RECENT CONTENT

Vascular Access

Critical Thinking: Insertional Assessment for IV Therapy and PICCs

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

This column originally appeared in the November issue of Healthcare Hygiene magazine.

Performing intravenous (IV) access assessment for patients is a dynamic and ongoing process for clinicians in an acute-care setting. Critical thinking is required to initiate and maintain the best device for the patient, the diagnosis, the medications, and the duration of therapy. Ideally, one device without complications should allow completion of therapy for the IV patient. Peripherally inserted central catheters (PICCs) can provide the patient with reliable IV access for therapies exceeding five days and are most cost-effective when initiated at the beginning of the patient's acute-care stay.

Determination of suitability with an indication for placement of a central catheter such as a PICC be established prior to placement with collaboration between the ordering physician and inserting clinician. Conditions such as sepsis, elevated INRs and renal failure require higher level consideration for device selection, estimated dwell time, potential complications, and impact on the need for future fistulas. Discussion of the best timing for placing a PICC with a febrile patient is centered around cultures, results, and initiation of antibiotics specific to sensitivity results. Considerable savings may be achieved by good timing of PICC placement rather than insertion and removal when culture results are ready. Ideally, the physician has initiated antibiotics that match with preliminary sensitivity results so the PICC can be placed with confidence and have a dwell time longer than 24 to 48 hours. When confidence is low and culture results unavailable, peripheral IV therapy should be considered for the short term, before the PICC can be safely placed.

Initiation of intravenous therapy always has the potential for problems in the presence of elevated platelets or in patients with bleeding problems as can be present with COVID-19 cases. The goal is to maintain needed intravenous access as long as possible with few skin penetrations, thus avoiding multiple bleeding sites. PICCs carry the lowest risk for access for the patient at risk of bleeding. No INR level will contraindicate the insertion of a PICC, although adequate experience for management of complications is essential by the inserter. High INR levels should identify the need for platelet transfusions and/or availability of bedside coagulating foam, glue or other coagulating agents to control insertion related bleeding. The potential for bleeding into the tissues remains a risk with every needle penetration. The patient with bleeding risk requires close monitoring following every access looking for the development of hematomas and subsequent compartment syndrome. Pressure dressings, coagulation foam, close observation and critical thinking all reduce the risk of serious complications for the patient with bleeding issues.

Renal, pre-renal and chronic renal patients require careful determination for the best type of access needed for administration of non-dialysate infusions. In all cases the nephrologists should be contacted regarding the IV access plan. All renal patients must have a plan for future fistula formation, ideally unimpeded by complications of peripheral intravenous therapy. PICC are only used with renal patients in situations where no other access is available and current needs outweigh future needs. Thankfully, many new dialysis catheters have intravenous access ports incorporated into the design thus eliminating the IV access decision process.

While more than 90 percent of patients entering acute care in the U.S. today require IV access, critical thinking is necessary to determine the best IV device for the prescribed therapy. Nurses and physicians now must have a good understanding of the vascular access options and be able to apply that knowledge to each patient diagnosis and therapy need. Prior to the insertion of any central catheter indications and need for central access should be confirmed, integrating the guidance present in the Michigan Appropriateness Guide to Intravenous Catheters (MAGIC) into every patient and catheter choice. Effective application of these concepts reduces risk for patients resulting in better outcomes now and in the future.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia. nancy@piccexcellence.com

References:
1. Chopra V, Flanders S, Saint S, et al. The Michigan appropriateness guide for intravenous catheters (MAGIC): Results from a multispecialty panel using the RAND/UCLA appropriateness method. Ann Intern Med.2015;163(6 Suppl):S1-40.
2. Gorski LA, Hadaway L, Hagle ME, et al. Infusion Therapy Standards of Practice, 8th Edition. J Infusion Nurs. 2021;44(1S):S1-S224. doi:10.1097/nan.0000000000000396

Clinical Voices of COVID and Survey of Ultrasound-Guided Peripheral Catheter Policies and Training

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

This column originally appeared in the October 2021 issue of Healthcare Hygiene magazine.

Patients admitted to acute-care facilities require intravenous access for the delivery of medical treatment today. As the most common invasive procedure performed in acute care today, approximately 340 million peripheral intravenous catheters (PIVC) are sold each year for the purpose of access for intravenous infusions. While our population continues to increase, the number of peripheral catheters and the skill required for successful insertion will continue to increase. Estimates of more than one out of every two to three patients is classified as having

difficult access requiring visualization technologies to enhance success. Solutions for managing greater patient difficulty with achieving intravenous access has led to escalation in the use of ultrasound-guided peripheral catheter insertions (UGPIV).

Currently, UGPIV insertion procedures performed in the United States are projected at approximately 12 million per year. Use of this type of visualization technology has reduced the number of failed attempts allowing clinicians improved success, faster intravenous access, and extended dwell time with the insertion of longer catheters. With the increase in these point of care procedures groups such as ERCI have expressed concerns over the training necessary to ensure safety with every patient.

In a recent survey, clinicians were asked about UGPIV procedures, their training, policies, and experiences with COVID-19 at each of their facilities. Clinical areas represented in the survey respondents included vascular access specialists, emergency departments, acute care and alternate care. The objective of the survey was to gain a greater understanding of the UGPIV policies for qualification and training received for UGPIV procedures, and feedback from the clinicians on the impact of the COVID-19 pandemic on UGPIV practices. Secondary outcomes were to record free-form text responses of the experiences of working nurses during the COVID-19 pandemic on aspects of aseptic technique, disinfection, management of protection and UGPIV insertions.

Training

Education and training positively contribute to increased patient safety and are needed before performing new invasive procedures on patients. Davis (2016) noted that vascular access device insertions are high-volume and high-risk invasive procedures requiring clinicians with specialized training and expertise to ensure positive outcomes. The survey asked clinicians, Prior to performing ultrasound guided peripheral catheter insertions did you receive training? The majority (82 percent) said yes, they did receive training prior to performing insertions. In a separate question, the group indicated they learned UGPIV insertions by themselves (14 percent), while 86 percent listed various types of training for on the job, online education, lecture, and hands-on simulation. According to Spencer (2020), such education and training activities should encompass basic knowledge of anatomy, ultrasound physics, and imaging techniques.

