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# Evaluating the Use of Stopcocks for Lab Collections from Central Venous Access Devices Related to Central Line Associated Blood Stream Infections

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Evaluating the Use of Stopcocks for Lab Collections from Central Venous Access Devices

Related to Central Line Associated Blood Stream Infections

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By

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Abstract

PURPOSE: Central line associated blood stream infections pose a threat to patient safety and are costly to healthcare systems. Heath care professional frequently access central venous access device (CVAD) to obtain blood samples for laboratory analysis. A commonly accepted procedure practice involves exchanging 3-4 syringes during the collection process. Each time a syringe is exchanged during the lab collection process the opportunity for bacteria to be introduced into the bloodstream exists. Decreasing the number of times a CVAD is accessed removes opportunities for bacteria to be introduced to the line thus decreasing the risk of infection. Due to the occurrence of CLABSI on a pediatric hematology/oncology (hemonc) unit, a practice change employing the use of stopcocks to reduce the frequency of direct access to the CVAD was implemented in 2013. The purpose of this project was to evaluate the stopcock method practice used for lab collections from CVAD among children on a pediatric hemonc unit. The goal of this evaluation is to determine if the implementation of the stopcock reduced CLABSI rates.

METHODS: A retrospective pre/post implementation design was used to evaluate the use of the stopcock method for lab collection. The data analysis involved comparing infections rates prior to implementation of the stopcock method to infection rates collected after its implementation. This project design is quantitative in nature as infection rates were compiled for comparison and analysis.

RESULTS: Monthly unit CLABSI rates were reviewed for patients admitted over a 10-year span (2008-2018). The data showed an increase in overall CLABSI rates after the initiation of the

stopcock. The infection rates prior to the initiation of stopcocks ranges from 26.7-41 with an average of 31.4 for the 5 pre-years assessed versus 35.7-52.9 with an average of 43.2 for the 6 post-years assessed.

CONCLUSION: The 10-year data review revealed CLABSI rates increased on the hemonc unit after the introduction of the stopcock apparatus use for lab collection. However, this study uncovered a number of confounding variables such as the lack of a standardized practice protocol. These confounding variables limit the conclusiveness of the study findings. Further research is recommended in order to determine the best practice for lab collections from CVADs.

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Leslie Scott, PhD, APRN, CDE, MLDE—Committee Chair

Nicole Garritano, DNP, RN—Committee Member

Chris Donaghey, MSN, RN, PCNS-BC, CPN, CPHON - Committee Member/Clinical Mentor

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Dedication

      I would like to dedicate this manuscript to my parents and my sister for all of their love and support over the past 8 years of my education journey. My family has pushed me and cheered me on through the years and I am eternally grateful. I would also like to dedicate my DNP project to my fiancé, Christian Bowling. Without your support and endless encouragement through this process I would never have made it. I look forward to all of the homework-free weekends in our future.

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## Background and Problem Statement

Central-line associated blood stream infections (CLABSI) are associated with thousands of deaths and billions of dollars in added expenses annually (Center for Disease Control and Prevention, 2016). A central line associated blood stream infection is acquired when germs enter the bloodstream through the central line. These preventable infections are not only costly for the healthcare system but also incredibly dangerous for patients. A study by Wilson, Rafferty, Deeter, Comito, & Hollenbeak (2014, p 575) found, "among pediatric hematology/oncology patients, CLABSI is associated with an increased LOS of 13.3 days and increased costs of $37,385 concluding that eliminating CLABSIs reduced the total cost of admission in by 35%". There are factors that contribute an individual patient's susceptibility but essentially these infections happen due to operator error. Failure to maintain a sterile field or aseptic technique during placement or maintenance of a central line is classified as operator error (Shah, Bosch, Thompson, & Hellinger, 2013).

## Context of the Problem

CVAD are useful in the acute care setting and are often used for medication, administering parenteral fluids and nutrition, or collecting blood samples for laboratory analysis (Center for Disease Control and Prevention, 2010). Healthcare professionals access CVADs in order to obtain the sample for laboratory analysis. Collecting blood off of a central line provides a significant opportunity for contamination. Current practice guidelines that are preformed in most hospital settings involve multiple exchanges of the syringe that is attached to the central line. A commonly accepted procedure practice for accessing central lines includes the use of three to four of syringes during the lab collection process (Day, 2018). After every syringe

exchange the operator is instructed to disinfect the catheter hub (Day, 2018). Each time the syringe is exchanged and a new syringe is connected the opportunity for bacteria to be introduced is presented. The risk for infection is especially high if the hub is not properly disinfected between every syringe exchange. Decreasing the number of times a central line is accessed could result in a decrease in the risk of acquiring a CLABSI.

**Consequences of the Problem**

The significance of a central line infection is that it is a preventable condition that is costly for hospitals and potentially fatal for patients. Central line infections over the past 10 years have been estimated to occur about 250,000 times a year in the United States (Center for Disease Control and Prevention, 2016). The medical community has given this problem attention and has worked to develop practice changes and protocols in an attempt eradicate its occurrence. While this number has been on the decline there is still significant room for improvement of this costly problem. A study conducted on a pediatric hematology/oncology unit by Wilson, Rafferty, Deeter, Comito, & Hollenbeak (2014) found for this population "a central line associate blood stream infection increases health care costs by nearly $70,000 and increases the length of stay by nearly 3 weeks". Riley Hospital for Children had seen a steady decline in CLABSI rates, which started in 2008. In 2012 there was a major spike in CLABSI rates, which prompted practice changes including the stopcock method in 2013. Stopcock use for lab collections from CVAD could provide an additional method of CVAD care that attempts to decrease CLABSI rates.

