Standardized Care of Midline and Central Vascular Access Devices in Home Infusion

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Abstract

Problem & Purpose: Vascular Access Devices (VADs) are potential sources for healthcare-acquired infections resulting in increased morbidity and mortality. Vascular access devices refer to any device utilized for venous access, regardless of location. When this project was proposed, the project site, a home infusion company, did not have written policies for the care of midline and central VADs for home infusion patients. The administrators at the agency identified VAD infections as a problem for patients receiving home infusions. The baseline VAD-related infection rate for midline and central venous catheters was 2 per 100 in one month (2%), and the rate for occlusions was 10 per 100 (10%). A preliminary audit found that none of the agency nurses completed all the steps outlined in the Infusion Nurses Society (INS) guidelines for midline and central line dressing changes. The purpose of this project was to implement a standardized protocol for the care of midline and central venous access devices in home infusion patients based on INS recommendations and to evaluate occlusions, line-related infections, and nurse adherence to INS guidelines following education regarding the new protocol.

Methods: Initially, a protocol was developed based off INS guidelines with the help of a project team at the project site. Eight full-time infusion nurses were trained to use the standardized INS protocol in caring for home infusion patients. Numbers of occlusions and line-related infections were reported in aggregate by the agency after implementing the protocol. Weekly tracking of the project was conducted with observations and review of documentation to determine adherence to the protocol.

Results: Nurses adherence to the protocol increased dramatically from 0% to 100%. The number of line-related bloodstream infections decreased from 2 to zero from the beginning to the end of the project. Rates of occlusions were not affected by the new protocol.

Conclusions: An evidence based VAD protocol is a feasible practice change to initiate in the home care setting to reduce or prevent infection rates. Mandatory requirement by the state for this competency at the time of hire is expected to sustain the practice change.

Introduction

The purpose of vascular access devices (VADs) is to facilitate medication and fluid administration and help patients recover with minimal vascular system damage (DeVries, 2019). Multiple studies indicate that infections related to VADs are a major healthcare challenge linked with high mortality and morbidity and additional healthcare costs (Lutwick et al., 2019; Patel et al., 2019; Zhang et al., 2013). In 2017, the number of central line-associated bloodstream infections (CLABSI) reported by 3,576 acute care hospitals in the US was 24,256 (Centers for Disease Control and Prevention, 2019). CLABSI is linked with a mean per case cost of $46,000 Haddadin et al., 2019). According to the INS best care practices, care and maintenance of the VAD is crucial to reducing infection risk. This includes routine dressing changes, assessment of catheter skin area, proper skin antisepsis (INS, 2016).

Interviews of stakeholders and informal observations regarding the current practice of performing midline and central vascular access care were conducted with employees of the project site during nurses' weekly huddles, home visits, and biannual competency days. During the interviews, the stakeholders identified and observed the lack of standardized protocol for the care of central line and midline catheters. This was a source of concern for the stakeholder because variation in the care of midline and central line catheters has been found to greatly influence central vascular access device infections (Kramer, 2019).

The purpose of this project was to implement a standardized protocol for the care of midline and central venous access devices in home infusion patients based on INS recommendations and to evaluate occlusions, line-related infections, and nurse adherence to INS guidelines following education regarding the new protocol.

Literature Review

Prevention of CRBSI has been well addressed in the literature. Yaseen et al. (2016) recommend simple, evidence-based approaches such as using chlorhexidine rather than iodine during skin preparation and providing hand hygiene certification to the healthcare staff. Bell and O'Grady (2017) explain that although evidence-based strategies such as appropriate hand hygiene and provider training reduce infections linked with central venous catheters, the guidelines should be combined with emerging technologies. According to Yaseen et al. (2016), the Institute for Healthcare Improvement (IHI) central line bundle is a group of evidence-based interventions combined into a protocol to help reduce the rate of CLABSI in high-risk patients and improve other outcomes (Institute for Healthcare Improvement, 2012). Recommended interventions range from simple handwashing to current infection control technology.

Pathak et al. (2018) recommend using midline instead of central line catheters to reduce CLABSIs. However, they note that, regardless of catheter line used, costs and hospital stays can be reduced when hospital care providers are well-trained and adhere to appropriate catheter care protocols. Similarly, Guenezan et al. (2018) point out that the use of catheter care protocols, training of healthcare providers, and implementing evidence-based central line bundle protocols reduce the incidence of CLABSI by 50 percent. Lo Vecchio et al. (2016) recommend the involvement of the patient and family members and a re-training program for providers to reduce the rate of CLABSI among oncology patients. Most importantly, Lutwick et al. (2019) demonstrated that most CLABSI events are caused by catheter maintenance breaches. Hence, they recommend healthcare provider training on catheter management of central lines followed by measurement of bundle protocol compliance rates. Measures used for evaluation should be

objective, easy to document, and allow tracking infection rates using run-charts (Lutwick, et al., 2019).

Given the evidence regarding CLABSI risk factors and prevention measures, this project protocol was based on the IHI (2012) central line care bundle. The key components being hand hygiene, maximal barrier precautions upon insertion, optimal catheter site selection and chlorhexidine skin antisepsis. Multiple studies have found that when these cares are properly and sufficiently provided, infection rates are reduced (Chopra et al, 2013). Therefore, it was expected that home infusion nurses be certified in handwashing upon hire and during annual competencies. Relevant evidence supporting this project is listed in the Evidence Review in the Appendices.