In the comments section of the survey, one respondent addressed education and training by noting, “We have great support and good training of performing ultrasound-guided PIVC and PICC insertion but luckily I did not need to perform one to any of those patients.” Another respondent said, “I took extra education available in community and online with my own funding. Hospital education and training is lacking, and I feel most nurses learn primarily by trial and error. There is no IV team in my hospital.” Another respondent observed, “We are now also training non-PICC RNs and X-ray/ED techs to perform USPIV with mandatory classroom and online training followed by ‘monitored’ placement of USPIV prior to being released to perform independently.” Still another respondent noted, “Although I was trained to do ultrasound PIVCs, I don’t get the opportunity nor developed the skill to be confident with my practice.”

Another said, “I only learned this technique from an AVA class several years ago from a nurse who said it was a ‘bridge procedure.’ No other coworkers were technically trained. I only knew what I know from this class.”

Many of these comments reflected minimal education and training with improvements happening over time.

Even after initial education and training there should be ongoing competency assessments to evaluate the skill of the inserter, as well as surveillance of compliance within the institution’s policies. In the survey nearly 58 percent of respondents indicated hands-on simulation training with 66 percent including supervised insertions. Forty-five percent of respondents stated that training competency included measurement of the level of UGPIV insertion success. Lennon, et al. (2021) reported that complications associated with intravenous device insertions relate to the skill and knowledge of the clinician for insertion, but that the skills for these procedures and the knowledge acquired should be measured. Key components of such ongoing assessment and measurement require monitoring of outcomes through data collection.

Considering that UGPIV insertion is a highly technical procedure dictating an increased level of skill, the lack of training and variable competency assessment reflects a potential for higher risk to patients that can result in an increased number of attempts and complications. UGPIV programs that monitor the number of insertion attempts, PIVC failure rates, and infections make it easier to quickly identify issues that need to be addressed, with additional training for an individual clinician or as team-wide/hospital-side areas for improvement.

Policies

Establishing policies for UGPIV provides the foundation and guidance for these UGPIV procedures while striving to create appropriate steps and safety measures to standardize the procedure. Overall, 60 percent of respondents reported their facilities/practice settings did have policies on UGPIV insertions. In addition, nearly one half of respondents said their facility policy required some form of education and training. While 43 percent said their policy required a successful level of competency, nearly one-quarter of the responding clinicians said there was no policy needed, though no further explanation was provided for this choice.

Within the comments section of the survey, respondents stated: “Although we have documentation and procedural requirements, there are still people who attempt it because they don't find the practice standards important. After training, staff is managed by their dept manager, and quality and data collection compromised.” “After doing ultrasound insertions for quite a long time, although rarely, facilities did come out with specific policies for it in last few years.” “No need for extended policy. We have a low frequency of complications.” “Policy exists for USGPIV inserted by VAT but not by anyone else (RNs and MDs) attempting it.” “Despite literature our facility has no policy and does not require a probe cover for UGPIV insertion. This did not change with COVID.” “We were in the process of updating our ultrasound probe cleaning policy but waiting for the new research and guidelines to come out.” “Policies were on

hold during COVID, so we kept our current cleaning procedure." "Our policy is tight and specific, cleaning and disinfection already incorporated viruses, no need for extending policy."

These comments reflected much variability but a need to consider and even improve policies, especially in light of the COVID-19 pandemic.

Voices of COVID

With the advent of COVID-19, healthcare facilities and staff were strained due to influx of patients requiring isolation practices causing a breakdown in some services and shortages in personal protective equipment (PPE). UGPIV services were also impacted, and PPE and equipment protection required additional safety adjustments to protect patients and staff. Feedback received from the survey included these and many more unpublished comments: "Very few COVID cases so far, our probe cover disinfect policy was robust before COVID." "We followed strict aseptic technic before COVID, no changes needed." "No supplies are removed from a COVID room and equipment is cleaned and disinfected in the room and after removing the machine from the room." "Often there are no gloves in the room or small packets so as to not waste gloves once a patient leaves; at one point all our probe covers were being utilized to cover IV tubing under doors to leave machines outside the doors; this has since stopped." "For UGPIV starts we can use either the dressing in our UGPIV start kit or a sterile probe cover. It's the clinician's choice. Our kit includes two disinfectant wipes for cleaning the probe pre- and post-PIV start." "Increased attention to sterility standards and equipment cleaning and protection during COVID." "Have had challenges of maintaining ultrasound equipment when entering COVID-19 patients' rooms."

While COVID-19 created many challenges, the need to standardize the now common procedure of UGPIV insertions is necessary. We know we can improve UGPIV patient safety with quality training, policies that indicate asepsis for equipment and insertion, and monitoring of compliance. The time has come to decide on best practices and take steps to implement them consistently across all departments.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:

1. 2020 Top 10 Health Technology Hazards. ECRI, 2020. Available at: https://www.ecri.org/landing-2020-top-ten-health-technology-hazards
2. 2020 Top Patient Safety Concerns. ECRI, 2020. Available at: https://www.ecri.org/landing-top-10-patient-safety-concerns-2020
3. AIUM practice guideline for the use of ultrasound to guide vascular access procedures. J Ultrasound Med. 2013;32(1):191–215; doi: 10.7863/jum.2013.32.1.191.
4. Davis L, Owens AK, Thompson J. Defining the specialty of vascular access through consensus: shaping the future of vascular access. J Association for Vascular Access. 2016 Sep 1;21(3):125-30.

