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Implementation of a central line bundle as a quality improvement priority.

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Implementation of a Central Line Bundle as a Quality Improvement Priority

by

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Implementation of a Central Line Bundle as a Quality Improvement Priority

Abstract

Background: Central-line associated blood stream infections (CLABSI) are a major threat to patient morbidity and mortality. Kentucky Continue Care Hospital (KCCH), a long-term acute care hospital, experienced a significant increase in CLABSI in 2018; therefore, implementation of a central-line bundle to reduce CLABSI was identified as a quality improvement priority.

Methods: This author used the Quality Improvement Model to plan, study, and evaluate the implementation of a central line bundle in KCCH following University of Louisville Institutional Review Board (ULIRB) approval, staff were educated on the new process and the audit tool using a self-study module over a 2-week period before implementation. Chart audits were done over a six-week period to identify changes for ongoing implementation strategies. The goal for this first PDSA cycle was 20% compliance.

Results: Outcome objectives determined overall compliance with all central line bundle interventions improved by 19.7%. There was a 22.2% demonstration of positive change from pre-implementation to post-implementation. Outcome objectives were met, overall compliance improved by 19.7% more often and staff were meeting the objectives 22.2% more of the time. Barriers included lack of standardized documentation and difficulty in identifying which patients needed daily chlorhexidine bathing.

Introduction

Hospital acquired conditions affect more than two million patients annually and account for an estimated 90,000 deaths per year in the United States. Central-line associated blood stream infections (CLABSI) are among the most common healthcare associated infections and have a significant effect on patient morbidity and mortality (Azar et al., 2019). The Centers for Disease Control and Prevention (CDC; 2019) defined a central line blood stream infection as a laboratory confirmed bloodstream infection not caused by infection at another site in the body. As many as 250,000 patients develop CLABSI annually, resulting in up to 60,000 deaths. Central-line associated blood stream infections increase hospital length of stay by approximately seven days with mortality ranging from 4-20% (Drews et al., 2017). Health care costs per patient for CLABSIs may exceed $45,685 in un-reimbursable costs (Drews et al., 2017). The Centers for Medicare and Medicaid Services has identified CLABSI along with other healthcare acquired conditions (HAC) as a preventable "never" event, which is a medical error that is clearly identifiable, preventable, may result in serious consequences for patients, and indicates a problem with safety and credibility of the health care organization (Center for Medicare and Medicaid Services, 2019).

The Healthcare Associated Condition Reduction Program is designed to improve quality of care and patient safety. CMS reduces payment to hospitals that exceed the national benchmark and they do not cover the cost of treating HACs (CMS, 2019). Healthcare acquired conditions are reported on the Hospital Compare website for transparency of care and are available to healthcare consumers (CMS, 2019).

Significance of CLABSI

Central-line associated blood stream infections have the highest number of preventable deaths and the highest cost impact of any HAC (Schreiber et al., 2018). The rate of CLABSIs for fiscal year ending June 30, 2019 was 3.04 per 1000-line days or a total of eight CLABSIs. This is significantly above the KCCH corporate goal of 1.30 per 1000-line days and a dramatic increase from the previous fiscal year ending June 30, 2018 when there were no CLABSIs (K. Skabo, September 11, 2019). KCCH had a policy for central line dressing changes, but it was missing critical components of an evidence-based central line maintenance bundle (K. Skabo, personal communication, September 11, 2019). The need for a central line bundle was identified due to the high rate of CLABSI in the 2018 fiscal year (FY) ending June 30, 2019. Therefore, this presented a valuable opportunity to improve patient safety through quality improvement.

Current Knowledge

Central-line associated blood stream infections are a major problem for the healthcare system with estimated annual costs up to two billion dollars annually. These costs do not include the expense of increased length of stay and the reduction in reimbursement associated with federal quality monitoring programs, health-adjusted life expectancy (HALE), disability-adjusted life years (DALY), or potential years of life lost (PYLL) (Azar et al., 2019). The Healthcare Associated Condition (HAC) Reduction Program is designed to improve quality of care and patient safety, CMS reduces payment to hospitals that have the most HACs and they do not cover the cost of treating HACs (CMS, 2019). These costs create a significant financial burden for the facility. Healthcare acquired conditions are also publicly reported on the Hospital Compare website.

Central line bundles have been shown to significantly reduce CLABSI rates in all patient care settings (Grigonis et al., 2014). Intensive care unit (ICU) patients are at highest risk for CLABSI and much of the research on prevention has been done in this setting. However, the majority of CLABSIs occur in patients outside of the ICU. Other risk factors for CLABSI include prolonged hospitalization before catheterization, prolonged duration of the catheter, heavy microbial colonization at the insertion site, heavy microbial colonization of the catheter hub, internal jugular catheterization, femoral catheterization in adults, neutropenia, reduced nurse to patient ratio, substandard catheter care, and male sex (Marschall et al., 2014).

Central line bundles are an effective way to address CLABSI. In a systematic review with meta-analysis including 144 studies, evidence-based bundles reduced all hospital acquired infections (HAI), including ventilator associated pneumonia, catheter associated urinary tract infection, and CLABSI, by as much as 70% (Schreiber eta al., 2018). In a systematic review and meta-analysis including sixty records in adult ICU's, CLABSI rates prior to implementation of a central line bundle ranged from 1.2 to 46.3 per 1000 catheter days. Post-implementation rates decreased to a range of 0 to 19.5 per 1000 catheter days. Compliance with the central line bundle was also reviewed and ranged from 7% to 45% improvement (Ista et al., 2016).

Target Population

The target population for this quality improvement project were direct-care nurses in the adult long-term acute care setting. The nurses in the facility included a mix of Licensed Practical Nurses (LPNs) and Registered Nurses (RNs) along with certified nursing assistants (CNAs). CNAs were included as critical members of the interprofessional care team who were primarily responsible for bathing because chlorhexidine bathing is a component of the central line bundle.