Theoretical Framework

Lewin's (1947) three-stage model of change is appropriate for this project implementation. This theory has three stages for replacing a previously learned knowledge or behavior through unfreeze, change, and refreeze stages (Lewin, 1936). This project involved a previously learned knowledge and behavior (i.e., the various techniques currently used by the nursing staff at the infusion company for VAD care). According to Lewin (1936), behavior replacement and adoption involve balancing forces working in opposite directions. Therefore, to reinforce the desired behavior, auditing and observation, feedback, and other performance indicators were intended to identify positive outcomes and progress toward the change. See Figure 1: Lewin Change Model (Mitchell, 2013).

In the first or unfreezing stage, the evidence-based practices were identified as hand hygiene, empowerment of healthcare providers, standardization of maintenance protocols, and the use of emerging efficacious technologies. These practices were verified with the stakeholders

as being important to the implementation of the protocol. In the second or change stage, the standard process and protocol was implemented. The implementation included developing the protocol for the care of midline and central venous catheters as well as implementing training sessions so that all full-time nurses were made aware of this change in protocol. The last freezing stage involved practicing the intervention through supporting the change champions while evaluating the data through continued observations of the nurses weekly including gathering data about infections, occlusions, adherence as well as providing data feedback.

Methods

This project's target population included the 8 full-time registered nurses (RNs) who delivered home infusion therapies at the project site, a home health care agency in the mid-Atlantic region. The eight nurses remained in their roles throughout the three months of the project. As part of their roles, they provided care to home infusion patients with vascular access devices. Nurses were excluded from participation if they worked part-time or per diem. Ideally, all nurses providing care related to central lines would be formally trained to use the new protocol. In most home health agencies, including this project site, all nurses do not routinely receive this training because of frequent changes in personnel and staffing patterns. The form in Appendix B was used to collect data about the training status of nurses providing central line care during the project.

The protocol was developed using the INS guidelines on VAD management. Specific guidelines on performing VAD care can be seen below in the observational checklist (appendix G). These include but are not limited to identification of patient, proper hand hygiene, assessment of site, proper skin antisepsis and complete documentation of procedure. No new

supplies or materials were needed as the agency already had the necessary prepackaged central line dressing change kits.

Training was provided to nurses regarding the proposed protocol at the beginning of the project. Posters (Figure 6) were placed in the agency, and handouts illustrating the posters were provided to nurses. Nurses were trained face to face on the developed policy using simulations, demonstrations, and other learning materials. They demonstrated their competency with returned demonstration during the training as well as follow up observation visits, and chart checks. Based on the duration of the project and the weekly admission rate of 2-5 patients who receive home infusion therapy, it was anticipated that the total number of patient visits to be observed or monitored in the quality improvement project would be 15 to 30. Patients were included without regard to gender, race, diagnosis, or other factors besides those in the exclusion group.

The implementation team, charged with supporting the creation, implementation, and evaluation of the project, included the project faculty advisor, the clinical site representative, the administrative sponsor, and the nursing director. Targeted stakeholders and project champions were engaged for their commitment and support of the project. Baseline data were collected by the project team from patients' electronic health records and observations in patients' homes. Process and outcomes data were collected through observations during nurses' visits and audits of the company's pertinent records for three months following nurse training.

Before implementing the new care protocol, an audit was conducted to assess nurse documentation of activities performed as part of midline and central line dressing changes. The data collected included the average number of line care activities performed and the number of activities to be recorded using the new protocol (a constant). These data points were used to derive a percentage and were recorded on the form in Appendix C. Documentation of line care

activities following the implementation of the new protocol was collected weekly and recorded on the form in Appendix D.

VAD-related infection was a primary outcome of interest. Data collected regarding VAD-related infection was recorded as a simple count of all patients with midline and central VADS who developed new VAD-related infections during the project. This data was recorded in the form, displayed in Appendix E. The second primary outcome of interest was line occlusions. This was collected and recorded identically to infections. See Appendix F for the form used to record occlusions. Relevant incidence rates per 100 patients/month were calculated for infections and occlusions. Baseline rates were compared to rates in the final month of the project for an overall result, and rates across time were assessed visually.

To protect privacy and confidentiality for participating nurses, the project manager kept all electronic patient records, observational data, and audit results in a locked and secured device. Instead of personally identifiable information, numbers were used to identify individual nurses and their patients in data collection forms. The agency had no information about individual nurses.

Results

All eight nurses included in the project were trained on the new protocol and completed return demonstration for competency verification. From baseline, beginning in September and then to the end of the fourth quarter in December, midline and central line-related infections decreased from 2 per 100 to zero, as shown in Figure 2. There was a steady downward trend in occlusions followed by a sudden spike at the end of the project (See Figure 3). The number of nurses trained increased across the project period, as shown in Figure 4. The proportion of nurses who adhered to all protocol components increased steadily from 90% to 100% across the 3

months of the project, as shown in Figure 5. It is more than likely that this improvement is the result of consistent check ins and the illustrations that each nurse received. Data collection forms to record measures are included in Appendices A through F. Various strategies were used to ensure that the training was effective, and that the desired outcomes would be achieved. Before implementing the new care protocol, an audit was conducted to assess nurse documentation of activities performed as part of midline and central line dressing changes. During implementation, illustrations of proper VAD care procedures were handed out to nurses. Pre-assessing, where the nurses stood on proper VAD care procedure, ensured that during training the implementation team focused on areas where the nurses fell short rather than losing them to redundancy. Utilization of illustrations and reinforcement of the material helped the nurses to remember and develop a habit of performing the proper procedure which ultimately resulted in decreased infection rates.