**Evidenced-based Intervention**

The practice being evaluated includes the use of a set of stopcocks (Figure 1) for lab collections from CVADs. Implementation of a stopcock method for lab collections should follow a comprehensive approach model involving setting a goal, identifying alternatives, implanting

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programs, and monitoring results (Issel, 2018). The goal of this practice is to decrease the risk and occurrence of CLABSI through the use of a stopcock for all lab collections from central lines. There are numerous alternatives to this method for lab collections. However, other methods require the exchange of syringes resulting in multiple accesses per lab collection. Therefore, this practice is most appropriate in order to attempt to decrease the number of CLABSIs by decreasing number of times a line is accessed. There are also alternative explanations for a decrease in CLABSI rates such as sterilizing the catheter prior to access, the patient's immunity and uncontrollable condition, regular dressing changes, regular line changes, and other maintenance practices for the central line. Ideally, all central lines will be treated the same as the healthcare professionals handling them will follow the same protocols for care. The use of stopcocks for lab collections has been implemented in the hematology/oncology unit at Riley Hospital for Children along with central line bundling protocols. This unit has seen a fluctuation in CLABSI rates since the initiation of the stopcock method. The goal is to evaluate the stopcock method and current practices on the hematology/oncology unit. The data from prior to the initiation of the stopcock practice and after the initiation will be compared in a pre/post design. The expected outcome for use of stopcocks for collecting labs is that it will decrease the number of times a central line is accessed subsequently decreasing the risk of infection.

**Purpose of the Project**

The purpose of this project is to evaluate the use of a double stopcock apparatus for lab collections from central lines. The goal is to provide data about the relationship between CLABSI rates and the implementation of stopcocks for lab collections. This project aims to evaluate CLABSI rates in a pre/post design in order to assess the degree to which the employment of stopcocks for lab collections assists in CLABSI rate reduction. If the data shows

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that the use of stopcocks for lab collections and the CLABSI rates reduction are inversely related then the stopcock use will be initiated in other units of the hospital. However, if the data demonstrates an increase in CLABSI rates with the use of the stopcock lab collection method then the method will be further evaluated and potentially discontinued.

## Theoretical framework/process improvement model

The motivating theoretical framework used for this research is the adoption process, which is a conceptual framework (Botha & Atkins, 2005). The stopcock method is under evaluation to determine if it is a practice that should be continued and adopted by other areas of the hospital or rejected and discontinued by the hemonc unit. The pre/post design of this study will allude to the appropriate response for the adoption process. According to Botha & Atkins (2005) the adoption process involved the steps of ignorance, becoming aware, gaining interest, comparing alternatives, testing, and adopting or rejecting an intervention (Figure 2). The development of this study has followed this process and will conclude with the adoption or rejection of the stopcock intervention.

## Review of Literature

Evidence on the most appropriate way to collect blood for analysis from a central line the data is limited. However, data collectively suggests that CLABSIs are dangerous problem in healthcare that should be eliminated (Edwards et al., 2015). According to the Center for Disease Control and Prevention (CDC), "Central-line associated blood stream infections result in thousands of deaths each year and billions of dollars in added costs to the U.S. healthcare system" (Center for Disease Control and Prevention, 2016). The guidelines from the CDC state, "the goal of an effective prevention program should be the elimination of catheter related blood stream infections from all patient-care areas" (O'Grady et al., 2017).

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**Stopcock Use**

A stopcock is a device with valve that can be turned "on" and "off", which is used to control the flow through the line in which it is attached. Typically, stopcocks are used in one of two ways. The first, is adding a stopcock to an existing IV tubing line. This stopcock is generally used continuously for the life of the IV line. The second way in which a stopcock can be used is for an isolated, single use lab collection. In this context two stopcocks would be attached together to form a double stopcock, which provides four access ports for use. The use of a pair of stopcocks for a lab collection is a new practice with minimal data comparing it to traditional lab collection methods (Benedict, Mayer, & Craven, 2017). The Guidelines for The Prevention of Intravascular Catheter-Related Infections developed by the CDC state that stopcocks could be dangerous and should be capped when not being used (O'Grady et al., 2017). The guidelines do not specify the effectiveness of stopcocks being used solely for a lab collection and then discarded. However, the guidelines recommend minimizing the number of entries into the system and the single use of a set of stopcocks for lab collections would accomplish the CDC recommendations. Similarly, Edwards (2015) gives inconclusive recommendations regarding stopcock use and lab collections stating, "blood sampling from CVADs and arterial catheters may employ stopcocks".

**Infection Potential**

There is significant evidence against continuous stopcock use as an add-on device to an IV fluid line due to its increased risk for infection (Infusion Nurses Society, 2011). The continuous use of a stopcock for tasks such as infusions and medication administration has been shown to have the potential to facilitate bacteria entry into the blood stream (O'Grady et al., 2017). Oto, Imanaka, Konno, Nakataki, and Nishimura (2011) conducted a study that compared

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needleless access devices protected by sterilizing caps and also found increase risks with the use of stopcocks in this facet. The study by Loftus et al. (2008) went even further to conclude stopcocks contaminate patients stating, "multidrug-resistant bacterial organisms are transmitted during the practice of general anesthesia to the intravenous stopcock sets". Finally, a randomized clinical trial conducted by Casey et al. (2003) concluded that contamination rates were much lower related to use of a single needleless connector than use of a three-way stopcock.

In contrast, Esteve et al. (2007) conducted a randomized trial in an ICU setting and found no significant difference in the infection rates when a stopcock is used versus when a needleless valve connector was used. They concluded all hubs are potential sources of contamination and should be disinfected prior to use but that there was no significant difference between infections and bacteria colonization rates associated with the needleless connector and stopcock (Esteve et al., 2007). The findings from a clinical study conducted by Oto et al. (2007) also support that there is no increased risk of contamination from use of a stopcock versus a simple needleless hub when cleaned the same way prior to access.

**Potential Benefits of Stopcocks**

These studies all touch on the concern that use of stopcocks increase infection risks and recommend against a continuous use of a stopcock within an IV tubing set. However, they do not address the use of stopcocks as a closed system for isolated lab collections in which the set of stopcocks is discarded after the sample is collected. A study conducted by Secola, Lewis, Pike, Needleman and Doering (2012) explored the possibility of developing a checklist for lab collections from central lines. Within this checklist a closed stopcock apparatus was included for collecting the blood sample (Secola et al., 2012). However, the rational behind the use of the stopcock is not included in this study. Within the discussion they reported that using a stopcock

may have been helpful but there was no evidence presented to support the use of the stopcock method for lab collections (Secola, et al., 2012).