Members of the leadership team were involved in holding the staff accountable, project approval, and resource allocation.

The target patient population included adult patients (65 years of age or greater) who had an implanted port, internal jugular or subclavian central venous line, tunneled or cuffed central lines (Hickman catheter), or a peripherally inserted central venous catheter (PICC). Hemodialysis catheters were excluded as the dialysis nurses were responsible for routine care. Patients in the facility had a variety of conditions including simple wound care, long-term intravenous antibiotics, high oxygen requirements, vasoactive drips, and critically ill patients who were intubated and mechanically ventilated.

Rationale For the Change in Practice

The extent of the problem was defined using quality data from the organization. The rate of CLABSIs for fiscal year ending June 30, 2019, the rate was 3.04 per 1000-line days or a total of 8 CLABSIs, which was significantly above the KCCH corporate goal of 1.30 per 1000-line days (K. Skabo, September 16, 2019).

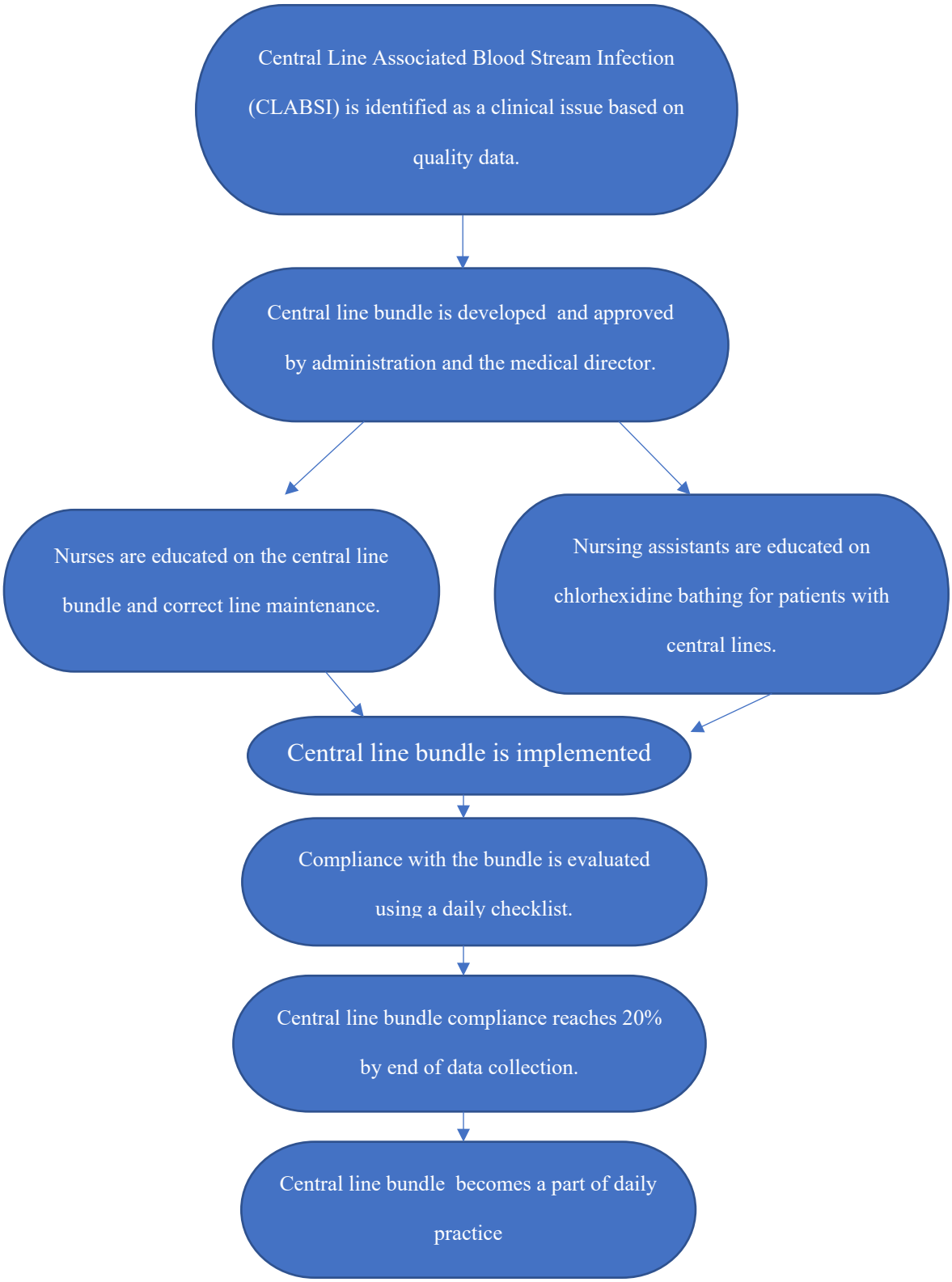
This author used the Institute for Healthcare Improvement (IHI) Model for Quality Improvement Model for this project (IHI, 2020). The Plan Do Study Act (PDSA) model (See Appendix A) was used to develop, implement, and refine the interventions as needed. This project involved one of several planned cycles for this initiative. The first step and goal of this project was implementation of and compliance with the central line maintenance bundle and the ultimate goal was a reduction or elimination of CLABSIs (IHI, 2020). The next phase was determination of how this goal can be reached, or what actions need to be taken to achieve the goal (IHI, 2020). Strong evidence suggested that central line maintenance bundle either reduced or eliminated CLABSIs in multiple health care settings (Grigonis et al., 2016). This author

developed a bundle for KCCH using the best-known evidence from the CDC, the Society for Healthcare Epidemiology of America (SHEA), and the Asia Pacific Society of Infection Control (APSIC) for use at KCCH. The third step was to determine how to measure whether or not a change resulted in improvement (IHI, 2020). The short-term goal of this DNP quality improvement project was to implement a central line maintenance bundle in one KCCH long-term acute care setting. This was measured with weekly audits of medical records looking for documentation of each of the central line bundle interventions over a six-week period following staff education. The long-term goal for this quality improvement initiative is to reduce the incidence of CLABSI in the KCCH long-term acute care setting to the corporate goal of 1.3 CLABSIs per 1000-line days or lower, which will be determined at the end of the 2020 FY by the corporation's administration.