A significant barrier to this project was patient and family fears about in-home visits during the COVID-19 pandemic. The nurses did patient and family teaching, and all caregivers and observers wore masks during each visit. Observers maintained social distancing throughout the process and stayed just long enough to observe the VAD care by the nurse. Results were disseminated to internal stakeholders at the project agency, including agency administration and nursing staff. All project reports consisted of aggregated data instead of data for individual nurses or patients

Discussion

This project represents a quality improvement process for the project site agency. The results suggest that adherence to the recommended protocol for midline and central VADs was more successful in preventing infection than preventing occlusions. The reduced infection rate in

this project validates studies by Guenezan, et al. (2018), Lutwick, et al. (2019), and LoVechhio, et al. (2016) as outlined in the literature review. Because of variations in factors affecting care in different settings, the project results cannot be validly generalized to other home health agencies or health care settings, but certainly suggests other quality improvement projects that could be done in these settings.

The evidence-based intervention included developing policy, procedure, protocols, and training to support the direct-care nurses. Communicating motivating factors and improvement goals, engaging project champions, developing a communication plan, and collaborating with other care professionals were other key activities in the project. This validates other studies as outlined in the evidence review and the Lewin Model of Change.

It is anticipated that the project will continue to influence education and policy regarding midline and central VAD care at the target agency. Sustaining gains achieved during the project period will require reinforcement of the education provided in the project and periodic repetitions of the message that the agency is committed to the new protocol for line care. It is recommended that the agency rely on change champions to reinforce the policy change, provide regular training regarding line care to nurses, provide periodic supervision of nurses providing line care, and clearly express expectations of nurses regarding adherence to the line care policy. Although not a part of this project, future quality improvement processes involving line care could benefit by observing nurses adherence with guidelines and include education components that increase patient awareness of risk factors for line-related infections and occlusions.

There are multiple risks associated with insertion and the ongoing care of a VAD that negatively impacts the vulnerable population represented by home infusion patients. Firstenberg et al. (2015) state that complications linked with central venous access such as infection,

misplacement, and injury can significantly alter the quality of life. Catheter-related bloodstream infections (CRBSI) are substantial burdens linked with VADs and preventing the occurrence of these issues should be a priority for healthcare providers (Carr et al., 2014).

Recent AHRQ reviews (AHRQ, 2017) indicate that the costs of treating inpatient CLABSIs range from $18,000 to more than $90,000. Using the average from this data ($54,000), the monthly cost savings for CLABSI treatment associated with this project is estimated to be about $108,000 if treatment of CLABSIs acquired by home infusion patients is like that of inpatients. Every healthcare agency searches for ways to contain or reduce costs while still assuring the quality of service. With this intervention, the project site can maintain a high level of service quality and reduce healthcare spending.

Conclusions

Implementing an evidence-based standardized protocol for VAD care was associated with reduced numbers of midline and central line infections in home infusion patients. This finding highlights the importance of creating and adhering to protocols and policies grounded in science. The results of this project correlate with other studies that show similar results in the hospital setting. There was no evidence to show that the protocol had any effect on VAD occlusions.

The agency plans to sustain the change in practice by expecting all home infusion nurses to adhere to the new protocol as a matter of policy. The agency will continue to do training during annual competency and bi-annual skills days. The agency expects that the adherence to this protocol will improve patient outcomes and decrease the cost of caring for the home infusion patient with a midline or central VAD.

Despite the limitations of study size and the home care environment, this project is relevant to healthcare delivery because it reinforces the importance of standardized protocols and policies to guide patient care. The project also reinforced the importance of staff education when implementing new policies and protocols. This project highlighted that patient outcomes and quality of care can be improved when protocols grounded in science are implemented.

The project also reinforced the usefulness of Lewin's change model. By consciously working with the staff to identify practices that would influence results in the first stage, the nurses became part of the change. In the second stage, the nurses were then willing to change their practice and follow the evidence-based practices that they helped to identify. This support for the change carried over into the measurement and observation stage when staff members were invested in ensuring that the quality of their care was exceptional.

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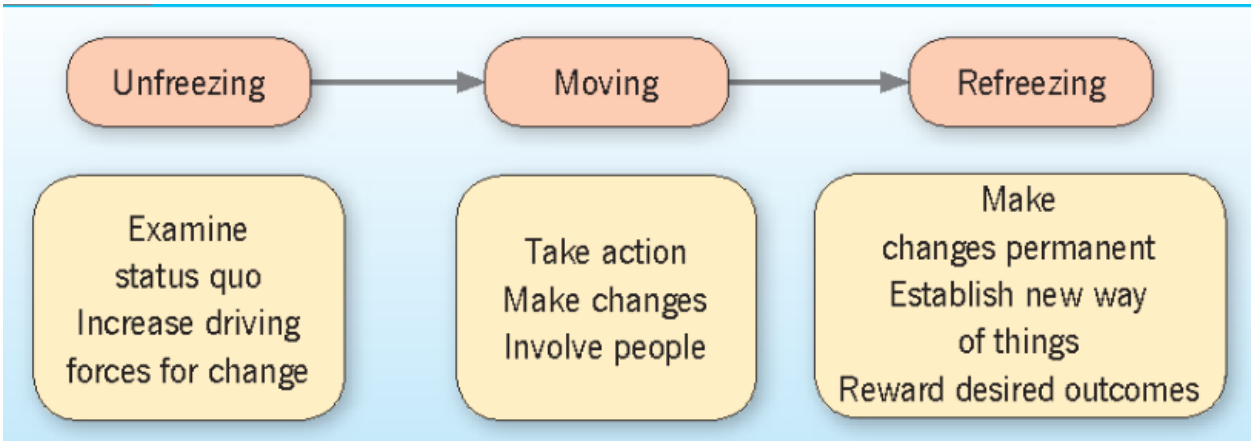
Figures

Figure 1

Lewin (2013) Change Model



Source: Mitchell, (2013)

Figure 2

Incidence of Infection across project period.