Current evidence is insufficient for drawing a conclusion on the use of the stopcock method to make lab collections off of central lines more sterile and less invasive. However, the data to support minimizing number of times a central line is directly accessed during lab collection is substantial. In the blood collection checklist developed by Secola et al. (2012) the use of the stopcock method rather than multiple flushes to clear a cap was recommended as an effort to minimize the number of direct accesses on a central line. Guidelines from the CDC written by O'Grady et al. (2017) instruct providers to "minimize the number of manipulations of and entries into a system". Further research is needed in order to conclude if the isolated use of a set of stopcocks for collecting labs would assist in decreasing CLABSI rates.

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**Agency Description**

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**Setting and Population**

The agency in which the stopcock method for lab collections was implemented is a large, mid-western Children's Hospital. Riley Hospital for Children at Indiana University Health is a 247-bed hospital comprised of 12 specialty units. Initially, the stopcock method for lab collections was implemented on the hematology/oncology unit (hemonc), which is a 26-bed unit. The hemonc unit is generally at full capacity with children admitted to acute care. The target population for lab collections using the stopcock method is pediatric patients with central venous lines in the hemonc area. Children in the target population typically range in ages from infants to 18 year olds. There is no recruitment necessary with this target population as this is a practice change that is already implemented on the entire unit. Anyone with a central line will receive the

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same standard care since the stopcock method is already in practice and is being reevaluated for efficacy.

**Congruence with Organizational Mission**

An organization wide goal is to provide the best care possible to all patients. A way to contribute to accomplishing this goal is to decrease central line blood stream infection (CLABSI) rates. The Indiana University Health mission is "to improve the health of our patients and community through innovation, and excellence in care, education, research and service" (IU Health, 2017). The goal of using the stopcock apparatus to collect blood labs is to decrease the risk of contamination of central lines being accessed. If this innovative change in protocol was successful in decreasing contamination through minimizing accesses then CLABSI rates should decrease as well. The idea of making lab collections safer thus reducing patient harm events aligns with the mission of Indiana University Health. However, should this method not contribute to decreased CLABSI rates and in fact is a threat to patient safety it would not be in congruence with the organizational mission and its practice should be discontinued.

**Description of Stakeholders**

Stakeholders within the organization are nursing staff, administrators, and patients. The goal for the stopcock method was to decrease CLABSI rates. Nursing staff is invested in this process change because it facilitates safer patient care and more time efficient lab collections. Hospital administration is invested in this process because decreasing central line infections helps to decrease unnecessary hospital costs and patient harm events, which negatively impact the hospital. The management implementing the process change plays a major role as stakeholders as it is important to have full managerial support during the implementation of a new practice change. The management also plays an integral role in the success of the practice

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change through tasks such as ordering appropriate supplies and ensuring adequate staff training. Most importantly, the patients are the primary stakeholders for this process. Decreasing the risk of infection from central lines helps to increase patient safety and provide more effective care. Finally, there are stakeholders outside of the IU health organization. People such as outside educators, physicians, patient caregivers, researchers, and other patients could be stakeholders for this process. Success of this practice change would provide evidence to support the same practice change in other units or institutions.

**Site-specific Facilitators and Barriers**

The most obvious barrier to the implementation of the stopcock is the current lack of research and data to support this method. The stopcock method does not have substantial supportive evidence in the literature. Another barrier prior to implementation of this practice change was the fact that this method was new, requiring education for the healthcare providers. Anytime a practice change is implemented staff "buy in" or support is a barrier that has to be considered. Nursing staff is the most critical group to consider for promoting "buy in" for any practice change implementation. Ensuring that the nursing staff supports a practice change is imperative to its success. There are also a few facilitators to this protocol implementation. The first is any stakeholder that is positive and supportive of the practice change. Another important facilitator for this practice change could be a nurse champion from St Louis Children's Hospital as it is already successfully implemented on the hemonc unit at this facility with positive impacts on reduction of CLABSI rates.

**Project Designs and Methods**

**Description of Intervention**

Limited data supporting the stopcock method for lab collection exists in literature. The lack of evidence, recognition of the potential benefits of the employment of stopcocks for lab collection, and continued problematic CLABSI rates initiated the completion of a retrospective data review spanning over a ten-year period. This data review began with meeting the clinical nurse specialist specific to the hemonc unit. At this meeting a plan was developed to compile and review data for the pre/post intervention time frame in order to evaluated the impact of the intervention. The data used for evaluation was obtained from the infection prevention team at the facility. This team is responsible for tracking monthly infection rates. The support of the facility was obtained through the Chief Nursing Officer by presenting the goal and potential benefits of this data review. Finally, an IRB application for exemption was developed and submitted.

The clinical components of the use of stopcocks for lab collections from central lines involved the assembly of two stopcocks, 2 20mL normal saline flushes, and 1 10mL empty syringe. The use of two stopcocks provides four open ports. The first port is attached to the patient, the second is used for an initial flush of the line and to collection back waste, the third port is used to collect the lab sample, and the forth port is used for the final flush. The apparatus is assembled together to allow the healthcare provider to clean and access the central line one time for all steps of a lab collection. The entire lab collection process can be preformed after thorough sterilization of hub through this one connection as described in appendix A.

**IRB Approval**

Approval for the evaluation project was obtained from The University of Kentucky Office of Research Integrity. Riley Hospital for Children did not require prior approval, as this is

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a process that is already in practice in the hospital. Data collected was preexisting and did not contain any patient specific information or identifiers. The project was a unit based practice-improvement evaluation. A letter of support was obtained from Riley Hospital for Children's Chief Nursing Officer, Elizabeth Linden.

