DEVELOPMENT OF PROTOCOL FOR REDUCTION IN CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTIONS

by

Alexander John Sundermann

B.S, Microbiology, University of Rochester, 2013

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This thesis was presented

by

Alexander Sundermann

It was defended on

November 24, 2014

and approved by

Carlene Muto, MD, MS
Associate Professor of Medicine
Medical Director of Infection Control and Hospital Epidemiology
University of Pittsburgh

Velpandi Ayyavoo, PhD
Professor and Assistant Chair, Infectious Diseases and Microbiology
Graduate Program Director, Infectious Diseases and Microbiology
Graduate School of Public Health, University of Pittsburgh

Aaron Barchowsky, PhD
Professor, Environmental and Occupational Health
Graduate School of Public Health, University of Pittsburgh

Thesis Chair: Linda Rose Frank, PhD, MSN, ACRN, FAAN
Associate Professor of Public Health, Medicine, & Nursing
Department of Infectious Diseases and Microbiology
Graduate School of Public Health
University of Pittsburgh

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ABSTRACT

Background: Central line associated blood stream infections (CLABSIs) are a highly expensive and deadly hospital associated infections (HAIs). Recent studies focus on reducing the CLABSI rate in both intensive care units (ICUs) and non-intensive care units. Each study focused on multiple aspects to reduce CLABSIs at the insertion of the line and the maintenance period, which is the length the central line, remains in place after the insertion. The results have shown there are many possible ways to reduce CLABSIs in the hospital setting.

Objectives: The purpose of this study is to evaluate the effectiveness of an audit tool to assess the compliance of nurse documentation and bedside duties of central line care and maintenance in a University-affiliated tertiary care hospital. The implementation of this audit is expected decrease the hospital's CLABSI rate.

Methods: This study has two portions. The first is a prospective examination of nurse documentation and bedside practices for patients with central lines in ICUs and non-ICUs. The second portion is a retrospective analysis of documentation of patients that developed CLABSIs compared to those who did not develop a CLABSI.

Results: All units increased compliance in 90.4% of documentation and bedside assessments. Weekly trends indicated increasing compliance as the audit period progressed. The retrospective analysis also revealed that daily line necessity (evidence that a patient still

requires the central line in place) was not properly documented for patients that developed CLABSIs compared to patients that did not develop a CLABSI (n=621, OR=4.99, Fisher exact P=0.016).

Conclusions: These results suggest initial success in increasing compliance by nurses and other clinicians providing care and maintenance of central lines. The retrospective analysis shows the importance of documenting daily line necessity in order to remove unnecessary central lines which may lead to infections. Future studies should be carried out to determine the cause of poor compliance.

Public Health Significance: The audit used in this study reflects prior research shown to reduce the CLABSI rate. With further use of this audit, the CLABSI rate should be reduced which can be help decrease patient morbidity and mortality and decrease costs to the patient and hospital.

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ACKNOWLEDGEMENTS

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1.0 INTRODUCTION

A recent Centers for Disease Control and Prevention (CDC) report states that there are approximately 43,000 central line associated blood stream infections (CLABSIs) every year in the United States (26). In 2011, the cost of each CLABSI was approximately $16,550 (26). This cost is distributed from patients, insurance, and hospitals. The mortality of a central line infection ranges from 12 to 25% (26). Recent reports have shown that up to 70% of these CLABSIs may be prevented (24). 70% of the original 43,000 CLABSIs translate to almost $500 million dollars saved along with many lives.

By implementing simple measures such as better hand hygiene, CLABSIs are easily prevented (2). A recent report states that monitoring compliance in documentation may be an effective method to reduce CLABSIs (11). Other interventions such as education programs and auditing central line care and maintenance have also proven effective in reducing CLABSIs (1, 7, 8, 9, 19, 22).

The purpose of this study is to evaluate the effectiveness of an audit tool to assess the compliance of nurse documentation and bedside duties of central line care and maintenance in a University-affiliated tertiary care hospital. The implementation of this audit is expected to decrease the hospital's CLABSI rate. This study was carried out over a six month period in a University affiliated tertiary care hospital with the aim to reduce the CLABSI rate in both ICU and non-ICU areas. The six-month study was divided into two three-month periods. At the end

of the two periods, CLABSI patient documentation was compared to those within the audit to determine the effectiveness of auditing documentation.

2.0 BACKGROUND

2.1 NHSN DEFINITION

The National Healthcare Safety Network (NHSN) is a system developed by the CDC to track health care associated infections (HAIs) across the United States (13). This system enables hospitals to track their infections, but also to find possible sources of infection and prevent them. NHSN has strict definitions to determine what defines all infections in terms of epidemiologic surveillance, including CLABSIs.

According to NHSN, a central line (CL) is an intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring (13). A central line associated blood stream infection is a laboratory-confirmed bloodstream infection (LCBI) where central line or umbilical catheter (UC) was in place for >2 calendar days on the date of event, with day of device placement being Day 1, and a CL or UC was in place on the date of event or the day before (13). There are many variations and combinations of signs and symptoms for laboratory-confirmed blood stream infections such as fever, increased white blood cell count, bacteremia, and others (13). This enables infection control practitioners flexibility to define each blood stream infections.

2.2 RISK FACTORS

Presence of a central line places a patient at risk for developing a CLABSI. Other factors increase this risk. These risk factors include long duration of central line placement, femoral central line, contamination at insertion site such as the catheter hub or skin, and lack of experience in clinicians caring for the central line site (21). Marschall et al list prolonged hospitalization before central line placement, prolonged duration of central line presence, neutropenia, and prematurity. The prematurity risk factor focuses on infants born early in gestational phase. This study also has shown that men are more at risk than women (11). Leonardo et al studied the various types of central line insertion sites and their risk of infection. The study showed that lines placed in the femoral sites are at higher risk for infection compared to those in the subclavian and jugular area. Central lines placed in the subclavian site had the least risk of infection (10). To minimize risk central lines should be in place only if necessary, and femoral line placement should also be avoided if possible. Decontamination of the skin prior to insertion and constant monitoring of the site also minimize risk (11, 10, 21).