5. Kaczmarek L. Vascular Access Imperatives: Protect the Patient, Educate the Clinician, and Save the Line. Healthcare Hygiene magazine. October 2020. file:///C:/Users/nancy/Downloads/SpecialEditiononVascularAccessOctober2020.pdf
6. Landon J. Ultrasound-Guided PIV Insertions and Patient Safety: How Practice Variations are Putting Patients at Risk. Healthcare Hygiene magazine. October 2020.
7. Moureau N, Gilbert GE. Survey of ultrasound-guided peripheral intravenous practices: a report of supply usage and variability between clinical roles and departments. J Assoc Vasc Access. 2020;25(3):1-11; doi: 10.2309/java-d-20-00021.
8. Moureau N. Establishing Vascular Access Teams for Patient Safety. Infection Control Today, May 2020:24(4). https://www.infectioncontroltoday.com/view/establishing-vascular-access-teams-patient-safety.
9. Rowley S, Clare S. Standardizing the Critical Clinical Competency of Aseptic, Sterile, and Clean Techniques with a Single International Standard: Aseptic Non-Touch Technique (ANTT). Association for Vascular Access, 2019. Available at: https://cdn.ymaws.com/www.avainfo.org/resource/resmgr/files/position_statements/ANTT.pdf.
10. Rozich JD, Howard RJ, Justeson JM, Macken PD, Lindsay ME, Resar RK. Standardization as a mechanism to improve safety in healthcare. Joint Commission J Qual Saf. 2004;30(1):5-14; doi: 10.1016/s1549-3741(04)30001-8.
11. Girgenti C, Spencer T. Vascular Access Imperatives: Vascular Access Specialists: Providing Quality Care Under Pandemic Conditions. Healthcare Hygiene magazine. October 2020.
12. Spencer TR, Bardin-Spencer AJ. Pre-and post-review of a standardized ultrasound-guided central venous catheterization curriculum evaluating procedural skills acquisition and clinician confidence. J Vascular Access. 2020 Jul;21(4):440-8.

Paying Attention to PIVCs Can Achieve Higher Quality of Care, Cost Savings

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the September issue of Healthcare Hygiene magazine.

Peripheral venous catheters (PIVC) are used for the delivery of medical treatment for almost every patient admitted to acute-care and represent 95 percent of all vascular access devices. The common usage of PIVCs makes them often overlooked by medical and nursing professionals, an afterthought at best, to insert, remove, replace, as needed without careful scrutiny. Little thought is given to the sheer volume of PIVCs attempted and used in acute-care, the rate of failure, the causes of failure, the number of failed attempts and the impact on patients, the PIVC cost per patient admission, and the association of PIVCs to other outcomes such as infection and central line-associated bloodstream infections (CLABSIs). Attention to the level of waste and inefficiency with insertion and management of PIVCs can result in a higher quality of care, fewer complications, longer device survival and significant cost savings.

Consideration of the volume of PIVCs purchased, inserted, and wasted in acute care is likely higher than once thought. According to iData Research Vascular Access Report published for 2020, the number of PIVCs purchased in 2020 exceeded 380 million. The total patient admissions for the more than 6,000 hospitals in the U.S. are more than 36 million per year as reported by the American Hospital Association (AHA). Doing the math equates to over 10 PIVCs per patient admission. With a national average for a hospital stay of 4.5 days according to the Agency for Healthcare Research and Quality (AHRQ), each patient would receive more than two PIVCs or PIVC attempts per day. According to Rickard and Marsh, 30 percent to 50 percent of PIVC insertions require multiple attempts. Published evidence by Helm and Kache and associates indicate only 37 percent of PIVCs reach the end of treatment, up to 63 percent fail and require replacement. According to a recent systematic review of PIVC dwell times by Hopkinson and associates, the dwell time of a PIVC does not typically exceed an average of 3.5 days. Considering average patient length of stay (LOS) and PIVC dwell time 10 PIVCs per patient stay represents either a tremendous level of waste or an incredible number of failed PIVC attempts.

Clinicians have become complacent regarding the impact of PIVC failure and common complications of phlebitis, infiltration, and occlusion, each attributed to PIVC failure, but often not documented in the patient record. Documentation in the patient medical record is rarely accurate in recording the number of clinicians' attempts to insert PIVCs and lacking in reasons for PIVC failure. In a randomized trial, Wallis and associates studied risk factors for PIVC failure; they noted occlusion, accidental removal, and phlebitis as the reasons for catheter failure and risk factors of poor insertion location, antibiotic infusion, and current infection, to name a few. In an analysis of a U.S. hospital discharge database by Lim and associates, they reported patients with documented PIVC complications had an average hospital LOS 33 percent higher with 5.9 days versus 3.9 days with concurrent cost increase of 36 percent; most importantly, those with complications had a higher risk of death.

With the high failure rate of PIVCs and the increasing burden of PIVC complications, measures to prevent these complications are rarely considered in day-to-day practice. As hospitals and clinicians are striving to reduce the use of central venous access devices (CVADs) to avoid the financial impact of CLABSI, the volume of PIVCs is increasing along with concerns over complications. An increasing number of publications are highlighting concerns around PIVC infections and the potential impact of PIVC contamination impact on CVADs when both are present for the delivery of patient treatment. In a systematic review by Mermel in 2017, he noted a 2-64-fold greater risk of catheter related bloodstream infections from central catheters rather than PIVCs, however the volume of PIVC infections, based on the high number used per year represents a growing concern. Tagalakis and associates studied thrombophlebitis and found 5 percent to 25 percent of PIVCs are colonized at the time of removal. Even the high number of PIVC replacements and attempts contribute to a higher infection rate. Hadaway in 2012 in a published literature review conservatively estimated 165,000 patients become infected annually. Much emphasis has been given to reduction of CLABSI over the past two decades. It is now time to re-evaluate the need for educational efforts aimed at implementing preventative strategies known to reduce infection and all PIVC complications.

Strategies to reduce PIVC complications begin with education on the basic education emphasizing aseptic non touch technique, increasing clinician understanding of clean practices, skin antisepsis leading to good skin preparation prior to insertion. Simulation focused on identifying sterile versus non-sterile and how to manage supplies is needed to reinforce safe practices among clinicians. Consideration for location and appropriate vein selection can limit catheter movement, minimize catheter failure due to accidental dislodgment and set the stage for better outcomes as noted in the Wallis study. Additional specialized training and designation of vascular access specialists or teams results in more consistent first-time success and vein preservation as noted in the Steere study. Establishing competency requirements for 90 percent success on first attempt can guide the selection of qualified inserters, promoting trust and safety for the patient.