**Sample**

The sample included 12 months of data for 10 years of infection rates. This data was collapsed into yearly rates due to months with a 0 infection rates and for the sake of analysis. Yearly comparison makes the data standardized & conducive to pre/post comparison. The CLABSI rates were recorded monthly by the infection prevention team for the facility. The sample for this study was taken from the data recorded for the hemonc unit. The infection rates were recorded for the unit and no patient identifiers were included in this record. The typical population for this unit is aged 18-years-old an under. The hemonc unit is comprised of two wings. Patients are admitted to a wing within the unit based on diagnosis and infection risk. There was no exclusion of data collected, as all monthly reports for the hemonc unit were included for data analysis. The data that comprised the pre-intervention group came from a CLABSI rates from 2008-2012. Data comprising the post-intervention group came from CLABSI rates from 2013-2018. Collecting the data was done via a spreadsheet with permission from the Chief Nursing Officer and assistance of the hematology/oncology clinical nurse specialist at Riley Hospital for Children

**Data Analysis and Measures**

The practice change evaluation for the use of the stopcock method is a retrospective pre/post intervention design. This data review is to evaluate the effectiveness of the current practice related to lab collection via central lines. The data analysis involved comparing

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infections rates prior to implementation of the stopcock method to infection rates collected after its implementation. The timeline of the implementation of the stopcock method was also analyzed to provide context for the CLABSI rate changes after practice change implementation.

Frequency of CLABSI rates were analyzed in a table of infection rates for the years classified as pre-implementation and compared to the years classified as post-implementation (Table 1). In order to make this comparison more clear graphs were developed using this data (Table 2/3). Consistency in comparison is important to decrease limitations and control confounders. Therefore, data from the same unit with the same patient population before and after the intervention was compared. The CLABSI rates are in a comparable form through a standard method for calculating the rates. In order to get the rate the total number of infections was divided by the total number of lines and multiplied by 1000. This calculation provides CLABSI rates per 1000 line days, which allows the rates to be compared and analyzed. The patient population included any pediatric patient admitted to the hemonc unit who had a central line device Patients admitted to these units are typically between infancy and 18 years old. This unit is typically at capacity and has a high number of patients with central lines.

 **Implementation**

The education of staff prior to this practice change reportedly took place in 2013. The specifics of the staff education process are unknown. This study is a retrospective data review in order to evaluate the effectiveness of the current practice. The current practice was implemented prior to this data review. Data collection began with meetings between the hemonc manager, hemonc clinical nurse specialist, and primary investigator. The primary investigator and clinical nurse specialist began compiling monthly CLABSI rates from recorded data on an excel spreadsheet. The monthly data rates were collapsed into yearly rates and graphs were made to

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clearly depict the pre/post results. Preforming a pre/post statistical test was not reasonable due to other findings uncovered during this data review. The final report is based on the analysis of data comparing infection rates from before and after the initial practice implementation. This data analysis provides a pre/post comparison of the use of stopcocks for lab collections to determine if they successfully helped reduce central line infection rates over the past several years.

## Timeline, Resources, and Feasibility

### Timeline

The timeline for this project started with meetings with the hemonc clinical nurse specialist is Junary 2019. The primary data collection and evaluation occured from May 2019 through October 2019. The project application was submitted to the Office of Research Integrity at The University of Kentucky by the end of May 2019 and approved in September 2019. The clinical nurse specialist for the hemonc unit at Riley Hospital for Children assisted in data collection. The data for infection rates was collected for the pre (2008-2012) and post (2013-2018) data. During the month of October the information was complied and studied for frequency of CLABSI occurrences and comparisons. The preliminary findings were shared in October with the clinical nurse specialist and manager for the hemonc unit.

### Sustainability

The sustainability of this process is dependent on the findings of the data comparison. The goal of the stopcock method use for lab collections from central lines is to decrease CLABSI rates. If the infection rates actually increase over time then this method of lab collections should be evaluated and possibly discontinued. If current infection rates continue, the practice method should revised and reevaluated in order to draw an evidence-based conclusion. If the infection

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rates decline, the practice change should continue on this unit, be trialed and implemented through other areas of the hospital, and possibly through the entire hospital system.

## Results

The data collected revealed varying rates of central line associated blood stream infections for both pre and post intervention results (Table 2). The stopcock method was implemented in 2013 during which time the overall CLABSI rates show a slight drop in recorded infections for the hematology/oncology unit as a whole (Table 3). Since the implementation of the stopcock method the unit totals have fluctuated staying within a range of 35.7 to 52.9 (Table 3). The CLABSI rates were tracked in further detail based on the area of the unit, which differentiates the typical patient population in each area. The area of the unit called 5EA is often specific to the transplant population and 5W is the rest of the hematology/oncology population. The overall CLABSI rates are tracked for each area along with the CLABSI rates that do not include a specific line infection classified as a mucosal barrier injury–associated, laboratory-confirmed bloodstream infection (MBI-LCBI) (Torres et al., 2016). The oncology population typically has a higher rate of infections classified as MBI-LCBI (Torres et al., 2016). These infections are not reported out as CLABSI by Riley Hospital for Children but are important to account for. The total infection rates separated by the two patient population units are shown in Table 2 as bar graphs while the CLABSI rates excluding MBI-LCBI rates are plotted as a line. The data does not clearly depict the impact of the stopcock method. After implementation the rates continue to fluctuate and there is no clear trend down in infection rates. The infection rates prior to the initiation of stopcocks ranges from 26.7-41 with an average of 31.4 for the 5 pre-years assessed. The infection rates after the initiation of the stopcock range from 35.7-52.9 with an average of 43.2 for the 6 post-years assessed. The rates are all reported per 1000 line days.

Based on the data the average infection rate before the initiation of the stopcock method was lower than the average infection rate after the stopcock method practice began. Due to confounding variables during the initial implementation of the stopcock method preforming a statistical pre/post analysis test does not provide reliable results.

## Discussion

The data reveals slight differences in the infection rates between the two divisions of the unit but these findings are not conclusive. This difference is likely partially attributed to the difference in the two primary patient populations that the hematology/oncology service cares for. The 5EA side of the unit is often specific to the transplant population. This patient population is typically at a higher risk than 5W due to their length of stay and how prolonged their immune systems are suppressed. However, the 5EA side also has a relatively consistent renal population. The renal patients only intermittently contribute to the line data, which contributes to the slightly lower rate than the 5W side of the unit. The 5W side of the unit consists of the rest of hematology/oncology population. This side of the unit accommodates patients receiving chemotherapy, being admitted for fever management, and the hematology population. The hematology population on the 5W side would typically include patients such as those in sickle cell crisis or with hemophilia. Based on this patient population the 5W side of the hematology/oncology unit generally has more patients with central lines that are frequently accessed for lab collections and/or therapies. This more frequent line use could be a factor in the higher rate of infections for this side of the unit.