2.3 LENGTH OF STAY

Length of stay (LOS) effects cost on the patient, hospital, insurance, and loss of bed days for other patients (5, 6, 15, 18). LOS for CLABSIs is defined as the additional days a patient remains in the hospital due to the infection. CLABSI increases the length of stay up to 4.7 days for a patient in an intensive care unit without a CLABSI (5, 6). Other studies show a wide range of LOS 4.5 to 19.6 with an average of 12 days (15). Renaud et al showed the median length of

stay was approximately 9.5 days. The study differentiated primary infections and secondary blood stream infections to control for underlying disease (18).

2.4 MORTALITY

The exact mortality of a CLABSI is difficult to calculate as many patients die of other causes, and confounding factors are highly prevalent (23, 18, 27). A study by Stevens et al controlled for the underlying disease and other healthcare associated infections and demonstrated that patients with CLABSIs have a 2.27 times higher mortality rate than those without CLABSIs (23). Renaud et al showed that patients with catheter related blood stream infections have an excess of mortality of 11.5%. This study stratified on multiple levels including type of bacteremia (18). Ziegler et al performed a meta-analysis that pooled eighteen studies. The results revealed an odds ratio of 2.75 of hospital death with a CLABSI which is slightly higher than the Stevens et al study which shows the difficulty to accurately describe the mortality of CLABSIs due to underlying conditions (27).

2.5 INTERVENTIONS

2.5.1 Education

Education methods are highly effective interventions that increase compliance in many clinical aspects such as CLABSI documentation and maintenance compliance (19, 9, 8). A previous

study by Rosenthal et al showed that implementation of surveillance measures and education by an infection control department significantly decreased the rate of CLABSI infections (19). A study by Lobo et al showed that education practices focused on the maintenance of central lines after insertion are effective in both increasing compliance of clinicians and decreasing the CLABSI rate (9). Similarly, Higuera et al showed that education practices by infection control the focus on process control outputs in conjunction with active surveillance significantly reduce the CLABSI rate (8).

2.5.2 Hand Hygiene

Studies conducted show that hospital wide programs reduce overall nosocomial rate. Pittet et al implemented a hospital wide program that focused on displaying signs to remind clinicians to wash their hands and making hand washing materials easily accessible to clinicians. This method increased hand hygiene compliance and decreased the hospital nosocomial rate (16). Previous studies implemented educational programs that specifically targeted hand hygiene. Zingg et al introduced a program that taught hand hygiene along with catheter care and intravenous drug preparation. This three pronged education method (teaching of hand hygiene, standards of catheter care, and preparation of intravenous drugs) reduced the university hospital's CLABSI rate from 3.9 per 1000 catheter days to 1.0 per 1000 catheter days in a one year period (28). Rosenthal et al had shown that hand hygiene education that also uses training and feedback measures increased hand hygiene compliance from 23.1% to 64.5% while significantly decreasing nosocomial infections (26).

The CDC published a 2011 guideline that aimed at reducing catheter related intravascular infections (14). The recommendations suggested hand hygiene at important times during

catheter care, including before and after palpating the insertion site, accessing, replacing, or repairing the site (including dressing changes). These recommendations should be implemented in addition to all hand hygiene education programs to specifically target CLABSIs.

2.5.3 Care and Maintenance

Daily care and maintenance are vital to prevent CLABSIs. The Pennsylvania Patient Safety Authority, an independent state agency that strives for harm reduction for patients in Pennsylvania, published a review in 2011 that showed 71.7% of CLABSIs reported to NHSN occurred after five days of insertion in Pennsylvania hospitals (1, 3). The group stated that insertion occurs in a very short period of time and follows a strict set of rules. Maintenance occurs for up to months at a time. Thus, there is a greater risk for a CLABSI during the maintenance period. The Pennsylvania Patient Safety Authority stated that there should be auditing of compliance much more closely after day five of insertion.

Shapey et al administered a multiple choice questionnaire to staff caring for central lines to identify areas of non-compliance. The study showed an overall non-compliant rate of 44.8%. More specifically, dressing and cap changes were the most commonly non-compliant sections (22). A non-compliant rate of 44.8% indicates a need of improvement. The results of the study show that clinicians were following correct protocol 55.2% of the time which creates multiple infection risks.

Guerin et al implemented an audit that is similar to the audit used in this study. Guerin used an audit that examined insertion site itself, dressing change, and documentation of daily necessity, site care maintenance, and hand hygiene during care. The study showed a significant decrease in the CLABSI rate compared to the pre and post intervention stages (5.7 per 1000

catheter days pre intervention to 1.1 per 1000 catheter days post intervention). The success of this study could be a model for other hospitals (7).

2.5.4 Daily Line Necessity

Daily line necessity is a documentation process carried out every day to determine if a patient still requires the central line that is in place. Necessity for a central line is documented in Table 1. Every day a central line is left in place increases the risk for a CLABSI. Therefore the central line should only remain in place only if clinically indicated by the daily line necessity needs. Pronovost et al conducted a study of 103 intensive care units that used clinical leaders to disseminate information on CLABSI prevention strategies. One of the main interventions of the strategy was daily line necessity. The results of this study showed a high efficacy, with the mean rate of CLABSIs decreased from 7.7 to 1.4 per 1000 catheter days after the study was completed. The mean catheter days decreased from 4779 to 4757 catheter days (17).