By managing policies for safe insertion practices through education and clinically indicated PIVC replacement with assessment practices monitored on a consistent basis, complications free survival of PIVC can be achieved. The cost associated with the volume and frequency of PIVC insertions, and the current level of failure touches all patients and bedside clinicians. But even more so, those same factors impact the bottom line for chief financial officers and chief executive officers of hospitals, whether they realize it or not. PIVCs and ultrasound guided peripheral catheter insertions are increasing making PIVC failure and poor practices a target for performance improvement initiatives. With the increasing concern over limited financial resources in acute care more attention should be given to the undervalued PIVC.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:
1. Clare S, Rowley S. Implementing the Aseptic Non-Touch Technique (ANTT®) clinical practice framework for aseptic technique: a pragmatic evaluation using a mixed methods approach in two London hospitals. J Infect Prev. 2018 Jan;19(1):6-15. doi: 10.1177/1757177417720996. Epub 2017 Aug 4. PMID: 29317909; PMCID: PMC5753945.
https://doi:10.1177/1757177417720996
2. Hadaway L. Short peripheral intravenous catheters and infections. Journal of Infusion Nursing. 2012 Jul 1;35(4):230-40.
3. Helm RE, Klausner JD, Klemperer JD, Flint LM, Huang E. Accepted but Unacceptable. Journal of Infusion Nursing. 2019;42(3):151-164.
4. Hopkinson SG, Green AK, Hewitt BE, Grace SA. Short peripheral catheter dwell time and associated complications: a systematic review. Journal of Infusion Nursing. 2020 Jul 1;43(4):200-7.
5. Kache S, Patel S, Chen NW, Qu L, Bahl A. Doomed peripheral intravenous catheters: Bad Outcomes are similar for emergency department and inpatient placed catheters: A retrospective medical record review. J Vasc Access. 2020; doi:1129729820974259
6. Lim S, Gangoli G, Adams E, Hyde R, Broder MS, Chang E, Reddy SR, Tarbox MH, Bentley T, Ovington L, Danker W 3rd. Increased Clinical and Economic Burden Associated With Peripheral

Intravenous Catheter-Related Complications: Analysis of a US Hospital Discharge Database. Inquiry. 2019 Jan-Dec;56. doi: 10.1177/0046958019875562. PMID: 31524024; PMCID: PMC6747868.
7. Mermel LA. Short-term peripheral venous catheter–related bloodstream infections: a systematic review. Clinical Infectious Diseases. 2017 Oct 30;65(10):1757-62.
8. Rickard CM, Marsh NM. Annals for hospitalists inpatient notes-the other catheter—the mighty peripheral IV. Annals of internal medicine. 2017 Nov 21;167(10):HO2-3.
9. Steere L, Ficara C, Davis M, Moureau N. Reaching one peripheral intravenous catheter (PIVC) per patient visit with lean multimodal strategy: the PIV5Rights™ Bundle. Journal of the Association for Vascular Access. 2019;24(3):31-43.
10. Tagalakis V, Kahn S, Libman M, Blostein M. The epidemiology of peripheral vein infusion thrombophlebitis: a critical review. Am J Med, 2002;113(2):146-151.
11. Wallis MC, McGrail M, Webster J, Marsh N, Gowardman J, Playford EG, Rickard CM. Risk factors for peripheral intravenous catheter failure: a multivariate analysis of data from a randomized controlled trial. Infection Control & Hospital Epidemiology. 2014 Jan;35(1):63-8.

The Cycle of Improvement to Lock in Quality

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the August 2021 issue of Healthcare Hygiene magazine.

The topic of discussion last month was establishing standardization with procedures and while it is beneficial to aim for standardization there must be a systematic process for evaluation, planning, education and implementation of the goal. Types of systematic approaches that work together are the Lean Six Sigma and the Plan Do Study Act (PDSA) methods. Through the application of these methods a procedure or problem is evaluated, a goal established so an implementation plan achieves the goal.

One example of a Lean Six Sigma and PDSA initiative was the PIV5Rights Bundle performed at Hartford Hospital published by Steere and colleagues. The PIV5Rights was a study and quality improvement process that applied a bundle of practices to a comparative cohort unit with one group of patient rooms under current practice and the other group with the bundle approach. The outcomes of each cohort were compared to evaluate the intravenous catheter insertions, attempts, complications and number of catheters sustained to end of treatment. By applying the PDSA approach the PIV5Rights was implemented with the goal of one PIV per patient admission.

The Lean Six Sigma and the PDSA Cycle move through three processes of investigation, Lean, Six Sigma and PDSA methods. Lean is a method taken from manufacturing that relies on a collaborative team effort to evaluate and improve performance. Lean methods can

systematically pinpoint variability in current practice leading to elimination of waste and defects resulting in greater efficiency and cost reduction. In simple terms Lean is about learning to do things better.

The Lean approach works to identify inefficiencies and waste within healthcare through situational analysis of current intravenous activities and outcomes within the 5-Ps of Process, Protocol, Practice, Products & Patient Outcomes. The Process works with clinical decision makers to uncover the current activities, and the authority for establishing and enforcing policies for past, present and plans for the future. Protocol investigation evaluates the facility policies looking at the why, when and what of protocols, then the how of procedures. The processes for Practice studies current work to define standard work considered as ideal for the procedure or practice, often associated with outcomes. Product review incorporates data collections on quantities used that relate to current practice establishing a baseline to aid in the before and after analysis. Patient outcomes applies to results of current practice that pinpoint areas that need improvement to inform the later comparison. Each of the 5-Ps are used within the Lean approach working together with Six Sigma evaluation strategies for healthcare data analysis toward improvement.

The Six Sigma strategy adds a data-driven quality tool to specifically guide a programmed approach and activity called DMAIC (pronounced Duh-May-Ick). DMAIC is an acronym for the five phases that make up the quality approach for improving, optimizing and stabilizing processes such as establishing intravenous access and delivery of infusion therapy. Six Sigma strives to identify quality processes that correct the identified defects in a system.

- D Define opportunity for improvement, project goals, and patient requirements.
- M Measure pharmacy and medical supply consumption, overall cost and performance.
- A Analyze the consumption data to determine root causes of variation and poor performance (defects).
- I Improve process performance by addressing and eliminating the root causes.
- C Control by building a system of checks and adjustments for ongoing improvement in the 5-Ps through defining current work and application of standard work to achieve the designated goals.

Applying Lean for Healthcare within Infusion Therapies

A Lean Six Sigma program begins with mutual agreement and consensus of the stakeholders from supply chain, pharmacy and in this example, the vascular access team. Provision of intravenous therapy through peripheral or central catheter access are necessary for more than 90 percent of acute-care hospital patients. The delivery of intravenous therapy requires skilled clinicians, procedures and the use of supplies and technologies. The bundle and five components, representing improvement practices and supplies, was identified through research literature review with moderate to strong evidence. Analysis of the published evidence produced a peripheral intravenous catheter (PIVC) insertion process which included a 10-step PIVC insertion and five-step overall bundle for application as standard work. Incorporation of the 5Ps of Process, Protocols, Practices, Products and Patient Outcomes into intravenous (IV) therapy for insertion and management of vascular access provides a basis for

decisions. This process uses the 5Ps as a tool to assist to differentiate the value-added actions from the non-value-added actions. In using 5Ps systematic approach waste and variability become obvious and detectable.