The overall trend of the data does not allow for a clear conclusion to be drawn about the relationship between the use of the stopcock method for lab collections and infection rates. Based on this data it appears as though the stopcock method does not decrease infection rates.

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The average infection rate of the post intervention data is higher than the average infection rate for the pre intervention data. Therefor, at this time, it cannot be said that the stopcock method for lab collections helps decrease CLABSI rates.

As a result of the findings of this study a standardized protocol is in the process of development as a result of this data review and will be implemented in order to ensure proper practice of the stopcock method in the future. The re-education for the hemonc unit with the new protocol will take place for a month, ensuring adequate opportunity for training on all shifts. The first task will be educating the staff members who will serve as change champions. The lead investigator, the manager of the hemonc unit, and the clinical nurse specialist of the hemonc unit will be responsible for providing education to the change champions. These nurses will be provided education by the line team and will check off prior to beginning education sessions on the unit. After the change champions have demonstrated competency, the protocol will be distributed around the unit for review. The unit will be informed as to who the change champions are and will be directed to approach them or leadership with questions. It is imperative that the change champions promote positivity and demonstrate confidence in their skills when implementing the protocol, as change champions can be imperative to the success of a practice change in the hospital setting (Shaw et al., 2013). Following the distribution of the new protocol staff will be provided education through hands-on practice facilitated by the change champions or unit leadership as the facilitator. Finally, all staff will be required to complete a check-off. These check-offs will be initiated by the registered nurse working in the unit during a shift and may be in the presence of one of the change champions or a member of management. The check off will require the nurse to be responsible for completing the task of collecting a lab from a central line on a manikin without breaking sterile technique. Every nurse will also be observed

by a change champion, lead investigator, the manager of the hemonc unit, or the clinical nurse specialist of the hemonc unit when completing the task for the first time with a patient.

The new standardized protocol will be implemented after adequate training and education. The protocol will be finalized after decisions are made on the appropriate requirements for sterility of the stopcock lab collection process. There will be a deadline for completing the education and check off. The hemonc management will issue corrective actions for any nurse that does not meet the deadline as proper education is imperative to the success of the current practice and to the safety of the patients.

## Limitations

There are several limitations to this study. The data shows a spike in infections in 2012. This spike led to multiple changes in order to decrease infection rates. Initiating multiple changes simultaneously makes it impossible to distinguish the cause and effect of outcomes. The fact that the stock method was not trialed in an isolated fashion is the first limitation as there is no way to truly know the impact it had on infection rates. The other limitations to be acknowledged include but are not limited to discontinuation of biopatch device, introduction of chlorhexidine-gluconate cleanse, changes in needleless cap care protocols, discrepancies in the most appropriate approach for stopcock apparatus assembly, and lack of a true practice protocol for the stopcock lab collection.

### Biopatch

The hospital discontinued use of a device called a biopatch at the end of 2013. A study by Safdar et al. (2014) describes a biopatch as "a round chlorhexidine-impregnated sponge dressing which is placed circumferentially around the insertion site". This study concluded that chlorhexidine-impregnated dressings help to prevent infections (Safdar et al., 2014).

However, the used of these patches were discontinued around the same time that the stopcock method was initiated. The justification for the discontinuation of the biopatch use is unclear.

**Chlorhexidine-gluconate Cleanse**

Chlorhexidine-gluconate (CHG) is an antimicrobial agent used on the skin to reduce bacteria that can lead to infection (Food and Drug Administration, 2017). Riley Hospital for Children initiated daily CHG cleansing for patients with central lines at the end of 2012. There are conflicting reports regarding CHG cleansing and the impact it has on CLABSI rates. A study by Popovich, Hota, Hayes, Weinstein, & Hayden (2010) concluded that CHG had no impact on CLABSI rates while a study by Montecalvo et al. (2012) found significant reductions in CLABSI rates with CHG bathing. The initiation of CHG cleansing happened around the same time as the stopcock method. The simultaneous initiation of different interventions to combat CLABSI rates limits the ability to determine causal relationships between variables.

**Needleless Cap Maintenance**

At the end of 2012 Riley Hospital for Children also changed the protocols for needleless access device maintenance. Needleless access device sit at the end of the line allowing connections to the line to be made between two luer lock ends. The hospital changed the policy regarding changing these devices. The new protocol required needleless access devices to be changed every 96 hours and did not require removal prior to blood cultures. This is another example of multiple changes being initiated at the same time making it difficult to determine the impact the stopcock lab collection method had on CLABSI rates.

**Stopcock Apparatus Assembly**

The clinical nurse specialist is evaluating the set up of the stopcock apparatus to determine best practice for this task. The question is in regards to the sterility required while

setting up this system. Currently, the practice is to set up the apparatus using aseptic technique. However, initially the stopcock apparatus is an open system until it is assembled. As an open system the set up should require sterile technique. There is limited research regarding stopcock use for lab collections and the most appropriate way to execute this practice. However, research shows that anytime a central line is classified as "open" or requires intervention that increases susceptibility to infection sterile technique should be implemented (Ling et al., 2016). This serves as another significant limitation as the stopcock apparatus has always been set up using aseptic technique.

**Practice Protocol**

The final limitation to be addressed is the lack of a protocol associated with this practice. The stopcock lab collection method on the hematology/oncology unit was in practice prior to employment of any of the current leadership. This practice was initiated in 2013 with an unknown education and without any true protocol in place. Since its initiation a "critical elements" guide has been in use but no protocol has been developed.  The lack of a true protocol to follow makes it impossible to know if the execution by staff was appropriate.