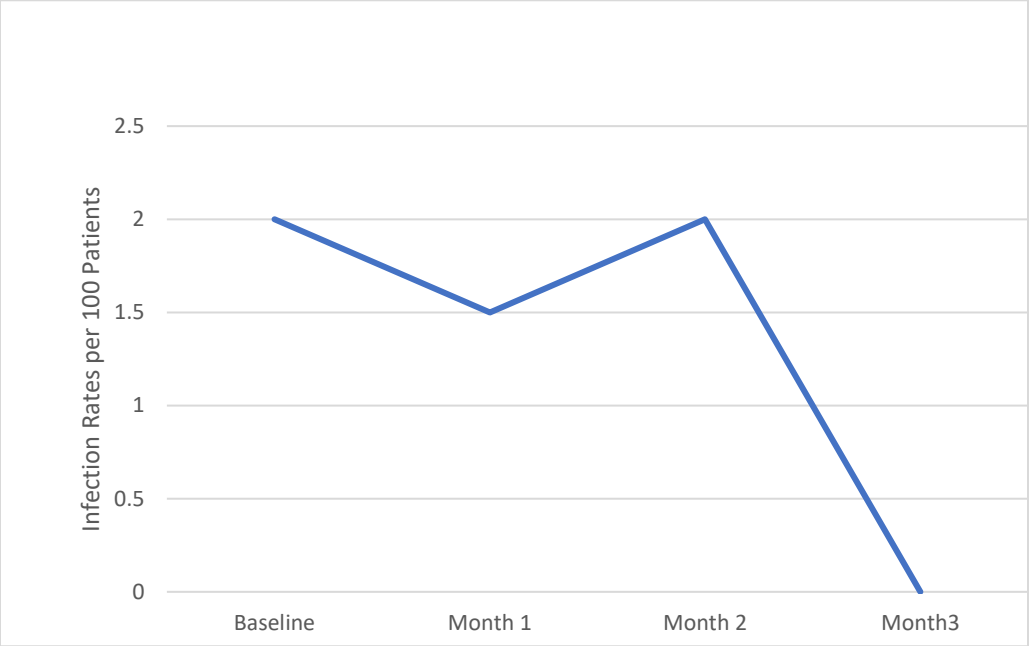


Figure 3

Incidence of Occlusions across project period

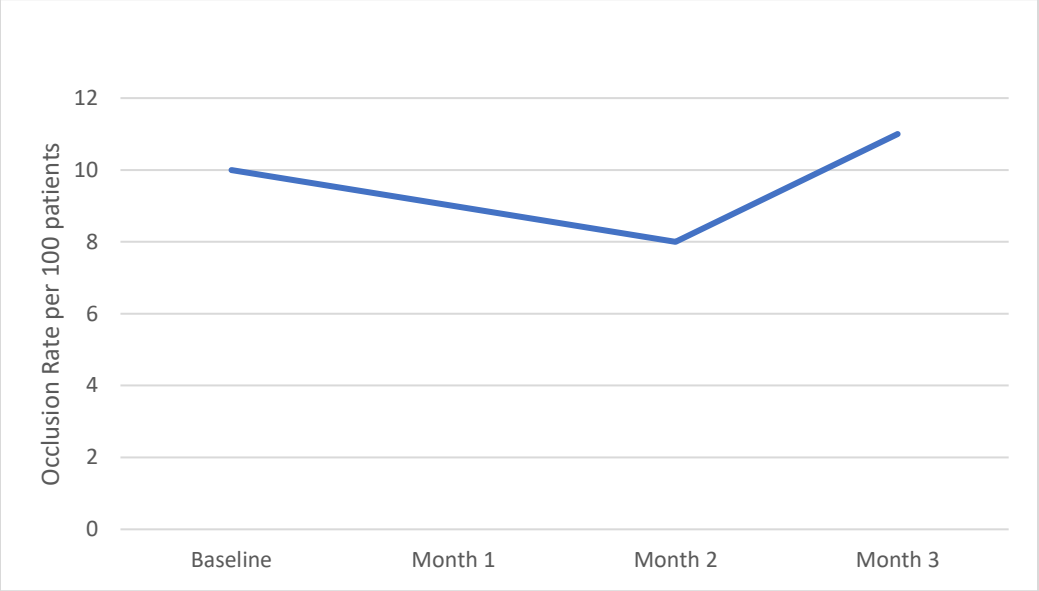


Figure 4.

Number of Nurses Trained

Note: Nurses were trained over the course of two weeks.