The project was feasible and sustainable because the equipment used in daily care was already in use and it was inexpensive to implement. Similar quality improvement projects, including a Foley catheter bundle have been implemented with success and become a part of daily practice (K. Skabo, personal communication, September 11, 2019).

The conceptual model (see Figure 1) outlined the steps in the process. The problem was identified using quality data followed by bundle development and policy development in collaboration with the interprofessional quality improvement team, which will be discussed in detail under stakeholders. Next, nurses were educated on the bundle and CNAs were educated on chlorhexidine bathing. The bundle was implemented and compliance was evaluated through weekly chart audits on patients 65 years of age or older. The goal of this project was to reach 20% compliance with the central line bundle by the end of data collection, which was thought to be a reasonable expectation for the first cycle.

Figure 1 Conceptual Model



Project Aims

The aim of this quality improvement project was to implement a central line maintenance bundle at KCCH following University of Louisville Institutional Review Board approval, policy development, and staff education with a positive change (improvement) benchmark of 20% by the end of data collection. Compliance with the central line maintenance bundle was also used to identify expected process refinements. The agency's goal for CLABSI rates was 1.3 per 1000-line days or less, which aligns with the aim of this project (K. Skabo, personal communication, September 11, 2019). The staff completed the training for the central line maintenance bundle care process using a self-study module, which is seen as the most effective means for staff nurse education (Bastable, 2008). This training involved explaining the purpose of this project, central line maintenance bundles, measures for CLABSI prevention, explanation of the formative evaluation (chart audits) for the change process, and KCCH's expectations for sustaining this change as a routine daily practice. A poster board of the bundle interventions was displayed in the staff breakroom as a reminder for the direct care staff. Materials such as dressing kits, antiseptic barrier caps, IV tubing labels, and chlorhexidine solution were readily available for use and standard equipment used for patient care prior to this project.

Environment

KCCH was a 37-bed long-term acute care hospital (LTACH) with all private rooms. The average census was 16 patients. KCCH was a distinct entity within a regional medical center whereby the corporation leases the space and use of ancillary services. The facility had two halls, one with low acuity patients such as wound care or long-term intravenous antibiotics staffed by LPN's and RN's, and the other hall had high-acuity patients with complex needs such as mechanical ventilation, high oxygen requirements, and vasoactive drips staffed by RN's.

Patients were all over 18 years old, came from short-stay acute care hospitals, and required prolonged hospital stays due to complex medical needs that could not be met in the outpatient setting or a skilled nursing facility. Many of the patients had central venous catheters due to long-term need for intravenous access, most of which are inserted in the facilities they were in before admission. This project provided a means to identify differences between CLABSI's related to insertion and those with maintenance, which would allow the facility to engage with the outside providers who inserted the lines as needed.

Stakeholders

Stakeholders in this project included the Chief Nursing Officer (CNO), the Chief Executive Officer (CEO), the Director of Quality, the medical director, direct care nurses, CNAs, patients and families. The CNO was responsible of approval of the central line bundle, any policy changes and is also responsible for staff accountability for the central line bundle. This was a critical component for quality improvement compliance. The Director of Quality was responsible for creating new policies, ongoing education on the bundle, infection surveillance, chart audits for compliance, and reporting of CLABSI to appropriate regulatory agencies. The medical director was the attending physician for all of the patients and was responsible for approving the project and approving the interventions outlined in the central line bundle. Direct care nursing teams (RNs, LPNs, and CNAs) were the most important stakeholders in this project. They were responsible for carrying out the interventions in the central line bundle. The project would fail without buy-in from the direct care team. CNAs were responsible for hygiene and daily chlorhexidine bathing was an essential component of the project and were also essential in reporting new signs and symptoms of infection in the patients, soiled or loose dressings, and abnormal vital signs indicative of infection. Patients and families were not directly involved

with the project but have an important role in infection prevention. Patients and families must be aware of the potential complications of a central line and things they can do to prevent CLABSI, such as hand hygiene and reporting any new symptoms to the nurses.

Facilitators for Practice Change

This project had the support of the leadership team. They were committed to providing the resources to make the project successful and achieve a reduction in CLABSI. KCCH is a small facility and leaders are more visible than they are in a larger organization and available as resources for staff and project support.

Barriers to Practice Change

Barriers to change exist in any organization and KCCH is no different. Resistance to change is a common barrier in any organization. For this project, direct care nurses were involved in planning and implementation providing them an interest in seeing the project succeed. The nurses in the organization are busy as the patients have complex illnesses and needs. It was essential to make the components of the intervention a part of routine care and ensure it was easy for nurses to comply with the components of the bundle. Sustaining the project over time was also identified as a potential barrier, which could not be addressed within the timeframe of this project. However, measures were taken to involve the entire team in development and implementation and making it a part of new hire orientation proactively addressed this issue.

Project Approval

A letter of support (See Appendix B) indicating the project was approved by the CNO, CEO, Medical Director, and Director of Quality at KCCH. It was determined by KCCH that Institutional Review Board approval was unnecessary for this quality improvement project. The

application for IRB approval at the University of Louisville was submitted in December 2019. An approval letter (See Appendix C) confirming this project was quality improvement and not human subjects research was received on January 8, 2020.

Conceptual Framework

The IHI model for improvement was a simple tool used successfully by numerous health care organizations for various quality improvement projects (IHI, 2020). The model consists of two parts. The first part consists of three fundamental questions that can be addressed in any order. The three questions ask what are we trying to accomplish, how will we know a change is an improvement, and what change can we make that will result in improvement. Aims, or what is trying to be accomplished, should be time specific, measurable, and define a specific population that will be affected. Quantitative measures are used to determine if a specific change actually results in an improvement. The ideas for change may come from those who work in the system or from experiences of others who have successfully improved. The second part of this model consists of the Plan-Do-Study-Act (PDSA) cycle for testing change in the real work setting. The steps of this cycle consist of planning change, trying it, observing the results, and acting based on what is learned. This cycle is useful for continuous quality improvement in the health care setting (How to Improve, 2019).