<div align="center">

**Future Implications**

</div>

There are several implications elicited from this research. The evaluation of the use of the stopcock method for lab collections uncovered several process improvement needs. Most importantly, the research uncovered the need for a true standardized protocol for lab collections using this method, which is currently in the process of being created (appendix A). Furthermore, the need for reeducation of the staff executing this practice procedure will be required once the practice protocol is established. This protocol will be initiated after the question of sterility is resolved. This protocol should be initiated after reeducation for the staff and competency check-

offs to ensure best practice is followed. After the unit has initiated a true protocol this research should be repeated. This research is inconclusive due to the fact that there were multiple limitations and cofounding variables involved. Ideally, the research should be repeated when it is an isolated intervention being evaluated. The pre and post infection rates should be tracked over a period of time in order to compare rates and evaluate the effectiveness of the use of stopcocks for lab collections.

## Summary/Conclusion

Central line associated blood stream infections are dangerous consequences of medical treatments that can be prevented. These infections are not only costly in a monetary aspect but are also life threatening (Center for Disease Control and Prevention, 2016). The stopcock method has the potential to decrease risk of infections through the use of an apparatus that prevents multiple accesses to a patient's central line. The decrease in number of times a line is accessed inadvertently decreases the risk of introducing infection. This research study cannot definitively draw conclusions on the relationship between the stopcock method and CLABSI rates due to the multiple limitations and confounding variables impacting the findings. The use of stopcocks for lab collections should be evaluated further in order to determine best practice recommendations for collecting labs from central lines.

References

Botha, N., & Atkins, K. (2005). An assessment of five different theoretical frameworks to ...

Retrieved from https://pdfs.semanticscholar.org/c85a/325bc004cb4ba9c2fa

7f59ae7139aec92397.pdf.

Center for Disease Control and Prevention. (2016, March 01). Healthcare-associated

Infections. Retrieved from https://www.cdc.gov/hai/bsi/bsi.html

Centers for Disease Control and Prevention. (2010, April 01). Healthcare-associated

Infections CVCs. Retrieved from https://www.cdc.gov/hai/bsi/catheter_faqs.html

Day, J. A. (2018, April 19). Johns Hopkins CLABSI Toolkit. Retrieved from

https://www.hopkinsmedicine.org/armstrong_institute/improvement_projects/infe

ctions_complications/stop_bsi/clabsi_toolkit.html

Food and Drug Administration. (2017). FDA warns about reactions with antiseptic chlorhexidine

gluconate. Retrieved from https://www.fda.gov/drugs/drug-safety-and-availability/fda-

drug-safety-communication-fda-warns-about-rare-serious-allergic-reactions-skin-

antiseptic.

IU Health. (2017). About Our System. Retrieved from https://iuhealth.org/about-our-system

Issel, L.M., & Wells, R. (2018). *Health Program Planning and Evaluation: A Practical,*

*Systematic Approach for Community Health (4<sup>th</sup> Ed.)*. Sudbury, MA: Jones and

Bartlett. ISBN 978-1-2841-1211-5

Ling, M. L., Apisarnthanarak, A., Jaggi, N., Harrington, G., Morikane, K., Thu, L. T. A., Ching,

P., Villanueva, V., Zong, Z., Jeong, J. S., & Lee, C.-M. (2016, May 4). APSIC guide for

prevention of Central Line Associated Bloodstream Infections (CLABSI). Retrieved from

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4857414/.

Montecalvo, M. A., McKenna, D., Yarrish, R., Mack, L., Maguire, G., Haas, J., DeLorenzo, L., Dellarocco, N., Savatteri, B., Rosenthal, A., Watson, A., Spicehandler, D., Shi, Q., Visintainer, P., & Wormser, G. P. (2012, May). Chlorhexidine bathing to reduce central venous catheter-associated bloodstream infection: impact and sustainability. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22482848.

Popovich, K. J., Hota, B., Hayes, R., Weinstein, R. A., & Hayden, M. K. (2010, May). Daily skin cleansing with chlorhexidine did not reduce the rate of central-line associated bloodstream infection in a surgical intensive care unit. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20213074.

Riley Hospital for Children. (2016). Numer of Patients Suffered Preventable Harm [Digital image].

Shah, H., Bosch, W., Thompson, K. M., & Hellinger, W. C. (2013). Intravascular Catheter-Related Bloodstream Infection. *The Neurohospitalist, 3*(3), 144-151. doi:10.1177/1941874413476043

Torres, D., González, M. L., Loera, A., Aguilera, M., Relyea, G., Aristizabal, P., & Caniza, M. A. (2016). The Centers for Disease Control and Prevention definition of mucosal barrier injury-associated bloodstream infection improves accurate detection of preventable bacteremia rates at a pediatric cancer center in a low- to middle-income country. *American Journal of Infection Control*, *44*(4), 432–437. doi: 10.1016/j.ajic.2015.11.007

Safdar, N., O'Horo, J. C., Ghufran, A., Bearden, A., Didier, M. E., Chateau, D., & Maki, D. G. (2014). Chlorhexidine-Impregnated Dressing for Prevention of Catheter-Related Bloodstream Infection. *Critical Care Medicine*, *42*(7), 1703–1713. doi: 10.1097/ccm.0000000000000319

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Shaw, E. J., Howard, J., West, D., Crabtree, B., Nease, D., Tutt, B., & Nutting, P. (2013).