Figure 5

Nurse Adherence to Protocol

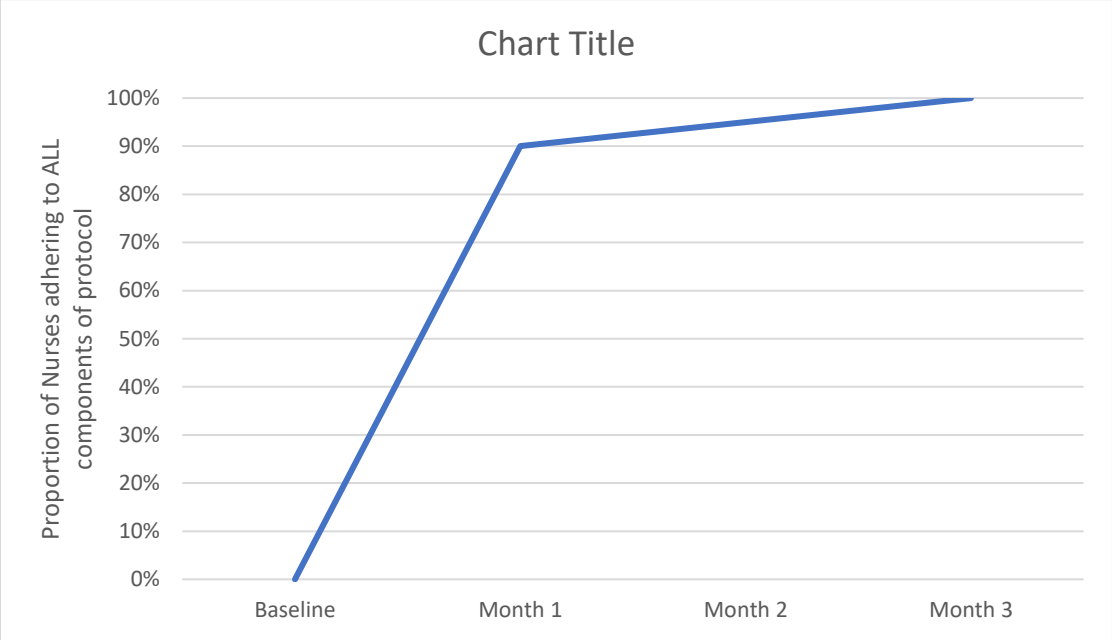


Figure 6

Implementation Handout and Poster

Appendices

Appendix A: Evidence Review Citation: Cotogni, P., Pittiruti, M., Barbero, C., Monge, T., Palmo, A., & Boggio Bertinet, D. (2013). Catheter-related complications in cancer patients on home parenteral nutrition: A prospective study of over 51,000 catheter days. *Journal of Parenteral and Enteral Nutrition, 37*(3), 375-383. doi: 10.1177/0148607112460552					**Level of evidence Cohort: 4**
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**
"The aim of this study was to investigate the actual risk of CRCs in cancer patients on HPN and the incidence of such complications in relation to the type of VAD, as well as to the most significant risk factors."	Primarily, this is a prospective study that explored VAD-related complications in homecare settings.	**Sampling Technique**: Convenience **# Eligible Participants**: Researchers enrolled patients who were home care settings and had medium and long-term central VAD during the period of this study. **# Excluded**: All potential participants who did not agree to take part in the study or did not meet the above criteria. **# Accepted**: Researchers involved 254 participants who were receiving care in home settings. **Control**: The study did not indicate whether any of the recruited patients dropped out during the research activities. **Intervention**: The researchers evaluated the different issues that patients encountered during the treatment period. **Power analysis**: The study did not disclose how the participants met the power analysis. **Group Homogeneity**: The research had the control and intervention groups based on different training strategies.	**Control**: None **Intervention**: The researchers used multiple interventions during the research activities, including an organized system of offering materials, training programs, and well-defined management protocols.	**DV**: The researchers assessed whether certain treatment bundles could reduce VAD-related complications in home care settings. **Measurement tool (reliability), time, procedure**: Researchers worked with cancer patients to assess which treatment approaches could help reduce VAD-related infections	"**Results:** Two hundred eighty-nine VADs in 254 patients were studied, for a total of 51,308 catheter-days. The incidence of catheter-related bloodstream infections (CRBSIs) was low (0.35/1000 catheter-days), particularly for PICCs (0/1000; $P < .01$ vs Hohn and tunneled catheters) and for ports (0.19/1000; $P < .01$ vs Hohn and $P < .05$ vs tunneled catheters). Mechanical complications were uncommon (0.8/1000), as was VAD-related venous thrombosis (0.06/1000). Ultrasound-guided venipuncture was associated with a decreased risk of CRBSI ($P < .04$) and thrombosis ($P < .001$). VAD securement using sutureless devices reduced the risk of CRBSI and dislocation

					(P < .001). Hohn catheters had no advantage over PICCs (higher complication rate and shorter dwell time; P < .001). **Conclusions:** In cancer patients, HPN can be safely carried out with a low incidence of complications. Also, VADs are not equal in terms of complication rates, and strict adherence to meticulous insertion policies may effectively reduce catheter-related complications."
Citation: Fenik, Y., Celebi, N., Wagner, R., Nikendei, C., Lund, F., Zipfel, S., ... & Weyrich, P. (2013). Prepackaged central line kits reduce procedural mistakes during central line insertion: A randomized controlled prospective trial. *BMC Medical Education, 13*(1), 60. doi: 10.1186/1472-6920-13-60					**Level II**
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**
The study sought to examine "whether the use of prepackaged all-inclusive central line insertion kits reduces procedural mistakes during central line catheter insertion by novices."	This was a randomized, single-blind, prospective, and controlled study that focused on how nurses can improve care by using pre-packaged central line kits.	**Sampling Technique**: Convenience **# Eligible Participants**: The study only selected medical students in their final year of study. **# Excluded**: Researchers excluded potential participants who had performed more than 15 central line insertions. **# Accepted**: Researchers selected 30 participants who took part in this project. **Control**: The study did not lose any participant during research activities.	**Control**: The control group used standard kits that experts use in inserting central line catheters. **Intervention**: Researchers provided the other group with pre-packaged central line kits, and this was to illustrate whether there are variations in the	**DV**: The dependent variable in this analysis was the consistency in maintain quality insertion of central line catheters and the researchers revealed that pre-packaged kits have an impact on the dependent variable. **Measurement tool (reliability), time, procedure**: The investigators selected	"The prepackaged kit group outperformed the standard kit group in four of the five quality indicators: procedure duration (26:26 ± 3:50 min vs. 31:27 ± 5:57 min, p = .01); major technical mistakes (3.1 ± 1.4 vs. 4.8 ± 2.6, p = .03); minor technical mistakes (5.2 ± 1.7 vs. 8.0 ± 3.2, p = .01); and correct steps (83 ± 5%