3.0 METHODS

3.1 STUDY OBJECTIVES

The purpose of this study was to evaluate the nurse documentation of central line necessities and evaluate the central line insertion site, tubing, and medications bag at the bedside. The evaluation process increases awareness of central line documentation. Over a long-term period, we expected to see the rate of CLABSIs drop. If shown successful, the audit would be implemented in multiple units to decrease the CLABSI rate even further.

This study included three main research questions:

1. What is the relationship between a clinical audit and compliance with documentation of CL care?
2. What are the relationship between a clinical audit and long term compliance?
3. What is the relationship between a clinical audit and CLABSI rate?

3.2 STUDY DESIGN

The study is a prospective review of patient chart documentation and bedside assessment of central lines. The study was carried out for two three-month periods from January 1, 2014 to March 31, 2014, and from May 1, 2014 to August 31, 2014. The bedside inspection was

completed once a week for each unit involved in the audit process. An infection preventionist (IP) would round with a nurse from the unit involved in the audit. The nurse and IP would inspect the central lines on the unit. This process is explained in more detail under section 3.5. The documentation assessment would be completed after finishing the bedside audit. An IP or the investigator would inspect the patient charts that were seen by the nurse and IP. The chart was examined for lapses in documentation protocol which is explained in section 3.5.

The retrospective analysis of CLABSI patients included all CLABSIs from January 2014 to August 2014. The documentation of the CLABSI patients was examined for any non-compliance within a one-week period prior to the confirmed CLABSI date. During a one week period, there should be 7 daily line necessity and blood return documents, and one documentation of dressing change, cap change, and tubing change. The total number of compliant documents and non-compliant documents were compared to the total number of compliant and non-compliant documents in the two audit periods. This data was analyzed using Epi Info (version 7.1.4) supplied by the University of Pittsburgh to calculate an odds ratio and Fisher exact P value to determine significance.

This study is a continuous quality improvement project that is exempt from Institutional Review Board (IRB) approval. According to the U.S. Department of Health and Human Services regarding quality improvement projects, this study is "collecting patient or provider data regarding the implementation of the practice for clinical, practical, or administrative purposes," which does not meet criteria for an IRB review (25). An application of approval was submitted to the tertiary care hospital Quality Review Improvement Committee as an IRB exempt study as the audit is a quality improvement initiative.

3.3 STUDY AREA

The Central Line Focus group and Infusion Best Practice Team developed the audit that was approved by the Infection Control Department. The audit was carried out at 900 bed tertiary care hospital with a level 1 trauma center. The hospital is a large teaching center where students from local universities have residencies, fellowships, and nursing and allied health services.

3.4 STUDY POPULATION

Clinical units at UPMC Presbyterian were selected based upon quarterly data. Those units who had a central line infection rate above 0.65 infections per 1000 central line days were included in the audit process. The rate was established by Highmark's Quality Blue Program which strives to reduce nosocomial infections (4). The selected clinical units would carry out the audit once a week. Patients that had central lines were included in the audit. For large units that had many patients with central lines, the patients that had the highest central line days were included and the audit was carried out for an hour to fit in as many patients as possible. The patient population had no defined demographics.

3.5 DATA COLLECTION

Each week an infection preventionist (IP) would round with a nurse of the unit to audit the central lines. An example of the audit used is listed in the Appendix. The nurse would then

examine the central line dressing for any presence of drainage, blood, swelling, or tenderness. The nurse would also examine the date recorded on the dressing to ensure it is not due for change. The nurse would also inspect the tubing, caps, and medication bags attached to the central line noting their presence and dates changed to the IP at the door. This process would repeat until all patients with central lines had been inspected or an hour had passed.

The documentation assessment would be completed after the bedside assessment. The investigator would examine each patient's chart using the tertiary care hospital's patient chart program. The documentation assessment would look for daily line necessity within 24 hours, blood return within 24 hours, dressing change within 7 days, and tubing and cap change within 96 hours. The results would then be compiled and added to a database containing all other audit results.

The audit data was analyzed at the end of each quarter. The results were divided into weekly sections to examine weekly improvements in compliance as the audit period progressed. The data was stratified by individual units to show any unit specific improvement or lack of compliance in any category. The results were presented at the monthly CLAB focus group meeting and disseminated to unit directors of the units involved in the audit process.

Table 1: Audit categories with purpose

Audit	Purpose
Documentation Assessment	
On line within 24 hours	Ensures the line is not blocked or damaged by flushing with saline and looking for blood return
Daily line necessity within 24 hours	Ensures the patient still needs the central line. Necessity: the patient have impaired peripheral venous integrity, infusion of multiple therapies, pH < 5 or > 9 frequent blood sampling, vesicant/irritant medication therapy, and/or require IV therapy for over 6 days
Dressing change within 7 days	A sterile occlusive dressing is applied initially. If a gauze pad is placed over the site on insertion then the dressing is changed 48 hours after the line insertion, removing the gauze pad over the insertion site. If no gauze pad is used with the initial dressing or after the gauze pad is removed 48 hours later, subsequent dressing changes are every seven days and when the dressing becomes non-occlusive or damp.
Tubing change within 96 hours	All tubing and caps are changed every 96 hours, except in special populations, i.e. oncology, tubing are changed every 72 hours. Propofol tubing is changed every 12 hours and TPN tubing is changed daily. All tubing should be dated and timed when hung.
Cap change within 96 hours	Patency cap change is performed with tubing changes, no more frequently than 72 hours (on a multilumen catheter with IV therapy infusing in only one lumen, all caps should be changed when that tubing is changed) or when visibly soiled or blood visible in the cap.
Bedside Assessment	
Dressing change current within 7 days	See dressing changed and dated within 7 days
Occlusive dressing	See dressing changed and dated within 7 days
Site without drainage, blood, swelling, tenderness	Ensures the site is not infected or at higher risk for becoming infected
Tubing change within 96 hours	See tubing changed and dated within 7 days
Bag current	Ensures any bags of fluid infusing are not out of date
Tubing capped	Ensures the system of the central line is not open to the external environment, thus reducing risk of infection

The Infusion Best Practice Initiative team developed the audit tool in conjunction with the CLAB focus group. The categories included are points of care in central line maintenance that put a patient at risk for a CLABSI. The documentation uses the tertiary hospital specific protocol in conjunction with ideas developed by the CLABSI focus group. The policies are available for all employees on the hospital's website. The first quarter did not include cap change documentation. The CLABSI focus group decided to add cap change to the second audit period based on feedback from nurses. Cap change ensures the caps do not become soiled with bacteria which may lead to an infection.

4.0 RESULTS

4.1 QUARTERLY DATA

4.1.1 First Quarter Results

Each quarter was carried out for a three-month period. Tables 2 and 3 shows the total results for the first quarter which ran from January to March 2014.

Table 2: Results from Quarter 1: January to March 2014

	Documentation Assessment			
	Daily Line Necessity	**Blood Return**	**Dressing Change**	**Tubing Change**
Compliant	189	199	159	77
Non-compliant	8	2	37	76
Total Episodes	197	201	196	153
Percent Compliant	95.94	99.00	81.12	50.33
STDEV	8.58	3.07	18.24	34.04

Table 3: Results from Quarter 1: January to March 2014

	Bedside Assessment					
	Dressing Change Current	**Occlusive Dressing**	**Site Without D/B/S/T**	**Tubing Change**	**Bag Current**	**Tube Cap**
Compliant	163	201	198	132	116	167
Non-compliant	36	1	2	17	24	2
Total Episodes	199	202	200	149	140	169
Percent Compliant	81.91	99.50	99.00	88.59	82.86	98.82
STDEV	18.60	2.75	4.45	21.11	32.56	19.49

Overall, tubing change was the most challenging for documentation by the nurses, and fluid bag with a current date label was the least compliant bedside activity for documentation. The standard deviation shows the variation among the individual unit audits. The categories with high standard deviations show the variability in compliance between specific units. Tubing change documentation had the highest standard deviation which indicates high variability of documentation among individual units.

Figure 1 shows the overall documentation by week. Each week's audits were combined to show overall progression across the audit period

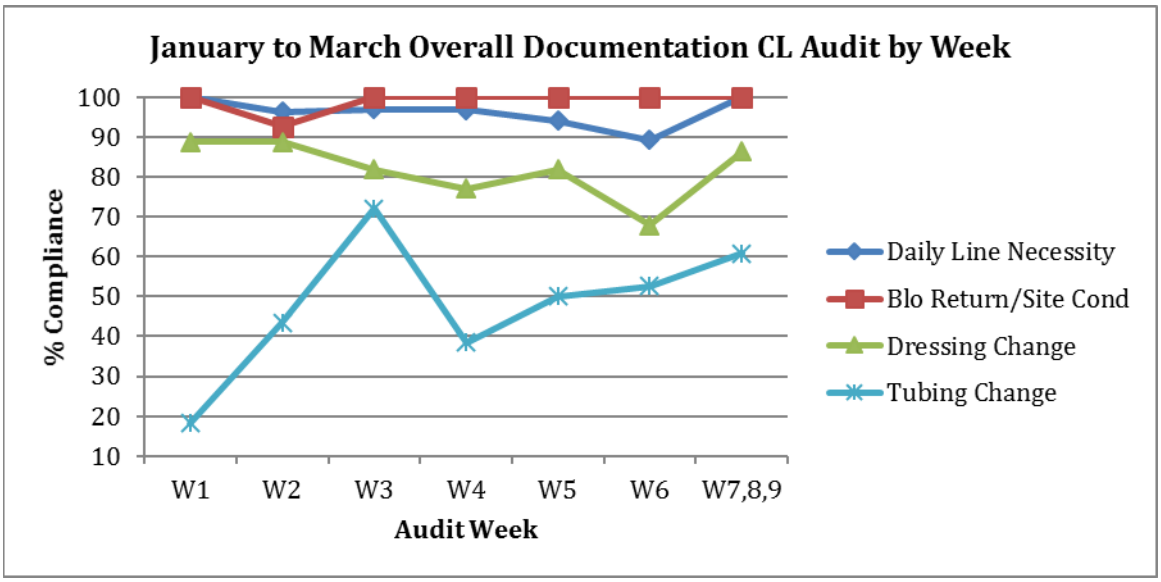

Figure 1: Quarter 1 Overall Documentation CL Audit by Week

Weeks 7, 8, and 9 were combined at the end due to poor participation in the latter portion of the audit. The combination of weeks 7, 8, and 9 takes away power from the study due to lack of participation which decreases the validity of the last data point. Tubing change started out around 20% compliance on the first week and increased to approximately 60% by the end of the audit period. Dressing change and daily line necessity showed decrease in compliance in the middle of the audit period, but increased by the end of the period. Figure 2 shows the bedside compliance by week of the first quarter.

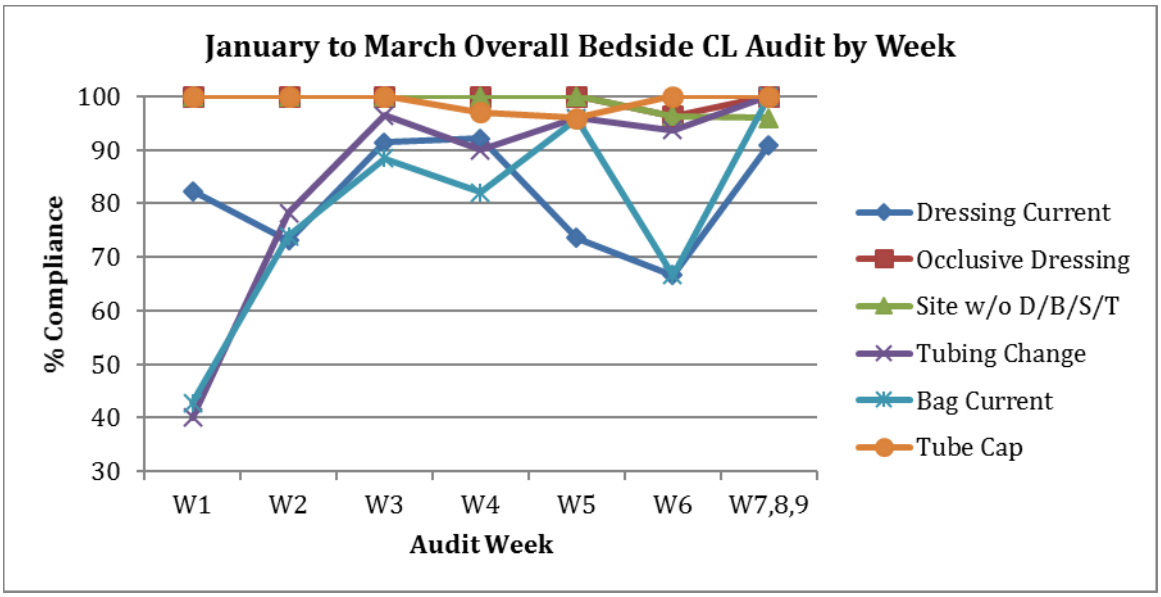

Figure 2: Quarter 1 Overall Bedside CL Audit by Week

Tubing change and bag current started the audit period at 40% compliant rate. By the end of the period, both categories were approximately 90% compliant. Tube cap, site without drainage, blood, and tenderness, and occlusive dressing present remained above 90% compliant during the whole period. Dressing change fluctuated throughout the audit period with a decrease to 70% near the end of the period. All categories were ranked 90% or higher at the end of the audit.

4.1.2 Second Quarter Results

The second quarter was from May 2014 to July 2014 and included seven units, only one of which was a repeat from the first quarter. Cap change was added to the documentation portion for this audit. Tables 4 and 5 show the total data from the second quarter.

Table 4: Results from Quarter 2: May to July 2014

	Documentation Assessment				
	Daily Line Necessity	**Blood Return**	**Dressing Change**	**Cap Change (96 hours)**	**Tubing Change**
Compliant	385	388	340	70	67
Non-compliant	12	9	50	87	242
Total Episodes	397	397	390	157	309
Percent Compliant	96.98	97.73	87.18	44.59	21.68
STDEV	7.78	6.72	16.10	31.34	28.18

Table 5: Results from Quarter 2: May to July 2014

	Bedside Assessment					
	Dressing Change Current	**Occlusive Dressing**	**Site Without D/B/S/T**	**Tubing Change**	**Bag Current**	**Tube Cap**
Compliant	117	374	389	305	304	355
Non-compliant	34	24	9	30	23	0
Total Episodes	151	398	398	335	327	355
Percent Compliant	77.48	93.97	97.74	91.04	92.97	100.00
STDEV	39.52	10.05	8.83	19.34	14.18	0.00

Tubing changed was the lowest documentation category during this quarter with a compliance rate of 21.68% while daily line necessity was the highest with 96.98% rate of compliance. On bedside assessment, tubing change was the lowest compliant. Dressing change current had the lowest compliance of 77.48%. Tube capped had 100% compliance for the whole quarter. The greatest standard deviation was in dressing change current in the bedside assessment. This result indicates that some units had poor compliance in dressing change while

some units had a high rate of compliance. Figure 6 shows the weekly documentation compliance, similar to Figure 3.

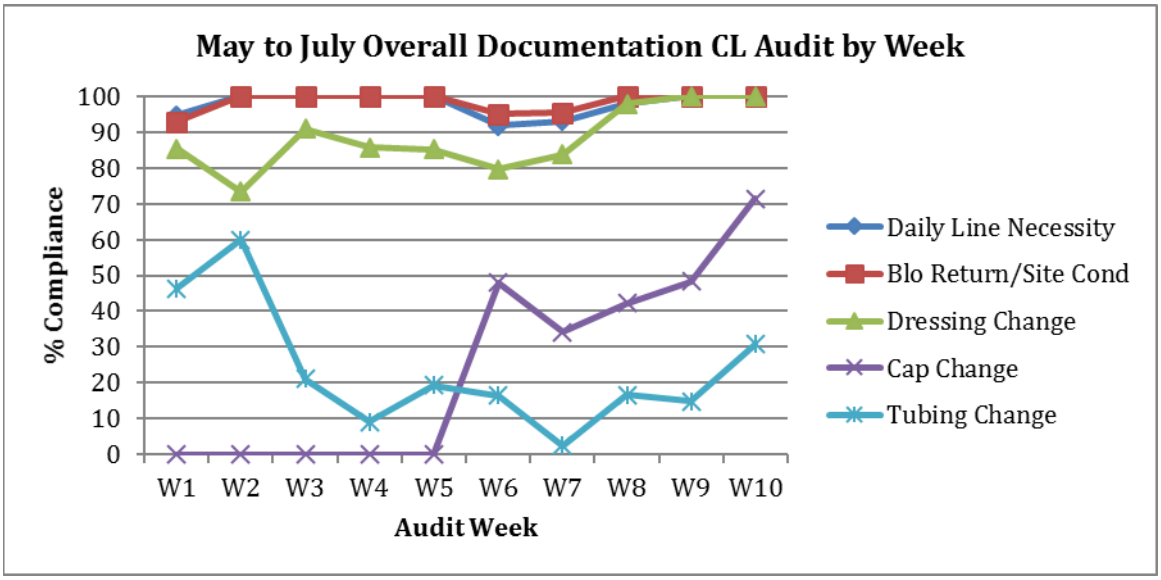

Figure 3: Quarter 2 Overall Documentation CL Audit by Week

From weeks 1 to 5, cap change compliance is 0%. The units were still using the prior audit forms from the previous quarter due to a technical error. Cap change documentation was not inspected during this period. During this quarter, tubing change dropped from about 50% at the beginning close to 0% during week 7. Blood return, daily line necessity, and dressing change all increased from the start of the audit period. Figure 4 shows the weekly bedside compliance for the second quarter.

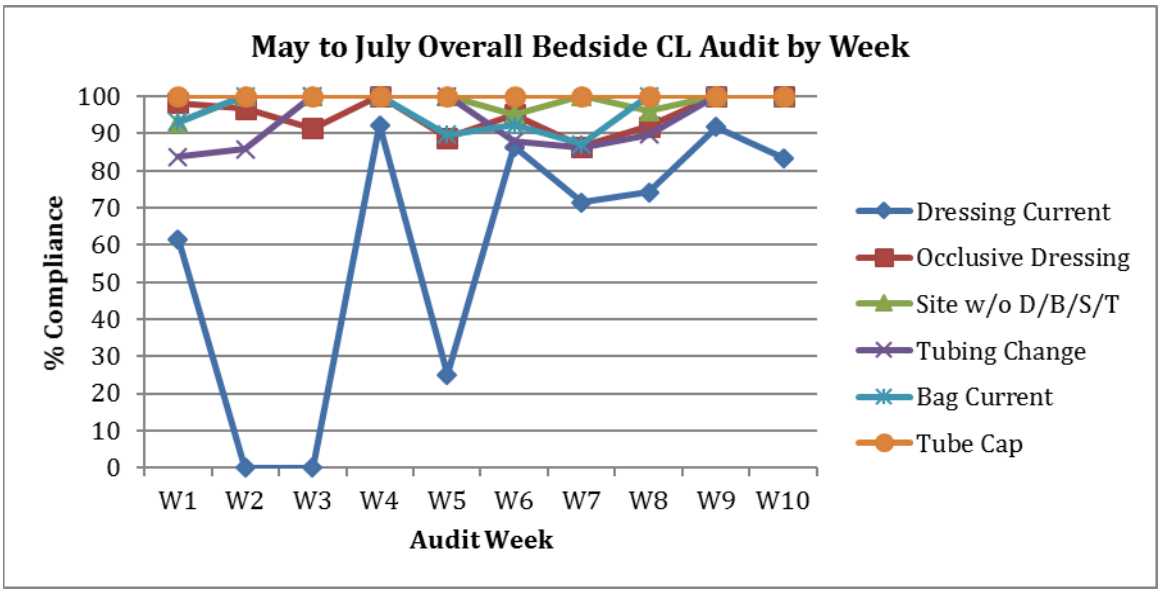

Figure 4: Quarter 2 Overall Bedside CL Audit by Week

All the categories remained above 80% during this quarter except for dressing change which varied greatly as the weeks progressed, but maintained a steady rate of compliance during week seven and on. The variation may be due to poor participation of units during weeks two, three, and five. Regardless of participation, the documentation inspected on those weeks revealed 0% compliance. Tubing capped remained at 100% compliance during the whole quarter for all units.

It is important to point out that some units out-performed others during the audit. For example, Figure 5 shows a specific unit that increased all but one category to 100% and greatly increased the last category, dressing change current.

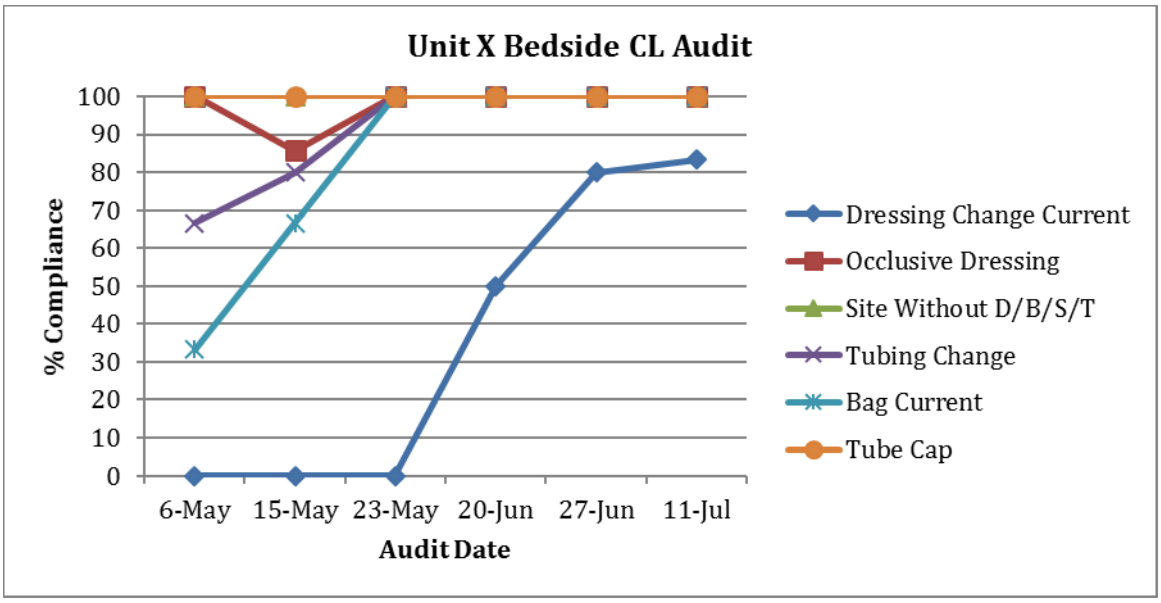

Figure 5: A Unit specific bedside audit

The nurses on this unit were very receptive to the audit. After the audit period the unit was below 0.65 CLABSIs per 1000 central line days. The unit continued to carry out the audit based upon its success. The unit initially started with low compliance on tubing change, current bag, and current dressing change. As the audit progressed, the unit showed increase in all categories to 100% except dressing change current which increased from 0% to approximately 80% compliance.

4.2 RETROSPECTIVE DOCUMENTATION OF CLABSIS

Central line documentation was examined for patients that developed CLABSIs from January 1, 2014 to August 31, 2014. These results were compared to the overall data collected from the

audits to observe any significance. The data collection method is explained in section 3.2 study design. The results are shown in Tables 6 and 7.

Table 6: Comparison of daily line necessity documentation for patients who developed CLABIs

Daily Line Necessity		
	CLABSI	**No CLABSI**
Not Documented	4	20
Documented	23	574

Table 7: Comparison of blood return documentation for patients who developed CLABIs

Blood Return		
	CLABSI	**No CLABSI**
Not Documented	3	11
Documented	24	596

Table 4 produced an odds ratio of 4.99 with a Fisher's Exact Test P value of 0.016. Table 5 produced an odds ratio of 6.77 with a Fisher's Exact Test P Value of 0.0183. Both tables produced a P value less than 0.05, indicating significance. These results indicate that the patients cared for by nurses who did not document daily line necessity were more likely to develop a CLABSI than patients where nurses documented daily line necessity. Section 2.5.4 (Daily Line Necessity) explained the importance that central lines be removed if they are not in use. Every day a patient has a central line in place is another opportunity for a CLABSI as each day increases the time exposed to a central line. If the nurse is not documenting the necessity of a line, there is a chance the patient may no longer need the line.

4.3 NURSING RESPONSE

The infection preventionists (IP) received ongoing feedback from nurses and unit directors as the audit period progressed. During the audit, IPs were encouraged to ask nurses if they had any concerns or questions pertaining to central line care. When prompted on their documentation, nurses would frequently indicate that they were unaware of the need to document cap or tubing changing. Some nurses indicated that documentation once a week was required. However, the hospital specific policy states that cap and tubing change should be documented every 96 hours. The investigator of the study did not record the numbers of nurses who provided feedback or the documentation and summarization of their responses. Future studies may be carried out to accurately describe clinician knowledge blood return policy in the tertiary care hospital.

Nurses also stated their concern about dressing change documentation. Some nurses would document with a date the dressing was changed, while others would document a same date every day to show that the dressing was changed on that date. Nurses would state they documented how they were taught during their orientation. Another future study may implement a program directed at standardization of documentation for all nurses.

Lastly, a large amount of nurses stated that carrying out these audits was very helpful as it reminded them about policy and protocol of documentation and inspection of central lines.

5.0 DISCUSSION

5.1 SUMMARY OF RESULTS

The audit in general showed promising results for the clinical units involved. All categories of documentation of intervention increased or remained above 90% compliance in the first quarter. All categories in the second quarter increased except tubing change. These data shows that audits brings awareness and increased compliance to central line protocol. Categories that had high standard deviations reflect high variability in compliance among the units involved.

There were six units involved with the first quarter with rates above 0.65 CLABSIs per 1000 central line days. Of these six units, only one unit remained above 0.65 CLABSIs per 1000 central line days to the second quarter. The repeat non-compliant unit only participated in 2 of 9 weekly audits during the first quarter, while participating in 6 of 10 in the second quarter. The unit was questioned about its participation during the first audit which may have increased its participation in the second audit period.

The retrospective review of documentation for those patients who developed CLABSIs compared to those who participated in the audit shows significant differences. Daily line necessity and blood return are vital documentation steps that are required to be performed every 24 hours. When not documented or performed, the patient may have a buildup of bacteria in the line that may lead to an infection that would go unnoticed. The patient may also no longer need

the central line, but maintains it due to the lack of documentation which also places the patient at a higher risk for infection.

5.2 AREAS FOR IMPROVEMENT

5.2.1 Participation

The first quarter had a participation rate of 50% for all of the units involved. The second quarter had a participation rate of 54.2%. Tables 8 and 9 show the individual participation rates for each unit specific to each quarter.

Table 8: Participation rate of first period units

Period 1	**Participation Percentage**
Unit 1	66.6
Unit 2	66.6
Unit 3	55.5
Unit 4	66.6
Unit 5	22.2
Unit 6	22.2
Mean = 50%	

Table 9: Participation rate of second period units

Period 2	**Participation Percentage**
Unit 1	60
Unit 2	60
Unit 3	90
Unit 4	0
Unit 5	90
Unit 6	80
Unit 7	10
Mean = 54.2%	

A representative from the CLAB focus group helped units determine alternative options that would enable these units to fill out the audit forms. A representative also contacted the units that had low participation rates. The low participation rates were often due to units indicating lack of time. Flexible audit times were established with busy units. This scheduling helped increase some of the unit's participation. Future studies can be carried out to determine nurse time management and staffing needs in relation to central line maintenance to determine where improvements can be made.

5.2.2 Nurse Education

The results showed that some nurses were unaware of the documentation policy, specifically, cap change and tubing change. When shown the policy, nurses were unaware that these hospital specific policies existed. Nurse education may be helpful to increase awareness of these hospital specific policies.

Provonost et al showed that choosing a clinician leader to disseminate information can significantly decrease the CLABSI rate. Choosing a clinical leader on each ICU will allow for proper dissemination of information from infection control departments to the respective ICUs. Each unit in the tertiary care hospital has a designated unit director that is involved in all administration activities of the unit. Each unit also has a charge nurse who acts as a supervisor for all the nurses on the shift. These two clinicians can be designated clinician leaders that can disseminate the proper information to all clinicians on the unit. The leaders would meet once a month or quarterly throughout the year with the hospital's infection control and prevention department. The infection control and prevention department would inform the leaders regarding policies related to central lines, proper central line care, and the current state of the

hospital's CLABSI rate. The leaders would return to their units and circulate the information to the clinicians. This top-down process allows for optimal information exchange.

The study by Pittet et al showed that by placing signs in frequented areas by the patient, and making hand hygiene stations readily available significantly decreases nosocomial infections. Such measures can be implemented in CLABSI prevention. Signs can be placed on patients' rooms that have central lines to remind nurses to use proper hand hygiene and constantly inspect the central line.

Further studies should be carried out to measure the knowledge, attitudes, and beliefs (KAB) of nurses in the tertiary care hospital. The result of this study was limited to analyze the KAB of nurses. By measuring KAB, the hospital can measure the variability in each category and address lapses accordingly. Lapses in knowledge and changing attitudes about the importance of nursing intervention with these lines can be addressed with education programs. Convening nurse group meetings to engage them in problem solving and increasing their involvement in this important clinical intervention may have an impact of changing attitudes and beliefs.

5.2.3 Hospital Infection Control

The hospital infection control and prevention team should also have transparency with and timely dissemination of data/findings to all units involved. The units can adjust practices if they receive constant feedback from the infection control department on the unit's CLABSI status and other nosocomial rates. A unit may be under the 0.65 CLABSIs per 1000 central line days, but may be close to rising above the rate. The infection control department can predict how many

CLABSIs will cause a unit to rise above the 0.65 rate. The infection control department can alert units if they are nearing the 0.65 rate. The early alert may help units from exceeding this rate.

In conjunction with nursing continuing education, hospital infection control committees can hold monthly in-services with units that have high nosocomial infection rates. CLABSIs and other nosocomial infections can decrease if early intervention strategies are in place. This includes meeting with clinician/nurse leaders to express concerns of rising infection rates and ways to decrease the rates.

5.3 LIMITATIONS

The first limitation of this study is the low participation rate. Some units participated more than others, while one unit on the second quarter did not participate. In cases where there was not participation, the staff of the unit state there was not enough time, or did not carry out the audit. The lack of data decreases the power of the trends present in the weekly graphs as the participating units fluctuate between weeks.

The second limitation is the retrospective review of documentation of those patients that developed CLABSIs. The analysis assumes that the patients participating in the audit did not develop a CLABSI. Although when the first quarter data is used as a comparison rather than both quarters combined, and the unit that remained above the 0.65 CLABIs per 1000 central line days is removed from the data to reduce chance of having a CLABSI in the audit data, the comparison still maintains significance (data not shown).

6.0 CONCLUSION

The results of this study show that the audit tool is an effective method in increasing nursing documentation and bedside duty compliance of central lines. The audit must be carried out for a longer period in order to determine its effect on the CLABSI rate. Other central line programs must be taken into consideration when determining the effectiveness of this audit on the CLABSI rate. Due to the participation rate in this study, there should be more communication between the infection control department and ICUs to create a clinician leader in each intensive care unit. This leader would be in charge of carrying out the audits and disseminating information on CLABSI reduction efforts while maintaining a positive atmosphere that promotes safety of all patients. Furthermore, the infection control department or clinician leaders of each unit could establish education programs. These programs would focus on safe and sterile practice of central line care and maintenance. Along with education programs, future studies can be carried out to evaluate the effect of staffing and compliance rates.

6.1 IMPLICATIONS FOR PUBLIC HEALTH

The result of this audit shows promising results that increase nursing compliance of central line care. The audit tool would be an effective public health intervention that reduces patient mortality and patient and hospital costs if the CLABSI rate decreased. The tool would still be an

effective nursing tool to increase central line care compliance even if the CLABSI rate remained steady. The tool can be utilized by other infection control and prevention departments in order to decrease the CLABSI rate worldwide. A decrease in the CLABSI rate would also decrease patient mortality, length of stay, and costs placed upon the patients, hospitals and insurance companies. These audits can also increasing nursing compliance which may better overall nursing care. Quality nursing care leads to better public health interventions for patient safety and care.

APPENDIX: CENTRAL LINE AUDIT TOOL

Below is an example of the central line audit tool used in the study.

	Date	Unit	MRN#	Line Type/# lumens	Documentation					Bedside Assessment						Comments
					Daily line necessity within 24 hours? Yes/No	On central line within 24 hours (blood return, site condition, line type) All present? Yes/No	Dressing change date within 7 days? (gauze within 48 hours) Yes/No	Cap change? (96 hours) Yes/No	Tubing change? (96 hours) Yes/No	Dressing change current with date? (7 days) Yes/No	Occlusive dressing? Yes/No	Site without drainage, blood, swelling or tenderness? Yes/No	Tubing change current with date? (96 hrs) Yes/No	Bag current? Date and time? (24 hours) Yes/No	Tubing capped with sterile caps? Yes/No	
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