This model was ideal for addressing CLABSI reduction and prevention and has been used successfully in similar projects and settings. At KCCH the aim was to implement a central line maintenance bundle, achieve 20% compliance by the end of data collection, and achieve an ultimate goal of reducing or eliminating CLABSI within the organization. Determining if the change was an improvement was accomplished through chart audits and audits of central line dressings and IV tubing within appropriate dates on a weekly basis. Rates of CLABSI were

monitored and already tracked and can be used to assess whether or not the bundle is reducing CLABSI rates. The idea for this quality improvement project came from data that showed CLABSI was a problem within the organization. The idea for a central line bundle came from literature research and experiences of other health care organizations. The plan for the project was achieved through collaboration with nurse leaders and direct care nurses. The implementation phase began after IRB approval and staff education, then data were gathered for a six-week period. Evaluation of outcomes determined if the project was successful and provided direction on any changes that need to be made to the process.

Practice Change Intervention

KCCH utilized most of the bundle components outlined by the CCDC, ASPIC, and SHEA; however, there were no facility policies and procedures, compliance auditing process for compliance, or routine part of new and ongoing staff continuing education. Prior to bundle implementation, staff completed a short self-study module outlining the bundle components, benefits of adherence to the bundle, and the reason for the change. Information about the audit process was included, and staff had the opportunity to ask questions and provide input to the author at a patient care council meeting and informally as needed. The central line maintenance bundle for KCCH is included below.

The central-line maintenance bundle interventions in the CDC Central-Line Bundle were graded using the Healthcare Professionals Advisory Committee Recommendation Categories. These recommendations consist of five categories (see Table 1).

Table 1 Maintenance Bundle Levels of Recommendation

	CDC (2011)	APSIC (Ling et al., 2016)	SHEA (Marschall, et al., 2014)
Daily need assessment	IA	IA	II
Securement device	II	Not included	Not included
Change transparent dressing q 7 days	IB	IB	II
Change gauze dressings q 48 hours	IB	IB	II
Change loose, damp, or soiled dressing	II	IB	II
Use chlorhexidine dressings or Bio Patch	IA	IB	I
Cleanse site with 0.5% chlorhexidine for 30 seconds during dressing change	IA	Not included	I
Scrub the hub, use antiseptic protective caps	IA	IIB	II
Hand hygiene with soap and water or 70% alcohol hand scrub	IB	IB	II
Change IV tubing q 96 hours for standard IVFs	IA	IA	II
Change TPN/lipid tubing q 24 hours	IB	IB	II
Change propofol tubing q 12 hours	IB	IB	Not included
Daily chlorhexidine bathing	II	IA	I

Recommendation Categories

- Category IA: strongly recommended for implementation and is strongly supported by well-designed experimental, clinical or epidemiologic studies. i
- Category IB: strongly recommended for implementation and supported by some experimental, clinical or epidemiologic studies. Interventions with a strong theoretical rationale or widely accepted practice, such as aseptic technique, supported by limited evidence also fall into this category.
- Category IC: required by state or federal rules, regulations, or standards.
- Category II: suggested for implementation and is supported by suggestive clinical or epidemiologic studies or a theoretical rationale.
- No recommendation is an unresolved issue that the evidence is insufficient or there is no consensus regarding efficacy exists (CDC, 2011).

The recommendations from the SHEA were evaluated using the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) and the Canadian Task Force on Preventive Health Care.

- Level I: high grade evidence and there is a high level of confidence the true effect lies close to that of the estimated size and direction of the major effect. Evidence is considered to be high quality when there are a wide range of studies with no major limitations, there is little variation between studies, and the summary estimate has a narrow confidence interval.
- Level II: moderate grade evidence. The true effect is likely to be close to estimated size and direction of the effect, but there is a possibility it is substantially different. Evidence is considered moderate quality when there are few studies and some have limitations but

no major flaws, there is some variation between studies, or the confidence interval is wide.

- Level III: low quality evidence. The true effect may be substantially different from the estimated size and direction of the effect. Evidence is rated low quality when supporting studies have major flaws, there is significant variation between studies, the confidence interval is very wide, or there are no rigorous studies, only expert consensus (Marschall et al., 2014).

The APSIC bundle was evaluated by assigning the following categories for strength and quality of evidence on which recommendations were made.

- Category A: assigned when there is good evidence to support recommendation for use.
- Category B: assigned when there is moderate evidence to support recommendation for use.
- Category C: assigned when there is insufficient evidence to support a recommendation for or against use.
- Category D: assigned when there is moderate evidence to support a recommendation against use.
- Category E: assigned when there is good evidence to support a recommendation against use.

Categories for the quality of evidence on which recommendations were made were also listed.

- Level I: assigned when there is evidence from at least one properly randomized, controlled trial (RCT).

- Level II: assigned when there is evidence form at least one well-designed clinical trial without randomization, from cohort or case-controlled studies from more than one center, from multiple time series, or from dramatic results in uncontrolled experiments.
- Level III: assigned to evidence from opinions from respected experts based on clinical experience, descriptive studies, or reports of committees (Ling et al., 2016).