		Intervention: The investigators grouped the participants into two groups, and one faction got pre-packaged kits while the other used standard central line kits. **Power analysis**: The study aimed at getting a power analysis of ≥ 0.80. **Group Homogeneity**: The research had the control and intervention groups, and the differences were the insertion kits that each faction used in the simulation.	performance of the two groups. **Intervention fidelity (describe the protocol)**: Researchers had submitted a protocol study, and the relevant stakeholders reviewed it and gave the authors the green light to continue with the main study.	novices who had not inserted central line catheters for more than 15 years. The goal was to provide one group with pre-packaged central line kits and assess whether this resulted in any significant variations in the quality of care and consistency in healthcare delivery.	vs. 75 ± 11%, p = .02). The difference for breaches of aseptic technique (1.2 ± 0.8 vs. 3.0 ± 3.6, p = .06) was not statistically significant."
Citation: Gunasegaran, N., See, M. T. A., Leong, S. T., Yuan, L. X., & Ang, S. Y. (2018). A randomized controlled study to evaluate the effectiveness of 2 treatment methods in reducing incidence of short peripheral catheter-related phlebitis. *Journal of Infusion Nursing*, *41*(2), 131-137. doi: 10.1097/NAN.0000000000000271					**Level II**
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**
"This study aimed to compare the effective-ness of 2 treatment methods in reducing the incidence of SPC-related phlebitis. The 2 treatment methods differed in terms of the cleansing solution used before insertion and dressing material used after removal."	Primarily, this is a randomized control trial that sought to explore the effectiveness of two treatment approaches.	**Sampling Technique**: Convenience **# Eligible Participants**: • Patients who required short peripheral catheter (SPC) insertion. • Patients between the age of 19 and 99 years. • Critically ill • Patients that are known to have	**Control**: The study had two groups and each faction used a different treatment method. **Intervention**: **Treatment 1** • "Pre-insertion skin antisepsis: 70% isopropyl alcohol swabs were used in circular motion and allowed the site to dry after cleaning." • In situ: "Aseptic technique when manipulating the SPC, flushing of	**DV**: The study focused on which of two treatment approaches was more effective in reducing catheter-related infections among patients. **Measurement tool (reliability), time, procedure**: Researchers worked with various groups to assess which of the two treatment approaches could be helpful in reducing infections among patients using vascular access devices.	The results revealed that the methods that nurses use in post-removal dressing and types of cleaning solutions do not affect the rate of phlebitis. Fundamentally, the research study stressed that medical practitioners need to adhere to aseptic techniques and comply with hand hygiene practices and other guidelines to reduce catheter-related infections in healthcare settings.

		dermatological issues. • Individuals allergic to chlorhexidine and/or alcohol. • Patients admitted for upper limbs cellulitis and/or phlebitis. # **Excluded**: All potential participants who did not agree to take part in the study or did not meet the above criteria. # **Accepted**: Researchers involved 960 participants who were admitted to a tertiary healthcare facility in Singapore. **Control**: The study registered a 10 percent dropout rate. **Intervention**: The researchers had treatment methods for both treatment approaches 1 and 2. **Power analysis**: The study did not disclose how the participants met the power analysis. **Group Homogeneity**: The research had the control	SPC before and after drug administration, and routine removal after 72-96 hours." • Post-removal dressing material: Use of sterile gauze -Application of adhesive bandage after hemostasis achieve **Treatment 2** • "Pre-insertion skin antisepsis: 2% chlorhexidine in 70% isopropyl alcohol swab sticks were used in circular motion, allowing the site to dry after cleaning." • In situ: "Aseptic technique when manipulating the SPC, flushing of SPC before and after drug administration, and routine removal after 72-96 hours." • Post-removal dressing material: "Use of sterile		