The Lean Six Sigma DMAIC method was used to specify standard work for PIVC insertions and best practices for PIVC management. This defined the Experimental Group method with application of the standard work in the PIV5Rights bundle. To maximize value and eliminate variability and waste, leadership in health care systems must first select a "specific clinical process" and then accurately specify the value desired by the stakeholders. The process for the PIV5Rights initiative included:

1. The first step of the LEAN PIV5Rights clearly Defined the goal of 1 PIVC per patient visit.

2. The second step Measured and determined how many catheters were being used in our hospital every year. PIVC usage for catheter consumption was collected from annualized supply chain purchasing records.

3. The third step Analyzed and compared the total hospital patient admissions, the number of PIVC purchased annually, divided by the number of patient admissions for the total and average PIVC per patient admission. Nursing labor costs were calculated based on standard work and average registered nurse (RN) salary for bedside versus vascular access specialist RN per 20-minute PIVC catheter insertion. The calculation of PIVC supplies used with each insertion established a cost basis for the control arm of average usage supplies and experimental arm with standard work supplies of IV Start Kit, chlorhexidine gluconate (CHG)/alcoholic skin antiseptic, 22g 1.75-inch catheter, anti-reflux valve needleless connector, chlorhexidine antimicrobial bordered dressing and ultrasound as needed. Ultrasound cost was not included. The annual PIVC catheter consumption data multiplied by the cost per PIVC placement established the per PIVC catheter insertion economic impact to the hospital.

4. The experimental arm Implemented the LEAN PIV5Rights bundle approach: (represented in Figure 1, Table 1)
a. Right Proficient Inserter for the least number of attempts
b. Right Insertion aseptic technique using visualization
c. Right Vein and Catheter Selection with a focus on forearm placement
d. Right Supplies and Technologies using an IV Start Kit, CHG/alcohol, 22g 1.75" catheter, anti-reflux needleless connector, and antimicrobial bordered dressing.
e. Right Management with site assessment performed every 12-24 hours with evaluation checklist and photo accountability through an iPad Cloud enabled HIPPA compliant app.

5. The cohorts were divided into the Control group with current practice procedures and the Experimental group with a centralized specialist team for PIVC insertion process.

The PIV5Rights and the bundle were based on this information: Up to 69 percent of PIVCs fail to reach end of therapy with 1 out of every 2 catheters failing prior to completion of treatment

(Marsh 2017, Helm 2015). Insertion success by clinicians ranges from 12 percent to 26 percent (Sabri 2013). The systemwide hospital review applying the Lean Six Sigma and PDSA approach revealed current practices for PIVC insertion success were 15 percent with pre-study usage of 5.6 catheters per patient visit representing an unnecessary cost waste in nursing labor and supplies. Patients complained of multiple catheter insertion attempts and complications causing failure with a need to reinsert catheters causing a delay in treatment. Peripheral intravenous catheter failure rate at this hospital was more than 50 percent within 24 hours.

The cycle of PDSA is a quality improvement method based on the scientific process where the cycle is engaged to gain information, apply the plan and study the impact. Through the planning stage a problem is identified to improve outcomes or patient care. The Do stage information from staff and records may be collected to reflect current practices and adherence to policies that support or deny the need for the proposed change or an action with the plan is applied. In the Study phase of the cycle the impact of the Do activity is analyzed leading to the Act phase where a decision is made to provide additional support through education or other activities that may lead back to re-initiation of the PDSA cycle.

The PIV5Rights is a PDSA project, Plan, Do, Study, Act processes, that applied the Lean Six Sigma method for improvement, designed to collect data of current practice, analyze the practices and apply evidence-based approach that result in cost savings. Using the information from Lean Six Sigma analysis the team was able to define a standard work process and plan with the PIV5Rights bundle that improved PIVC dwell time and patient satisfaction while lowering complications and costs.

How is PDSA Done?

- P – Plan an approach for the delivery of reliable vascular access designed to improve outcomes and reduce cost. Evaluate the problems, collect baseline data and determine objectives (i.e., inconsistency, waste and risk) and plan the intervention answering who, what, where and when with expectations of outcomes defined. Perform data collection and evaluation of current practices. Evaluate practices within the emergency department (ED) for consistency and whether study should include PIVC insertions by specialists within the ED. Analyze documentation practices within the ED and general floor units in relation to PIVC insertion practices, number of attempts, etc. Determine study period and optimal number of patients to be enrolled in each group that establish adequate power for statistical significance. Determine total admissions per year. Collect data on PIVC usage/consumption and supplies used with insertions x one year. Gain approval for products within the PIV5Rights, not already in use. Determine Institutional Review Board requirements for submission and study process with performance improvement initiative if there is an intention to publish.

- D – Select optimal unit and staff (proficient inserters and daily assessment staff) within the hospital to begin the study. Begin the intervention within designated unit and rooms and provide education (i.e., PIV5Rights). Collect results of the intervention with data collection through paper tools or digital processes. Determine supplies and products used in comparison to PIV5Rights.

• S – Study and evaluate the evidence/data comparing the results to current practice and expectations to see if the problem is corrected and standardization achieved. Analyze data to determine what is needed, what supply substitutions would apply and evaluate policies for when a PIV is restarted (e.g., loose dressing, non-standard dressing with tape or lack of securement, patient complaint of pain or discomfort, location not consistent with INS Standards, etc.). Work together with the research department for statistical review and study conclusions. Summarize what was learned.

• A – Act to determine gaps, areas still needing improvement and if additional education or intervention is needed. If areas are identified for continued improvement begin the PDSA again with a goal to promote even better results in the next cycle. Complete the cycle by expanding the application and implement the process like the PIV5Rights bundle hospital wide.

PDSA Results

Based on the hypothesis that a PIV5Rights bundle and standard work would increase dwell time and reduce PIVC overall complications to achieve one PIVC per patient visit the results of the experimental group demonstrated 89 percent success with patients reaching the end of treatment with one PIVC by applying the PIV5Rights bundle of practices. In addition, outcomes for PIVC complications were reduced from 40 percent in the control group to 11 percent in the experimental group. This same study achieved a 75 percent reduction in PIVC insertion and supply costs with greater than $6,000 per patient per bed cost savings. The PIV5Rights Patient Safety initiative at Hartford Hospital was an excellent application of the Vessel Health and Preservation pathway model for achieving the best outcomes for patients. For more detailed information on this study the publication is available as open access Steere 2019 https://bit.ly/3f7ONen.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:

Bahl A, Hang B, Brackney A, et al. Standard long IV catheters versus extended dwell catheters: a randomized comparison of ultrasound-guided catheter survival. Am J Emergency Med. 2019 Apr 1;37(4):715-21.

DeVries M. Beyond Bean Counting: Gathering and Using Data to Drive Improvements. J Infusion Nurs. 2021 Jan 1;44(1):41-8.

Elli S, Abbruzzese C, Cannizzo L, Lucchini A. In vitro evaluation of fluid reflux after flushing different types of needleless connectors. J Vascular Access. 2016 Sep;17(5):429-34.

Gibson SM, Primeaux J. Do Needleless Connector Manufacturer Claims on Bidirectional Flow and Reflux Equate to In Vitro Quantification of Fluid Movement? JAVA. 2020 Dec 1;25(4):28-36.

Gorski L, Hadaway L, Hagle M, et al. (2021) Infusion Therapy Standards of Practice, 8th Edition. J Infusion Nurs. 2021;44(1S):S1-S224. https://doi:10.1097/NAN.0000000000000396

Hadaway L, Richardson D. Needleless connectors: a primer on terminology. Journal of Infusion Nursing. 2010 Jan 1;33(1):22-31.

Hadaway L. Needleless connectors: improving practice, reducing risks. JAVA. 2011;16(1):20-33.

Helm RE, Klausner JD, Klemperer JD, Flint LM, Huang E. Accepted but unacceptable: peripheral IV catheter failure. J Infusion Nurs. 2015 May 1;38(3):189-203.

Hull GJ, Moureau NL, Sengupta S. Quantitative assessment of reflux in commercially available needle-free IV connectors. J Vascular Access. 2018 Jan;19(1):12-22.

Jasinsky LM, Wurster J. Occlusion reduction and heparin elimination trial using an antireflux device on peripheral and central venous catheters. J Infusion Nurs. 2009 Jan 1;32(1):33-9.

Jones RK. Short peripheral catheter quality and economics: the intravenous quotient. J Infusion Nurs. 2018 Nov 1;41(6):365-71.

Marsh N, Webster J, Larson E, et al. Observational Study of Peripheral Intravenous Catheter Outcomes in Adult Hospitalized Patients: A Multivariable Analysis of Peripheral Intravenous Catheter Failure. J Hosp Med. 2017 Oct 18;13(2):83-9.

Maunoury F, Motrunich A, Palka-Santini M, etal. Cost-effectiveness analysis of a transparent antimicrobial dressing for managing central venous and arterial catheters in intensive care units. PLoS One. 2015 Jun 18;10(6):e0130439.

Morrell E. Reducing risks and improving vascular access outcomes. J Infusion Nurs. 2020 Jul;43(4):222.

Sabri A, Szalas J, Holmes KS, et al. Failed attempts and improvement strategies in peripheral intravenous catheterization. Bio-medical Mat Engineering. 2013 Jan 1;23(1-2):93-108.

Steere L, Ficara C, Davis M, Moureau N. Reaching one peripheral intravenous catheter (PIVC) per patient visit with lean multimodal strategy: the PIV5Rights™ Bundle. JAVA. 2019;24(3):31-43.

Steere L, Rousseau M, Durland L. Lean six sigma for intravenous therapy optimization: a hospital use of lean thinking to improve occlusion management. JAVA. 2018 Mar 1;23(1):42-50.

Wallis MC, McGrail M, Webster J, et al. Risk factors for peripheral intravenous catheter failure: a multivariate analysis of data from a randomized controlled trial. Infect Control Hosp Epidemiol. Jan;35(1):63-8. 2014.

Standardization of Procedures for Safety, Quality and Savings

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the July 2021 issue of Healthcare Hygiene magazine.

The goal inherent in any healthcare service is to better the health of patients, usually through treatment and procedures. It is a given that patient safety and quality go hand in hand. But where and how is quality reflected in healthcare practices and how can it be improved, and even guaranteed? Standardization provides a means to minimize errors, increase patient safety, reduce inconsistency, avoid complication, diminish waste, and even improve the patient experience. When reviewing definitions and applications of standardization, it is evident that instituting this process can result in improvement in healthcare practices at many levels.

Many guidelines and standards have been published, with the intention that they will be applied to patient care to improve and guide practices. Application of these standards from hospital to hospital is inconsistent because healthcare systems pick and choose which guidelines to apply and which ones to ignore. In actual hospital practices, how often are systematic processes for standardization applied to healthcare procedures, and even more importantly, monitored for compliance? Creating a safe healthcare environment requires quality, reflected in the level of consistency in the application of evidence-based practices by every clinician.

Standardization, according to the Corporate Finance Institute, is the process of creating rules to guide good service and results. Merriam-Webster defines standardizing as a method to bring a process into conformity to ensure consistency and regularity. In an essay for Process Street, Benjamin Brandall says that standardization brings about improvement in quality, productivity, and overall morale. Standardization can be generalized for healthcare as the processes and procedures that allow each patient to receive the same level of care. The Institute for Healthcare Improvement (IHI), in an article by Rozich and associates, describes standardization as a mechanism to improve safety in healthcare. IHI provides more guidance through its published document, “Four Steps for Developing Reliable Processes,” in which it describes the institution of reliable systems and standardization as a step to reduce defects, increase consistency, and improve patient outcomes. With these insights in mind, standardization could be viewed as a method necessary to bring about and sustain quality in healthcare.

Application of standardization in procedures requires investigation to pinpoint gaps and inconsistencies in practices. The development of policies and procedures by U.S. hospitals and groups was designed to fulfill procedural standardization but falls short of truly applying the necessary levels of safety, consistency, and quality to every procedure. Most clinicians are required to read policies and procedures during orientation to a facility, but they may never

refer to those policies again. More hospitals are moving to boilerplate policies developed by large organizations such as Lippincott, which may not reflect actual practice and the details necessary to gain the value of standardization.