    The Role of the Champion in Primary Care Change Efforts. Retrieved from

    https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3535479/

Wilson, Rafferty, Deeter, Comito, & Hollenbeak. (2014). Attributable costs of central    line–

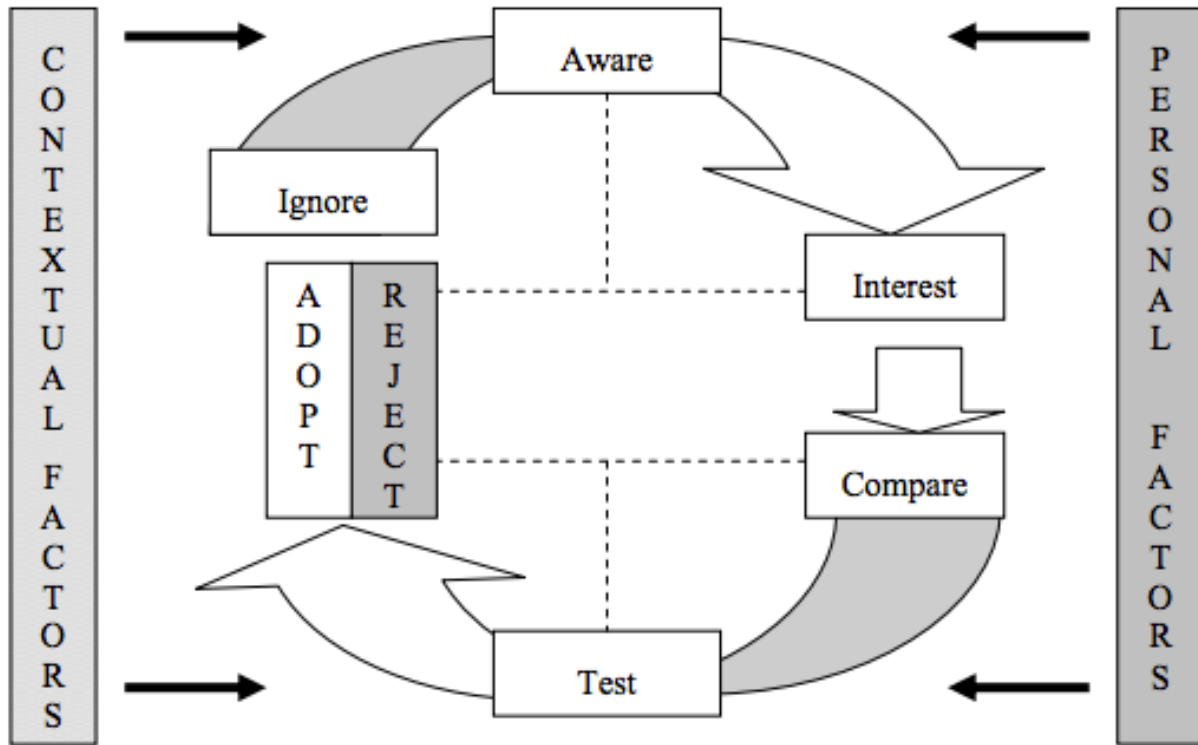    associated bloodstream infections in a pediatric hematology/oncology

    population. *AJIC: American Journal of Infection Control, 42*(11), 1157-1160.

Figure 1: Stopcock Apparatus

Figure 2: The Adoption Process

(A Conceptual Framework)



(Botha, N., & Atkins, K., 2005)

# Stopcock Method Intervention
### Practice Protocol Example

1. Gather supplies
2. Hand hygiene
3. Apply sterile gloves
4. Assemble supplies on sterile field (sterile drape cloth)
   a. Connect two sterile stop cocks
   b. Connect 1 sterile saline flush to top right port of stop cocks and prime stop cocks (syringe 1)
   c. Connect 1 sterile empty syringe to bottom right port of stop cocks (syringe 2)
   d. Connect 2nd sterile saline flush to the bottom port of stop cocks (syringe 3)
5. Using sterile gauze with one hand pick up line with sterile gauze in order to maintain a sterile hand
6. Scrub the line with alcohol or CHG (whichever is indicated) with the other hand for a minimum of 15 second
7. Connect the sterile stopcock lab draw device
8. Turn stop cocks on to syringe 1
9. Flush line with the syringe 1 and draw back waste into syringe 1
10. Turn stop cocks on to syringe 2
11. Draw sample into syringe 2
12. Turn stop cocks on to syringe 3
13. Flush the line with saline
    a. If heparin lock is indicated - turn stopcock off, scrub this connection site for 15 seconds, attach heparin flush, turn stopcock on, heparin flush the line
    b. If heparin lock is not indicated and fluids are running - turn stopcock off, scrub this connection site for at least 15 seconds, attach a line connected to IV fluids, and start the infusion
14. Disconnect stopcock lab draw method device
15. Transfer sample into correct lab draw vials
16. Send labs

Table 1: Overall CLABSI Rates per 1000 Line Days

| Year | Pre-stopcock Infection Rates |
|------|------------------------------|
| 2008 | 31.4 |
| 2009 | 29.9 |
| 2010 | 28 |
| 2011 | 26.7 |
| 2012 | 41 |

| Year | Post-stopcock Infection Rates |
|------|-------------------------------|
| 2013 | 39.5 |
| 2014 | 42.9 |
| 2015 | 41.5 |
| 2016 | 52.9 |
| 2017 | 46.5 |
| 2018 | 35.7 |