		and intervention groups based on different training strategies.	gauze -Application of film dressing (spray-on) after hemostasis achieved."		
Citation: Broadhurst, D., Moureau, N., & Ullman, A. J. (2016). Central venous access devices site care practices: An international survey of 34 countries. *The Journal of Vascular Access*, *17*(1), 78-86. doi: 10.5301/jva.5000450					**Level Cross-sectional (survey) descriptive: 6**
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**
"The goals of this international study were to: a) identify current practices for the site management of CVADs; b) recognize current practices for the site management of CVADs for patients with impaired skin integrity; c) rate current clinician confidence and decision-making regarding the site management of CVAD; and d) describe current training and institutional policies to support CVAD site management practice."	Cross-sectional study. This was an electronic (SurveyMonkey) survey that was developed by a committee of experts to explore why inconsistencies exist in VAD-related practices in healthcare.	**Sampling Technique**: Random sampling **# Eligible Participants**: Researchers considered participants from diverse areas, who could read and write English. The facilitators attempted to reach the participants through various national and international bodies, for example, Infusion Nurse Society. **# Excluded**: All potential participants who did not agree to take part in the study or did not meet the above criteria. **# Accepted**: Researchers involved 1044 participants practicing in various nations. **Power analysis**: The study did not disclose how if a power analysis was done to estimate needed sample size.	**Control**: The study did not have either control or intervention groups due to the methodology that the researchers adopted.	**DV**: The study showed that inconsistencies in VAD-related site assessment and dressing are due to various factors, including resource availability and the level of knowledge between medical practitioners. **Measurement tool (reliability), time, procedure**: Researchers developed a 34-item English language questionnaire. Questionnaires were sent to the selected participants. The random sampling technique was helpful in making sure that there was no bias.	Researchers received 1044 useable responses from invited participants residing in over 34 countries across the globe. A majority of the respondents were practicing nurses (89 percent) from North America. The participants revealed that there were inconsistencies in VAD-related procedures and the variations occur due to differences in knowledge levels and available resources in healthcare facilities. The research recommends that hospitals train nurses and other practitioners to reduce the gap in knowledge levels. Besides this, it is essential to offer support practices and avail

					resources to promote consistency.
Citation: Nailon RE, Rupp ME. Surveillance of home health central venous catheter care outcomes: Challenges and future directions. Am J Infect Control. 2019 Nov;47(11):1382-1387. doi: 10.1016/j.ajic.2019.04.177. PMID: 31676067.					**Level of Evidence:** Cohort study: 4
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**
Investigators noted that limited data existed regarding central venous catheter (CVC)-related complications that occur in home care. This study proposed to quantify the presence of central venous lines in homes and describe patient outcomes associated with CVC care.	Observational (Cohort) study in which secondary data analysis was performed on monthly aggregate data from January 2011 to March 2915.	10 home health agencies from 4 states.	**NA (secondary data analysis)**	Number of patients on service with a CVC, device days, central line-associated bloodstream infection (CLABSI), CVC-occlusions, doses of fibrinolytics administered, and number of patients receiving fibrinolytics.	A total of 913 occlusions and 73 CLABSIs occurred during the 51-month surveillance period, including both pediatric and adult cases. The CLABSI rates per 1,000 device days per year across the study surveillance period ranged from 0-0.37 for adult patients. Occlusion rates per 1,000 device days ranged from 2.59-33.29 for adult patients. Surveillance mechanisms were suboptimal and recommendations included making improvements in the processes by which patient outcomes are measured.
Citation: Keller, S.C., Williams, D., Gavgani, M., Adamovich, J., Hohl, D., Krosche, A., Cosgrove, S, & Perl, T.M. (2016). Environmental exposures and the Risk of Central Venous Catheter Complications and Readmissions in Home Infusion Therapy Patients. *Infection Control and Hospital Epidemiology,* 38(1):68-75. https://doi.org/10.1017/ice.2016.223					**Level of evidence:** cohort study: 4
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**

The purpose was to identify risk factors for complications related to central line infusions among patients receiving home infusion therapy	Prospective cohort	222 patients discharged to home from 2 academic medical centers. All patients had orders for infusion therapy administered through peripherally inserted central catheters (PICC lines). Data was collected until 30 days after central line removal. Data was extracted from charts and monthly telephone surveys, which focused on complications and exposures.	**NA**	Hospital readmission, bloodstream infection.	Complications, including readmissions, were common: Patients receiving total parenteral nutrition was almost 5 fold more likely than other patients to experience a hospital readmission within 30 days.
Citation: Institute for Healthcare Improvement (2012). *How-to Guide: Prevent Central Line-Associated Bloodstream Infections*. Cambridge, MA: Institute for Healthcare Improvement. Available at www.ihi.org					**Level of Evidence:** Expert opinion: 7
Purpose/ Hypothesis	**Design**	**Sample**	**Intervention**	**Outcomes**	**Results**
The purpose of the document is to present key evidence-based recommendations for care activities to prevent central VAD-related bloodstream infections.	Practice guidelines based on published studies.	**NA**	IHI Guidelines recommends 5 components of care to prevent central line associated bloodstream infections, including broadly) hand hygiene, maximal barrier precautions, chlorhexidine skin antisepsis, optimal catheter sire selection, and regular review of line necessity with prompt line removal	**NA**	NA

			when indicated. Components are described with recommendations for implementing each component. The guidelines also escribe how to implement a PSDA quality improvement process to integrate the guidelines into practice.		

Appendix B: Staff Training Tracking Form

Patient ID	No. of nurses with the training who perform midline and central catheter care	No. of nurses without the training who perform midline and central catheter care	Total no. of nurses who attended to this patient

Appendix C: Nurses documentation of line care activities based on Audit Checklist (Appendix G)

Nurse ID	Average No. of activities completed per patient	No. of activities to be documented under the developed protocol

Appendix D: Adherence to Procedural Steps in Care Protocol

Week: Patient ID: Nurse ID:	
No. of activities on the VAD Dressing Change Care Protocol performed	Total No. of steps on the VAD Dressing Change Care Protocol checklist

Appendix E: Infection Record for patients receiving care for midline and central VADs

Month:

Patient ID:	Month	Midline and central VAD-related infection (Yes/No)

Appendix F: Occlusion Record

Week:

Patient ID:	Month	Occlusion (Yes/No)