The central line bundle developed from these organizations' recommendations for KCCH were:

1. Assess the need for continued catheter use daily.
2. Use a sterile, suture-free securement device (Stat-Lock) for catheter stabilization.
3. Check dressings every shift and as needed to ensure it is clean, dry and intact. Promptly change the dressing if it is dampened, loosened, or visible soiled.
4. Change transparent dressings every seven days or when loose, dampened or soiled.
5. Change gauze dressings every 48 hours or when loose, dampened, or soiled.
6. Use chlorhexidine impregnated dressings or sponges (Bio Patch) on central venous catheters.
7. Cleanse the insertion site with chlorhexidine preparation using a back and forth motion for 30 seconds during dressing changes.
8. Wash hands with soap and water or an alcohol-based hand rub prior to and after accessing the central line, the dressing, the needless access device (access ports, male adapters).
9. Scrub the catheter hubs using a twisting motion for at least 15 seconds with chlorhexidine or 70% alcohol solution before access injection ports or male adapters. Use antiseptic protective caps on all injection ports.
10. Change administration sets not used for blood or lipids every 96 hours. Replace male adapter protective caps with tubing changes.

11. Replace IV tubing and male adapters used for TPN every 24 hours.
12. Change tubing for propofol every 12 hours.
13. Administer daily chlorhexidine baths (do not rinse and do not use on the face. A literature search was conducted using the databases CINAHL, PubMed, and Medline using the search terms central line blood stream infections and long-term acute care hospitals published between 2005 and 2019. This search resulted in 130 articles and was ultimately narrowed to two articles that met the inclusion criteria by reading abstracts and including articles that addressed central line bundle implementation in the LTACH setting. Due to the small number of articles, a second search for CLABSI was done using the same databases, and numerous articles were obtained. Search terms were refined to CLABSI and central line bundles and was reduced to 117 results. The abstract was reviewed and articles that included full central line bundle implementation in the adult population were included. Due to the small number of articles examining the LTACH setting, evidence was extrapolated from studies that were conducted in ICU and non-ICU acute care settings. The results were narrowed to eight articles for this review.

Evidence Synthesis

The Johns Hopkins Nursing Evidence-Based Practice Level and Quality Guide was used to evaluate and rank the evidence (Dearholt & Dang, 2012). The articles for this review included two systematic reviews with meta-analysis, one randomized controlled trial, one quasi-experimental study, one clinical practice guideline, three quality improvement projects. Quality improvement articles and expert opinion statements are generally considered low quality evidence, but the articles in this report showed results similar to the experimental studies and the expert guidance piece was an evaluation of interventions with grading of the evidence.

Level I Evidence

All of the reviewed articles showed a reduction in CLABSI rates with the use of a central-line bundle. Schreiber et al., (2018) conducted a systematic review with meta-analysis which showed reductions in CLABSI ranging from 6% to 100% with the use of a central line bundle. Thirty studies conducted between 2005 and 2016 were included in in the systematic review and meta-analysis. In a systematic review with meta-analysis median CLABSI incidence in a meta-analysis was 6.4 per 1000 catheter days. This decreased to 2.5 per 1000 catheter days after bundle implementation. This analysis included 79 articles published between 1990 and 2015 (Ista et al., 2016).

Marstellar et al. (2012) conducted a randomized controlled trial in forty-five ICUs from 35 hospitals to determine how mutli-faceted interventions would influence CLABSI. The CLABSI rate for the control group at the beginning of the study was 2.71 per 1,000-line days compared to 4.48 per 1,000-line days in the experimental group. At six months, the control group CLABSI rate was 2.16 per 1000-line days and the experimental group rate was 1.33 per 1000-line days (Marstellar et al., 2012).

Level II Evidence

Sacks et al. (2014) conducted a quasi-experimental study in a 16-bed surgical ICU in a large tertiary medical center. An 8-bed ICU in the same facility served as the control group. The central line bundle intervention was implemented in December 2005 and data were collected in the intervention and control group starting January 2006 and ending April 2006. The study found a reduction from 5.02 CLABSIs per 1000 catheter days to 1.60 per 1000 catheter days and reduction from 4.48 to 1.33 per 1000 catheter days in the intervention group. The authors estimated a net reduction in CLABSI of 68% with use of the central line bundle. The control groups did not show a significant change (Sacks et al., 2014).

Level IV Evidence

Marschall et al. (2014) outlined strategies to reduce CLABSI and evaluated and reported the strength of the evidence of each intervention commonly used in central line bundles. Each intervention was graded based on the quality of evidence to support the interventions (Marschall et al., 2014).

Level V Evidence

Grigonis et al. (2016) examined the use of central line bundles and the effect they had on CLABSI rates. Grigonis showed a reduction from 1.28 CLABSIs per 1000-line days to 0.96 per 1000-line days in the 14 days post implementation. The authors found the bundle to be sustainable as well (Grigonis et al., 2016). In a quality improvement initiative in the LTACH setting produced similar results using only the daily chlorhexidine bathing intervention of the central line bundle. This intervention alone demonstrated a 65% reduction in CLABSI after a six-month trial period in 2010. This reduction and intervention were maintained through 2012 (Edwards & Purpura, 2012).

O'Neil et al. (2016) evaluated the effects of a central line maintenance bundle in non-ICU setting in a 1250-bed teaching hospital. In this before and after trial, the authors found a 2.5% reduction in CLABSI rates but this was not statistically significant. The authors did find that compliance with dressing changes increased from 78% at the beginning of the intervention to 87.9% at the end of data collection.

Practice Change Implementation

The leadership team described above participated in implementation of the project through approval of the bundle, audit tools, and the self-study module for direct-care staff. They were updated weekly after audits are performed. The administrators held responsibility for staff member accountability for compliance with the bundle to preserve peer relations. Direct care

staff including RNs, LPNs and CNAs were the most integral participants in the project. These members were responsible for actually using the interventions contained in the central line bundle. Direct care staff were also involved in implementation as they were the best judge of what would work for them. All patients with central venous lines who were aged 65 or older were eligible for participation in the project.

Informed consent was waived as this was a quality improvement project and all patients with central venous access received the same care. Data collection was done through chart audits using a central line maintenance checklist (See Appendix D) from The Joint Commission (2013). This document is publicly available and permission for use was not required. Compliance data were collected on a weekly basis on patients over age 65 with a central line in place. Charts were audited and assessed for documentation of dressing change within seven days for transparent dressing and gauze dressing within 48 hours. Documentation of tubing change every 96 hours for standard IVFs, every 24 hours for TPN and every 12 hours for propofol infusion was assessed. Audits at the bedside checked for dates on dressing changes and IV tubing and presence of antiseptic caps on injection ports. Documentation for these variables was then confirmed in the chart. Patient data included the year of birth to protect identity and maintain security.

The tools for implementation were already used in the organization. The expenses associated with this project were an indirect cost of usual care and not considered additional expenses. Materials used included central line dressing change kits, IV tubing, antiseptic caps for injection ports, male adapters, and chlorhexidine bathing cloths. Costs for educating staff were estimated at $1710.00 as there are 57 staff members to complete training, an average salary of $30 per hour, and an hour to complete training. The training was a self-study module

completed during regular work hours. These were indirect expenses and were not expected to generate extra expenses associated with this project.

Following successful proposal defense, IRB approval, CCH KY approval, and collection of baseline data, the project was implemented on 2/14/2020. Staff were educated using a self-study power point and a poster board in the staff break room that defined what a central line was, listed the central line bundle interventions, explained the rationale for the central line bundle. Staff were informed to direct any questions or concerns to the author. Staff were given two weeks to complete the education. Completion was verified by signing a roster. The roster was signed by forty-seven nurses. The educational material remained in the break room throughout the first data collection cycle.

Baseline data were obtained from 20 medical records. Patients were included in the audit if they were aged 65 years or greater and had any type of central intravenous access (PICC, TLC, implanted port, or tunneled catheter). Hemodialysis catheters were not included because those lines are cared for by dialysis nurses. Patients were excluded if they were less than 65 years of age. The patient's year of birth was the only identifier used to protect patient identity and the was locked in a file cabinet in the chief nursing officer's office. The CNO and the author had access to the file cabinet.

Baseline data for nine variables were obtained through chart audits prior to implementation. These variables included documentation of a daily needs assessment, assessment of central line dressings (appropriately dated and intact), documentation of use of a Biopatch or CHG dressing, presence of protective caps on injection ports, documentation of IV tubing change, documentation of daily chlorhexidine bathing, documentation of male adapter changes with IV tubing changes, and presence of a securement device to prevent tension on the line. Chart audits were done at the end of six weeks to assess compliance with the interventions.

The timeline (See Appendix E) began in January with IRB approval. Prompt IRB approval allowed for early implementation and complete data collection prior to the COVID-19 pandemic. Staff education was completed the first two weeks of February followed by implementation on February 14, 2020. Data collection began the following week and continued for six weeks. Organization and analysis of data was done through May and the final report was completed in July. The project manuscript was completed in the end of July

Measurement

The process measure for this project was compliance with the central line bundle (CLABSI). Compliance with the CLABSI collective bundle and components was reported using frequencies and percentages. These data were collected weekly through chart audits and audits of compliance with interventions at the bedside. The audit tool used was obtained from The Joint Commission. The audit included type of line, date of placement, date injections caps changed, date administration set changed, date dressing last changed, and the type of dressing in place. The checklist also assessed documentation of daily need assessment for line, if the dressing was intact, if there was no tension on the line, and if the insertion site shows any signs of infection (The Joint Commission, 2019). The outcome measure was compliance with the components of the CLABSI bundle along with the data collected by the Director of Quality.

Results

Nursing experience levels ranged from less than one year to greater than 30 years of nursing experience. Education levels ranged from certifications for CNAs to master's level nursing education for RNs. Pre- and post-practice change data were entered into Microsoft Excel version 2016 spreadsheets. Data were analyzed for percentage of positive change, which was indicative of compliance with the practice change. Data were also analyzed and reported using frequencies and percentages for each bundle component and overall compliance with the

entire bundle. Twenty medical records were reviewed and presence of documentation of the nine practice components was assessed prior to implementation and six weeks after full practice change implementation. There were no negative findings in data analysis. There was improvement in the documentation of each central line bundle component. Some of the bundle components were not being used prior to this project; therefore, any documentation of those components resulted in positive change. The absence of negative change is indicative of success of this quality improvement project in improving compliance with central line bundle components.

The overall compliance rate with KCCH central line bundle interventions prior to implementation of this quality improvement project was 18.3%. Overall post implementation compliance was 38% with a demonstration of positive change of 22.2%. The goal of 20% compliance was met, however KCCH wants 100% compliance with central line bundle interventions so subsequent PDSA cycles are needed to assess the utility of changes and identify practice changes needed to increase the success of the central line bundle and ultimately decrease or eliminate CLABSI from the organization. This means there was compliance with central line bundle component documentation 38% of the time and the bundle components were being documented 22.2% more often post-implementation.

Daily Needs Assessment

The staff nurses' determination for the necessity of the central line is a critical component of the central line bundle as an infection control measure. Daily needs assessment documentation prior to implementation had a compliance rate of 0%. Post documentation and change rate improved with compliance of 35% (n = 7). The demonstration of change was positive at 35%. These results exceeded the 20% compliance goal. This result was in part due to the charge nurses proactively asking the physicians about line removal or reminding the direct care nurses to do so.

Recommendation

Compliance could be further improved by adding a central line documentation checklist to the nursing flowsheet to remind nurses to complete these interventions and make documentation easier for the next PDSA cycle.

Dressing Status

The presence of an intact and appropriate dressing that was correctly dated was a bundle requirement. This component had a pre-implementation compliance rate of 100% (n = 20). This was a neutral demonstration of change. The high rate of compliance with documentation of this intervention was likely related to presence of a place for documentation that the dressing is clean, dry, and intact on the nursing flowsheet.

Recommendation

The recommendation was to continue this process with the next PDSA cycle.

Biopatch or Chlorhexidine Gluconate (CHG) Impregnated Dressing

This bundle component resulted in a positive practice change that improved from 0% to 20% (n = 4). The goal was met but further improvement can be seen.

Recommendation

The addition of a central line checklist to the nursing flowsheet to improve documentation of the intervention. These dressings are being used as they are the only type available, but their use is not being documented.

Tubing Changes

Pre-change data for documentation of tubing date was n = 0 with compliance of 0%. Post-implementation this component had a compliance rate of 45% (n=9) and demonstration of positive change of 45%. The significant improvement in this intervention could be related to the

addition of a place on the medication administration record for tubing change documentation around the same time the central line bundle was implemented.

Recommendation

To ensure greater compliance, this intervention should also be included in the central line documentation checklist.

Daily Chlorhexidine Bathing

This practice was new to KCCH. Post-implementation compliance was noted to be 25% ($n = 4$) and a demonstration of positive change of 25%. The goal was met for this cycle; however, as a new practice measure, a learning curve is expected. The nursing assistants also reported to the author that they were not always sure if the patient had a central line.

Recommendation

In the next PDSA cycle, the author recommends that the nursing staff and administration collaborate to create a flowchart to easily document and track the bundle components. Adding a place to document chlorhexidine bathing to the nursing assistants' documentation may be helpful in increasing compliance in the next PDSA cycle. Reinforcement of education and improved communication between the nursing assistants and nurses should be included in the next PDSA cycle. Another option is a sign over the patient beds that identifies them as having a central line, so the nursing assistants know they need a chlorhexidine bath daily.

Weekly Documentation of Central Line Dressing Changes

The pre-bundle compliance rate was 65% (n = 13), which increased to 100% and demonstration of positive change of 35%.

Recommendation

The weekly dressing change is documented on the line assessment section of the nursing flowsheet. To ensure continued compliance and simplify the chart audit process, it is

recommended to include this intervention in a central line assessment section of the nursing flowsheet.

Adapter Cap Changes

Pre-practice change implementation documentation of male adapter cap changes $n = 0$ with compliance of 0%. Post-implementation $n = 4$ with compliance of 20% and demonstration of positive change of 20%.

Recommendation

To further improve compliance, this standard practice should be included in a central line assessment section of the nursing flowsheet to improve documentation and compliance.

Securement Device

The use of a securement device with no tension on the line had a pre-bundle implementation compliance rate of 0%. Post-implementation with a compliance rate of 10% ($n = 2$) and a demonstrated a positive change of 10%.

Recommendation

The recommendation to improve compliance with this intervention is including it in a central line assessment section of the nursing flowsheet. Documentation is the main problem with this intervention as visual audits on patients shows they are being used but not documented.

Summary of Recommendations

The recommendations for the next PDSA cycle include addition of a central line assessment section to the nursing flowsheet, reinforcement of central line bundle education, addition of a place to document chlorhexidine bathing in the nursing assistants' documentation, and a sign over the patient beds that identifies patients who have a central line in place. The main problem identified in the first PDSA cycle was lack of documentation of interventions that are being done. These additions will ease documentation and simplify chart audits.

Practice Implications

This project aimed to improve compliance with a central line maintenance bundle to reduce or eliminate CLABSI in a long-term acute care hospital. Success in this project may serve as a quality improvement model for other LTAC facilities and improve safety and reduce costs in this patient population and become the standard of care in LTAC facilities. Sustainability is achievable with leadership and nursing support. Involving all participants throughout the process increased ownership and importance of the project. This addressed common barriers to implementation.

Advance practice nurses are experts in clinical practice. It is essential to be aware of the best practices and ensure they are being used in the practice setting. Involvement in quality improvement projects demonstrates an active role in improving patient outcomes. Advance practice nurses have a unique role in which we can identify practice issues and translate research into practice.

Financial Implications

This project also had significant financial implications. The cost of treating a single CLABSI can be more than $40,000. Even two incidents of CLABSI could be financially devastating to a small facility like KCCH. The secondary goal of this project was to reduce the costs associated with CLABSIs, which will be determined at the close of the next fiscal year. KCCH may now be able to track the cost of CLABSI in the organization through this quality improvement initiative but reducing or eliminating CLABSI would result in significant financial savings for the organization.

Population Implications

Patients in the long-term acute care setting are a unique population. They have long-term, complex medical needs that require specialized care. They are a vulnerable population

who are at high risk of developing complications due to compromised immune systems, prolonged hospitalizations, and presence of invasive devices, including central lines. There is a gap in the literature regarding the efficacy of central line bundles in the LTAC population as most of the research and quality improvement activities has been conducted in the ICU setting. This project shows that central line bundles can be successfully implemented in the LTAC population. Further evaluation is needed to determine how this project influences CLABSI rates, but it is expected they would decline as central line maintenance has improved.

Dissemination Plan

Following successful presentation of the completed project, a manuscript will be prepared and presented to a peer reviewed journal for consideration for publication. The final project and results will be submitted to the agency and a presentation will be offered by the author at the local and corporate level. The project and results will be presented to the University of Louisville via a poster presentation.

Discussion

This author identified the problem and needed change and used the Institute for Healthcare Improvement's Model for Quality Improvement as a framework for the practice change process (IHI, 2020). High rates of CLABSI and the lack of use of an evidence based central line bundle was noted. Critical appraisal and synthesis of the literature showed a lack of robust research regarding central line bundle use in the LTACH setting. The majority of research has been done in the short-stay acute care setting. The need to apply these interventions in the long-term acute care setting was identified as an essential quality improvement project.

The intended outcome of 20% compliance with central line bundle intervention documentation was reached. Physical assessment of presence of the interventions in real time was inhibited by the COVID-19 pandemic. However, there was inadequate time to assess

whether the ultimate goal of reduction of CLABSI to the identified rate or elimination of CLABSI was influenced by the central line bundle. Continued quality improvement and data collection are needed to refine the use of the central line bundle at KCCH and determine the effects on the reduction of CLABSI.

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Central Line Associated Bloodstream Infections Toolkit and Monograph. Central Line Associated Bloodstream Infections Toolkit and Monograph | The Joint Commission. http://www.jointcommission.org/CLABSIToolkit.

Appendix A

Implementation of a Central Line Bundle

Plan • Literature review for central line maintenance bundles and CLABSI reduction techniques. • Central line maintenance bundle developed to meet the needs of facility. • Policy will be developed with Director of Quality. • Staff will be educated using self-study module.	Act • Refine process for bundle compliance • Address barriers to compliance • Begin PDSA cycle 2
Do • Implement central line maintenance bundle • Audit charts of patients 65 years and over using audit tool to assess compliance with bundle for 6 weeks	Study • Compile compliance data from audit tool • Determine barriers to compliance • Obtain feedback from stakeholders

Appendix B

Letter of Permission

September 10, 2019

To whom it may concern:

ContinueCARE Hospital Paducah would be pleased to have Harold Anthony Flood RN work on a project for CLABSI prevention in our LTACH. We understand the timeline for the project implementation is January 2020.

We look forward to working with Mr. Flood and will assist him with any data regarding previous CLABSI rates and terms of treatment for our facility. If you have any questions please feel free to contact me or Mary Lou Young our CNO here at CCH Paducah @270-575-2597.

Sincerely,

Kandice Skabo MSN, ARNP, FNP-C

Director of Quality, Infection Control, Risk/Safety, and Compliance

ContinueCARE Hospital Paducah

270-415-6981

Kandice Skabo MSN, ARNP, FNP-C

Appendix C

UNIVERSITY OF LOUISVILLE

Human Subjects Protection Program Office
MedCenter One – Suite 200
501 E. Broadway
Louisville, KY 40202-1798

DATE:	January 08, 2020
TO:	Candace C Harrington, Ph.D.
FROM:	The University of Louisville Institutional Review Board
IRB NUMBER:	19.1261
STUDY TITLE:	Implementation of a Central Line Bundle as a Quality Improvement Priority in the Long Term Acute Care Setting
REFERENCE #:	698519
DATE OF REVIEW:	01/06/2020 (01/08/2020 HIPAA Analyst)
IRB STAFF CONTACT:	Sherry Block 852-2163 slbloc04@louisville.edu

The IRB Chair/Vice-Chair (or An IRB member) has reviewed your submission. The project described does not meet the "Common Rule" definition of human subjects' research. This project does not require IRB review.

This submission has been determined to be quality improvement, and not human subjects research, based on the goal(s) stated in the protocol.

Institutional policies and guidelines on participant privacy must be followed. If you are using protected health information, the HIPAA Privacy rules still apply.

Any changes to this project or the focus of the investigation must be submitted to the IRB to ensure that the IRB determination above still applies.

If you have any questions, please contact: Sherry Block 852-2163 slbloc04@louisville.edu

We value your feedback; let us know how we are doing: https://www.surveymonkey.com/r/CCLHXRP

Paula Radmacher, Ph.D., Vice Chair
Biomedical Institutional Review Board
PR/slb

Appendix D

Daily Central Line Maintenance Checklist

Patient Name/ID#: _____ **Unit:** _____ **Room/Bed:** _____

Date: _____

Person Completing Form: Name _____

Date of initial line placement: _____

Date implanted port accessed: _____

Date injection caps last changed: _____

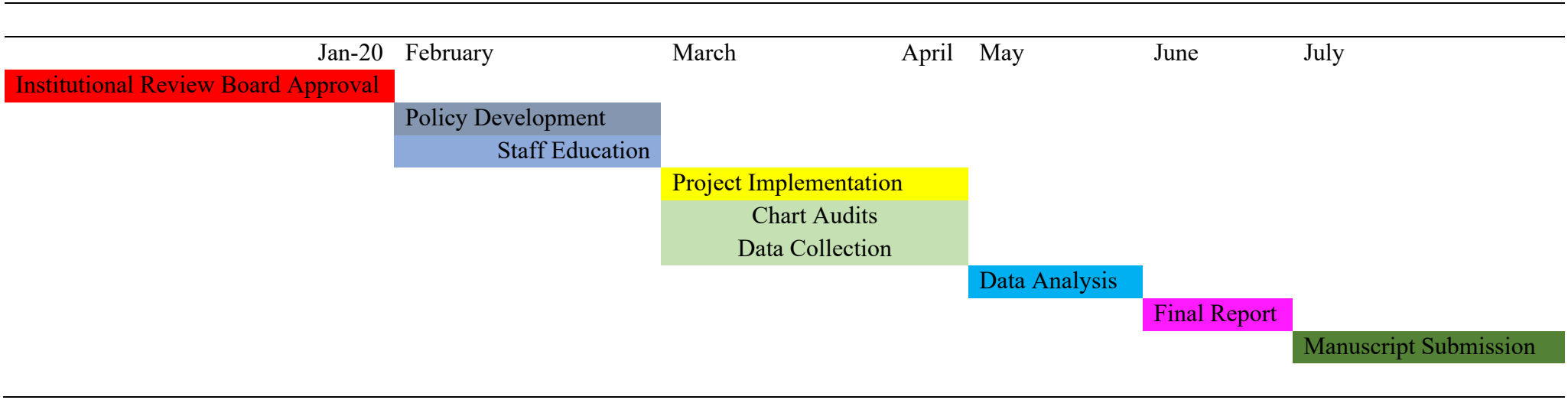
Date administration set and add-on devices last changed: _____

Set used for: Continuous Infusion ☐ Intermittent Infusion ☐

Date dressing last changed: _____ **Dressing type**: Gauze ☐ Clear ☐

Critical Steps	Yes	No	N/A	Notes/Comments
Necessity assessed If no longer necessary, remove, indicating details of removal in the records (including date, location, and signature and name of operator undertaking removal).				
Injection sites are covered by caps or valved connectors				
Caps changed today				
Implanted ports newly accessed today				
Accessed with (indicate type and size of needle)				
Insertion site without evidence of infection				
Dressing intact and labeled properly				
Dressing changed today				
Catheter stabilized/no tension on line				
Administration set replaced and labeled this time?				

Appendix E



Time Table