Table 2: Unit Total CLABSI Rates



**Unit Total CLABSI Rates**

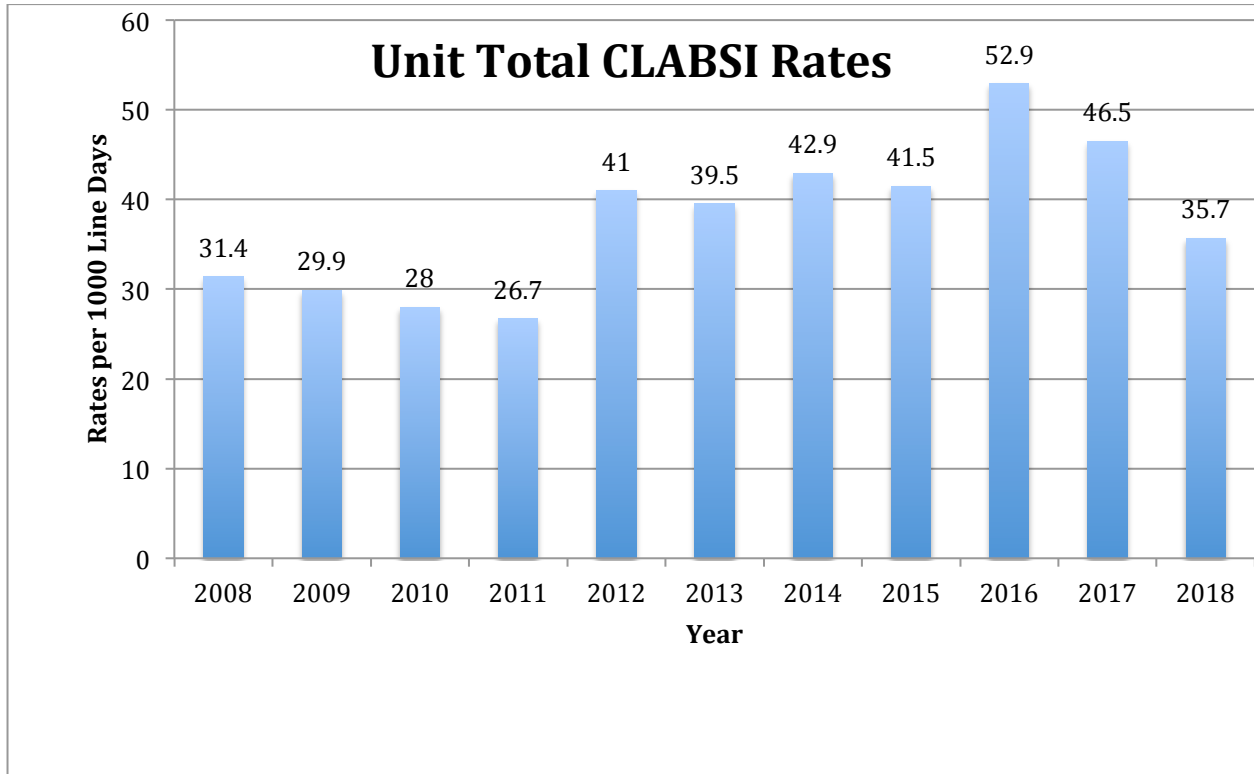| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|------|------|------|------|------|------|------|------|------|------|------|------|
| Rates per 1000 Line Days | 31.4 | 29.9 | 28 | 26.7 | 41 | 39.5 | 42.9 | 41.5 | 52.9 | 46.5 | 35.7 |

Table 3: Hematology/Oncology CLABSI Rates by Area



**Hematology/Oncology CLABSI rates by area**

Total infection rates per 1000 line days

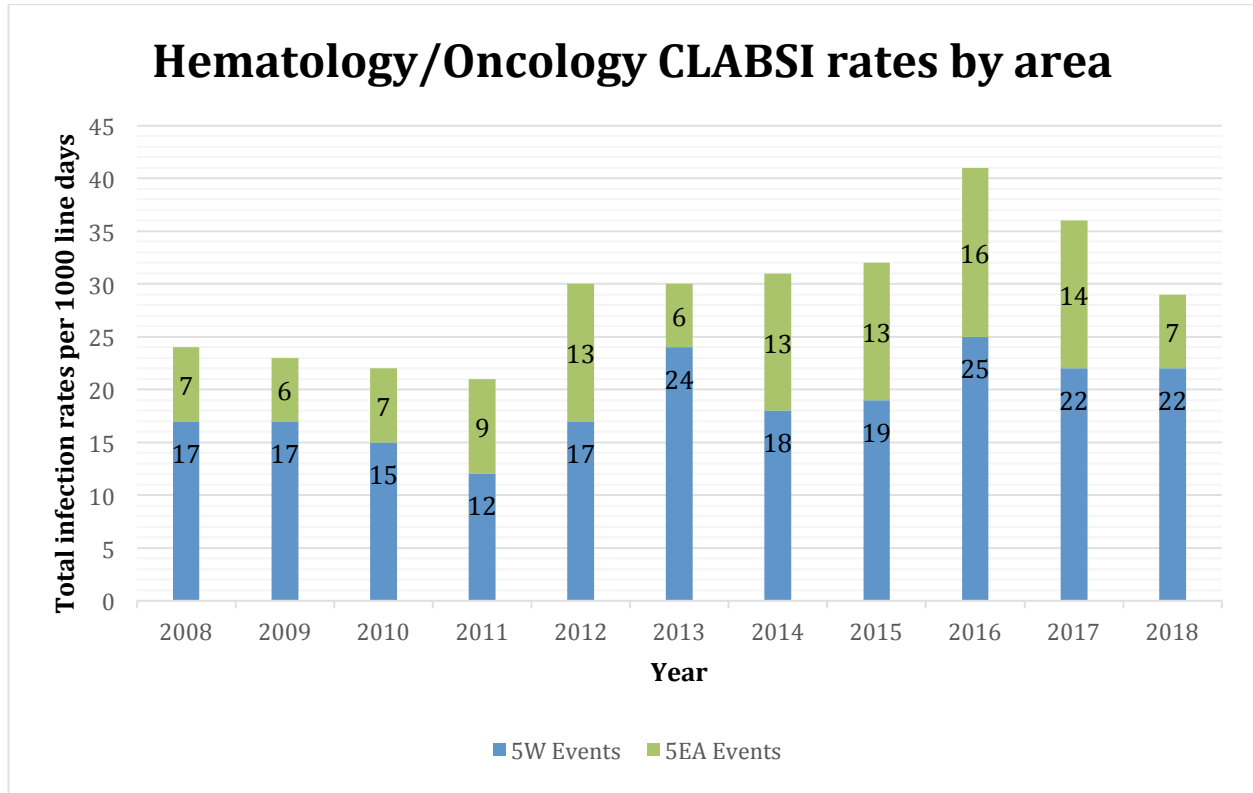| Year | 5W Events | 5EA Events |
|------|-----------|------------|
| 2008 | 17 | 7 |
| 2009 | 17 | 6 |
| 2010 | 15 | 7 |
| 2011 | 12 | 9 |
| 2012 | 17 | 13 |
| 2013 | 24 | 6 |
| 2014 | 18 | 13 |
| 2015 | 19 | 13 |
| 2016 | 25 | 16 |
| 2017 | 22 | 14 |
| 2018 | 22 | 7 |

■ 5W Events  ■ 5EA Events

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Table 4: Hematology/Oncology CLABSI Rates by Area



**Hematology/Oncology CLABSI rates by area**

Legend: 5W Events, 5EA Events, 5W, 5EA