Appendix G: Observational Checklist

MIDLINE and Central Venous Catheter Care

Procedural Steps	YES	NO
Verify patient's identity and review physician's orders	☐	☐
Perform hand hygiene	☐	☐
Gather Supplies	☐	☐
Explain Procedure to Patient	☐	☐
Don clean gloves	☐	☐
Open dressing change tray, put on mask and have patient put on mask or turn head away from site, as appropriate	☐	☐
Add the Stat-Lock and the biopatch into the dressing change tray using aseptic technique	☐	☐
Assess the insertion site and surrounding area for absence of redness, tenderness, swelling and drainage	☐	☐
Palpate through the intact dressing and ask patient about pain, paresthesia, numbness or tingling	☐	☐
Remove existing dressing, beginning at device hub and gently pulling the dressing perpendicular to the skin toward the insertion site. (Use alcohol pad or adhesive remover)	☐	☐
Remove stabilization device (Stat-Lock)	☐	☐

MIDLINE and Central Venous Catheter Care

Remove gloves	☐	☐
Perform hand hygiene	☐	☐
Open Central line dressing change kit	☐	☐
Don sterile gloves	☐	☐
Measure the external catheter length and compare to the external length documented at insertion or from previous visit	☐	☐
Measure upper-arm circumference 10cm above the antecubital fossa. Compare to baseline measurements to detect possible catheter associated venous thrombosis (a 3-cm increase in arm circumference and edema warrants further investigation)	☐	☐
Cleanse skin with antiseptic solution; allow to dry completely	☐	☐
a. Chlorhexidine solution (preferred): apply using a back-and-forth motion for at least 30 seconds	☐	☐
b. Povidone-iodine: apply using applicator and allow to remain on the skin for 1.5 to 2 minutes or longer to completely dry for adequate antisepsis. (Do not wipe off)	☐	☐
Apply Skin barrier solution to prevent medical adhesive-related skin injury (MARSI)	☐	☐

MIDLINE and Central Venous Catheter Care

Cleanse the skin around the catheter site to an area at least as large as the dressing, taking care not to dislodge the catheter	☐	☐
Apply stabilization device (Stat-Lock)	☐	☐
Apply bio-patch disc	☐	☐
Apply TSM (or gauze and tape) dressing to insertion site	☐	☐
Discard used supplies in appropriate receptacles	☐	☐
Remove gloves, and discard	☐	☐
Perform hand hygiene	☐	☐
Label dressing with date, time, and initials	☐	☐
Instruct the patient or caregiver to check the catheter site at least once per day for signs of complications and to report signs/symptoms or dressing dislodgment immediately	☐	☐
Document procedure and findings in the patient's medical record	☐	☐
a. Site assessment (includes signs/symptoms of infection and reaction)	☐	☐
b. Condition of the catheter if damage or compromised		
c. Site prep/technique, antiseptic used		
d. Type of dressing used.	☐	☐
e. External length of catheter and		

MIDLINE and Central Venous Catheter Care

Baseline Length		
f. Upper Arm Circumference measurement and baseline measurement	☐	☐
g. Patient tolerance	☐	☐
	☐	☐
	☐	☐
	☐	☐

Appendix H: Midline and Central Venous Catheter Care Audit Chart

Chart Audit Date: ____/____/20____

1. **Was proper hand hygiene used and documented by Infusion RN? (i.e., hand washing with soap and water AND alcohol-based hand sanitizer)?**

   [ ] Yes [ ] No, not during: ---------; not prior: ----------; not post---------

2. **Transparent Semi permeable (TSM) dressings changed at least every 5-7days? [ ] Yes [ ] No**

3. **Gauze dressings changed at least every 2days?**

   [ ] Yes [ ] No [ ]N/A

4. **Was the dressing changed within 7 days?**

   [ ] Yes, changed because:
   - [ ] Dressing soiled, damp or non-occlusive
   - [ ] Due to be changed (7 days for TSM OR 2 days for gauze)
   - [ ] Dressing was overdue to be changed?

   [ ] No, not changed because:
   - [ ] It was intact and not due
   - [ ] It was due but could not be completed.

   Explain:

5. **Was Chloraprep© or 2% chlorhexidine in 70% Isopropyl alcohol used for skin antisepsis?**

   [ ] Yes: [ ]N/A
   Was it used appropriately?
   - [ ] Scrub vigorously back and forth for 30 seconds
   - [ ] Air dry up to 2 minutes
   - [ ] No – Explain:

   [ ] No, Povidone iodine used
   Secondary to allergy?
   [ ] Yes [ ] No – Explain:

   Did scrub comply with recommendations?
   Povidone iodine air dry 2 minutes
   [ ] Yes [ ] No – Explain:

6. **Was Stat-lock and Biopatch changed during the visit?**

Biopatch
[ ] Yes, completed [ ]N/A
[ ] No, because:
[ ] Supply was not available
[ ] Other-Explain

Stat-Lock
[ ] Yes, completed
[ ] No, because:
[ ] Supply was not available
[ ] Other – Explain:

7. Was dermatitis and erythema assessed at catheter site?

Dermatitis
[ ] Yes [ ] No

Erythema
[ ] Yes [ ] No

8. Was upper arm circumference measured and compared to baseline?

[ ] Yes
Baseline Measurement( )
Current Measurement( ) [ ] No----Explain:

9. Was external length of catheter measured and compared to baseline? [ ] Yes

Baseline ( )
Current Measurement ( ) [ ] No---Explain:

10. Was the patient educated on signs/symptoms to report? [ ] Yes [ ] No—Explain: