Nursing Unit

Central Line Maintenance Checklist (Appendix B)

- Room number.....
- Date.....
- Shift.....
- Type of Central Line:
- Date dressing last changed:

Steps	Yes	No	N/A	Notes/Comments
Is review done for line necessity?				
Was hand hygiene performed before all line maintenance/access procedures?				
Unused Injection sites are covered by curo caps?				
Tubings labeled and initialed				
Was chlorhexidine used to clean the skin around the site?				
Dressing intact and labeled properly				
Is dressing changed every 7 days and as needed?				
Administration sets replaced per policy and labeled?				

(Joint Commission, 2022, November 5).

**K Card for Central line
Maintenance**

Date..... Room number.....

Shift.....

Date Dressing last changed:

Yes	Steps	No	N/A
	Is review done for line necessity?		
	Was hand hygiene performed before all line maintenance/access procedures?		
	Unused Injection sites are covered by curo caps?		
	Tubings labeled and initialed?		
	Was CHG bath done?		
	Dressing intact and labeled properly?		
	Is dressing changed every 7 days and as needed?		
	Administration sets replaced per policy and labeled?		

Notes

Appendix C: K Card for Daily Central Line Maintenance.

Sheet 1 below shows pretest data for nursing compliance with the CLABSI bundle.

Nurse	Gender	Employment	Nursing Unit	Central line Maintenance/Compliance Score
1	Female	Full time	MICU	50%
2	Female	Part time	MICU	62.50%
3	Female	Full time	MICU	87.50%
4	Female	Full time	MICU	75%
5	Female	Travel Assignment	MICU	62.50%
6	Female	Full time	MICU	62.50%
7	Female	Full time	MICU	75%
8	Female	PRN	MICU	50%
9	Female	Full time	MICU	50%
10	Female	Full time	MICU	75%
11	Female	Full time	MICU	87.50%
12	Female	Full time	MICU	50.00%
13	Female	Full time	MICU	62.50%
14	Female	Travel Assignment	MICU	87.50%
15	Female	Travel Assignment	MICU	50%
16	Female	Travel Assignment	MICU	75%
17	Female	PRN	MICU	100%
18	Female	Full time	MICU	50%
19	Female	Full time	MICU	36%
20	Female	Full time	MICU	62.50%
21	Male	Full time	MICU	50%
22	Female	Full time	MICU	75%
23	Male	Full time	MICU	75%
24	Female	Full time	MICU	75%
25	Male	Full time	MICU	100%
26	Female	Full time	MICU	62.50%
27	Female	Full time	MICU	62.50%
28	Female	Full time	MICU	87.50%
29	Female	Full time	MICU	62.50%
30	Male	Full time	MICU	100%

Sheet 1: above shows that the average pretest central line compliance score for the MICU nurses was 68.75%.

After the collection of protest data, K cards were implemented in the MICU as a peer compliance protocol during nursing handoff at the bedside. Each component on the k cards was checked off for completion at the bedside during nursing handoff for both dayshift and night-shift nurses. After the implementation of k cards, post-test data for nursing compliance to the CLABSI bundle was collected with the use of a central line maintenance checklist from the joint commission. Sheet 2 below shows post-test compliance scores for MICU nurses, following implementation.

Nurse	Gender	Employment	Nursing Unit	Central Line Maintenance/Compliance Score
1	Female	Full Time	MICU	100
2	Female	Full Time	MICU	75%
3	Female	Full Time	MICU	100%
4	Female	Full Time	MICU	100%
5	Male	Full Time	MICU	100%
6	Male	Full Time	MICU	100%
7	Male	Full Time	MICU	100%
8	Male	Full Time	MICU	100%
9	Male	Full Time	MICU	87.50%
10	Female	Full Time	MICU	100%
11	Female	Travel Assignment	MICU	100%
12	Female	Part Time	MICU	100%
13	Female	Full Time	MICU	100%
14	Female	Full Time	MICU	100%
15	Female	Full Time	MICU	62.50%
16	Female	Full Time	MICU	75%
17	Female	PRN	MICU	75%
18	Female	Full Time	MICU	100%
19	Female	Travel Assignment	MICU	75%
20	Female	Travel Assignment	MICU	100%
21	Female	Full Time	MICU	87.50%
22	Female	Full Time	MICU	62.50%
23	Female	Full Time	MICU	100%
24	Female	Full Time	MICU	75%
25	Female	Full Time	MICU	87.50%
26	Female	Full Time	MICU	75%
27	Male	Full Time	MICU	100%
28	Female	Part Time	MICU	100%
29	Male	Full Time	MICU	87.50%
30	Female	Full Time	MICU	100%
31	Male	Full Time	MICU	75%

Sheet 2: above shows a great improvement in nursing compliance with the CLABSI bundle. The average post-test compliance score for MICU nurses was 90%.

Data Analysis

Statistical Methods

Frequency and percentage statistics were used to describe the categorical demographic characteristics of the sample. Within-subjects analysis could not be used because participants were not followed across time to link each participant's record. Therefore, between-subjects analysis was used to compare the pre-intervention and post-intervention groups. The assumption of normality for the pre-intervention and post-intervention groups of central line maintenance/compliance scores was checked using skewness and kurtosis statistics. The assumption was violated if either statistic was above an absolute value of 2.0. Levene's Test of Equality of Variances was used to check for the assumption of homogeneity of variance. When both distributions met the assumption of normality and homogeneity of variance, an independent-sample t-test was used to test for a significant difference between the pre-and post-intervention groups. Means (M) and standard deviations (SD)

were reported and interpreted for the t-test analysis. The mean difference and 95% confidence interval of the mean difference were reported as well. Chi-square analysis was used to compare the intervention groups on the categorical demographic variables. All analyses were performed using SPSS Version 29 (Armonk, NY: IBM Corp.) and statistical significance was assumed at an alpha value of 0.05.

Results

All participants worked in the MICU (n = 60) and n = 47 (78.3%) were full-time, n=3 (5.0%) were part-time, n=3 (5.0%) were PRN, and n = 7 (11.7%) were travel nurses. There was n = 49 (81.7%) females and n=11 (18.3%) males. There was no difference between the intervention groups in terms of gender, $\chi^2(1) = 1.00$, $p = 0.51$, and type of employment, $\chi^2(3) = 0.83$, $p = 0.84$. See Table 1 below for the descriptive and frequency statistics associated with each group comparison.

Variable/Level	Pre-intervention	Post-intervention	p-value
Gender*			
Female	26 (86.7%)	23 (76.7%)	
Male	4 (13.3%)	7 (23.3%)	0.51
Type of Employment*			
Full-time	23 (76.7%)	24 (80.0%)	
Part-time	1 (3.3%)	2 (6.7%)	
PRN	2 (6.7%)	1 (3.3%)	
Travel	4 (13.3%)	3 (10.0%)	0.84
Central Line Maintenance/ Compliance**	68.75 (17.0)	90.00 (12.88)	< 0.001

Note: *values are frequency (percentage), **values are mean (standard deviation)

Table 1: above shows that, there was a statistically significant difference between the pre-intervention group (M = 68.75, SD = 17.0) and the post-intervention group (M = 90.00, SD = 12.88) on the central line maintenance/compliance scores, $t(58) = -5.46$, $p < 0.001$, mean difference 21.25, 95% CI 13.46 – 29.04.

Conclusion/Recommendation

The use of k cards during nursing handoff at the bedside increased nursing adherence to the CLABSI prevention bundle at the MICU, as there was a significant increase in central line maintenance scores by 21.25%, following implementation. In addition, no new CLABSI cases were reported during implementation and two months post-implementation and counting. The last CLABSI case was reported one month before the implementation of the use of K cards on the unit. The use

of k cards during bedside handoff also increased accountability among nurses, regarding infection control and maintaining patient safety. There was also an improvement in safe practices for line maintenance, and an increase in staff awareness, and education.

Given the fact that quality improvement is a continuous process, there is a need for continuous quality improvement and education in ICUs, to keep up with current standards of patient safety and safe central line maintenance practices by healthcare professionals.

Limitation/Challenges

A limitation/challenge of the project was resistance to change by a few nurses. Some nurses are used to old habits and routines and it's challenging for them to accept new practices and protocols. This issue was resolved with education on the importance of line maintenance and the intervention from nursing leadership in making the k cards mandatory. The busy schedule of the ICU nurses made education challenging because it was difficult to find a convenient time that worked for all nurses.

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