The basic premise of standardization is establishing a set of steps to direct consistent actions, such as within one procedure. A good example of standardization is in the application of the Central Line Bundle by Peter Pronovost and associates, known as the Michigan Keystone Project. This initiative implemented a set of five practices, or a bundle, that integrated the Centers for Disease Control and Prevention (CDC) guidance into a checklist for insertion of central venous catheters. The bundle first was applied in intensive care areas, and its use later expanded worldwide as a top-level method to ensure patient safety in preventing central line-associated bloodstream infections (CLABSI). This simple bundle standardized insertion practices and has contributed to a significant reduction in CLABSIs since 2008. Bundles became more popular through support of the IHI and other organizations, which defined a bundle as a small but critical set of processes, determined by Level 1 evidence, applied collectively and reliably as a structured way of performing a process of care to improve patient outcomes. Bundles are an excellent example of standardization when all components are performed, and a high level of compliance is confirmed through monitoring. According to David Mann, a fixed operations trainer with DLM Solutions, “You must inspect what you expect.”

An example of identification of gaps in standardized practices is with products such as with needleless connectors. Many facilities utilize multiple brands and types of needleless connectors, resulting in confusion among clinicians about the most appropriate instructions to use for clamping, changing, and disinfecting. In her 2010 and 2011 publications on needleless connectors, Hadaway noted that there are many different devices with differing internal and external designs, causing much confusion within facilities. Her survey showed that 24 percent of respondents were not taught, did not have a standard method for clamping, or did not know the type of needleless connector used by their facility. Of that subgroup, 65 percent said their facility consistently used the same connector.

By standardizing with one brand of needleless connector, staff confusion is reduced and a higher level of consistency is achieved for correct use with disinfecting, flushing, drawing blood cultures, clamping, and replacing connectors. The choice of products often is made amidst pressure from buying consortiums and compliance with the aim of driving down price. These choices may result in use of lower-quality products and poor consistency in practices, with patients paying the ultimate price. Choice of products should be evidence-driven with thought given to standardization throughout facilities.

Standardization promotes patient safety by reducing variability, increasing consistency, and reducing risk. A gap analysis and identification of practice and procedural variation, with the goal of establishing standard processes to integrate guidelines, is a necessary part of determining which practices have the greatest risk. Research indicates that relatively few U.S. healthcare facilities have established a standardized process for maintaining aseptic technique during ultrasound-guided PIV (UGPIV) insertions. In a recent survey by the author on UGPIVs,

more than 1,000 clinicians reported their common practices and supplies used with the procedure. From the survey responses, it was apparent that many clinicians were unclear about methods for protecting the transducer probe and what supplies to use. Respondents often said that they “sometimes used one item and other times used another.” The research revealed significant levels of variation in the UGPIV procedure with application of proper aseptic technique, even between departments within the same hospital.

While policies and procedures, along with training, are instituted before clinicians can qualify to perform these UGPIV procedures, little follow-up guidance or observation of compliance is evident. On-the-job training, see one do one teach one, activities also are part of the UGPIV process of learning and are totally lacking in consistency from department to department. Accountability is not required, and patients suffer from the learning curve of UGPIV insertions and multiple attempts to gain successful catheter placement. Ensuring that all staff behave and perform consistently at the highest level of care is challenging, but with every example of standardization, the levels of quality increase, risk and inefficiency are reduced, and quality control is elevated. This guarantees that processes minimizing those crucial elements or steps of quality are not overlooked. According to David Mann, “It is easier to manage a process than a behavior.”

The variability of clinician behavior may reflect their drive to complete tasks quickly, with supplies on hand, and to move quickly to the next patient. While this may be an oversimplification, and one hard to validate, the UGPIV study of supply usage demonstrates the inconsistencies present in this procedure. The inconsistencies manifest in healthcare, with patient reports of many IV attempts, increasing costs associated with supply usage, ineffective training, lack of oversight to verify competency, and waste in many procedures.

The Lean healthcare standard work approach to healthcare, coupled with a Six Sigma systematic evaluation process, can be used to identify areas of waste and apply methods of improvement. In the 2019 study by Steere and associates, they applied a five-component bundle, termed the PIV5Rights Approach, with standard work to reduce waste associated with peripheral catheter insertions. The results of this study were a significant increase in successful insertions by a trained team using ultrasound, longer catheters, anti-reflux needleless connectors, and antimicrobial dressings. They demonstrated longer dwell time, with one catheter used through the completion of therapy in 89 percent of cases. The annual savings reflected in this quality initiative exceeded $2 million. A similar approach was used by Morrell and associates for performance improvement, with institution of a policy that integrated catheters would be inserted by a specialized team and site assessments would be performed. Similar results were achieved with fewer attempts, longer dwell time, and annual savings of almost $200,000. When quality is an issue during highly invasive procedures such as IV catheter insertions, the result is higher risk and cost. By establishing standardized processes and procedures within a specialized team, these risks are reduced, waste is minimized, and as a result, cost savings are achieved.

Work and staff activities can be further standardized by establishment of consistent processes for education and training. As discussed in previous columns, improved outcomes for patients are evidence of the value of consistent education. Education and training for clinicians reduces the likelihood that quality elements of procedures are not overlooked. Integrating standardization within training policies and requirements sets a level at which staff must qualify and maintain competency for these high-risk procedures. Establishing training criteria and benchmarks for achievement, with monitoring of performance and competence, ensures a higher level of quality in any facility. In her 2021 publication, DeVries noted that data collection and outcome measures for vascular access procedures are recommended to achieve the level of quality performance that reflects a commitment to patient safety. The provision of education and training should be followed by a combination of strategies to verify performance and compliance with procedures. As recommended by DeVries, some strategies include collaborative observation and bedside rounding, staff and patient interviews, chart review, and data mining that leverages electronic medical record reports. Analysis and application of data should motivate change to improve performance. Education about results provides a basis for communication and motivation for change.

By working together collaboratively in a committee process or with study initiatives, professionals in infection prevention, pharmacy, supply management, specialists in vascular access and administration can identify areas of procedural variability, create standard work for integrating guidelines and evidence, develop plans for increasing education and communication of the standard work, and periodically evaluate the results of each action to verify the quality. As providers strive to improve the patient experience and provide value-based care, standardized procedural steps and order sets can provide a means to ensure a patient-centric approach to consistent and efficient care. In a white paper recently released by iPro, standardization was addressed with an emphasis on standardized order sets. They also noted that the Institute for Safe Medical Practices encourages standard order sets to improve care by integrating and coordinating multidisciplinary care, reduce errors, and apply evidence-based practices. As quality in the provision of treatment and services increases, so, too, is patient satisfaction elevated. Standardization can not only improve the patient experience but also support positive word-of-mouth marketing, improve staff satisfaction minimizing clinical workload, and enhance efficiency that reduces waste. When standardization in practice is established and treatment consistency becomes the norm, costs go down, all based on taking fewer unnecessary actions, using less supplies, saving time, and avoiding complications.

In conclusion, the benefits associated with application of standardization to procedures, processes, education, training, and order sets include improved clarity that minimizes guesswork, optimizes work leading to higher quality results, enhances productivity resulting from greater staff understanding, and improves patient and staff experiences, based on consistency and the knowledge that services are provided in the best way possible. Working together to establish standardization in products, education, and training, through the application of specialized teams for higher-risk procedures and establishing committees to identify gaps in practice and procedures that need a defined set of steps, including application of guidelines, all are examples of actions that increase quality and, as a result, improve patient

outcomes to drive down healthcare cost. Consider standardization of procedures as a means to secure safety, quality and savings within your healthcare services.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:

Brandall B. Why Process Standardization Improves Quality, Productivity, and Morale. https://www.process.st/process-standardization/

Clare S, Rowley S. Implementing the Aseptic Non Touch Technique (ANTT®) clinical practice framework for aseptic technique: a pragmatic evaluation using a mixed methods approach in two London hospitals. J Infect Prev. 2018 Jan;19(1):6-15. doi: 10.1177/1757177417720996. Epub 2017 Aug 4. PMID: 29317909; PMCID: PMC5753945. https://doi:10.1177/1757177417720996

DeVries M. Beyond Bean Counting: Gathering and Using Data to Drive Improvements. J Infusion Nurs. 2021 Jan 1;44(1):41-8.

Drafz M, Goeller K, Dizon B, Buc D, Moureau N. Efforts Toward Standardization of UGPIV Insertion through Quantitative Clinical Product Evaluation. Association for Vascular Access Annual Scientific Conference; Scientific Abstract Poster Oct. 5, 2019; Las Vegas.

Gorski L, Hadaway L, Hagle M, Broadhurst D, Clare S, Kleidon T, Meyer B, Nickel B, Rowley S, Sharpe E, Alexander M. (2021) Infusion Therapy Standards of Practice, 8th Edition. J Infusion Nurs. 2021;44(1S):S1-S224. https://doi:10.1097/NAN.0000000000000396

Guideline for Ultrasound Transducer Cleaning and Disinfection [policy statement]; 2018. https://www.acep.org/patient-care/policy-statements/guideline-for-ultrasound-transducer-cleaning-and-disinfection/

Hadaway L, Richardson D. Needleless connectors: a primer on terminology. J Infusion Nurs. 2010 Jan 1;33(1):22-31.

Hadaway L. Needleless connectors: improving practice, reducing risks. J Assoc Vascular Access. 2011;16(1):20-33.

iPro. How to Standardize Order Sets and Aid Value Based Care with Disruptive Technology. 2021. https://cdn.baseplatform.io/files/base/ebm/hci/document/2021/05/iPro_WP___How_to_Standardize_Order_Sets_and_Aid_Value_Based_Care_with_Disruptive_Tech.60ac088a1dd84.pdf

Morrell E. Reducing risks and improving vascular access outcomes. J Infusion Nurs. 2020 Jul;43(4):222.
Moureau N, Gilbert GE. Survey of ultrasound-guided peripheral intravenous practices: a report of supply usage and variability between clinical roles and departments. J Assoc Vasc Access. 2020;25(3):1–11; https://doi:10.2309/java-d-20-00021

Pronovost P. Interventions to decrease catheter-related bloodstream infections in the ICU: the Keystone Intensive Care Unit Project. Am J Infect Control. 2008 Dec 1;36(10):S171-e1. Doi: 10.1016/j.ajic.2008.10.008

Rozich JD, Howard RJ, Justeson JM, Macken PD, Lindsay ME, Resar RK. Standardization as a mechanism to improve safety in health care. Joint Commission Journal on Quality and Safety. 2004;30(1):5-14.

Steere L, Ficara C, Davis M, Moureau N. Reaching one peripheral intravenous catheter (PIVC) per patient visit with lean multimodal strategy: the PIV5Rights™ Bundle. J Assoc Vascular Access. 2019;24(3):31-43.

The Lowdown on Ultrasound Transducer Disinfection: Intersocietal Endorsement for Low-Level Disinfection with UGPIV

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the June 2021 issue of Healthcare Hygiene magazine.

In healthcare practices today there is increasing use of advanced ultrasound visualization for vein assessment and percutaneous procedures. Concerns over transmission of microorganisms on ultrasound transducers has driven the need to establish guidelines and policies on the most appropriate type of procedure and disinfection prior to patient use. During percutaneous procedures such as biopsies and vascular access device insertions, the skin is punctured by the needle during the ultrasound guided insertion, exposing the patient to the surface of the transducer, if uncovered. The Spaulding Classification for processing medical devices with disinfection and sterilization recommendations was published in 1957 and is still applied, in many instances, for medical device policies establishing the necessary low or high-level disinfection for equipment used in procedures. More recent publications by various associations have put into question the application of the Spaulding criteria for these percutaneous procedures.

The associations of American College of Emergency Physicians (ACEP), the American Institute of Ultrasound in Medicine (AIUM), The Association of Professionals in Infection Control and Epidemiology (APIC), the Association for Vascular Access (AVA), and the Society for Healthcare Epidemiology of America (SHEA) each collaborated on an intersocietal position paper (ISPP) addressing the issue of disinfection of ultrasound transducers/probes for percutaneous procedures. These organizations recognized the need to clean transducers after procedures to limit transmission of pathogenic organisms. The organizations reviewed the literature, the current level of transducer protection, and formulated a statement that endorsed the use of low-level disinfection for transcutaneous ultrasound transducer cleaning and disinfection when used for percutaneous procedures.

Ultrasound is used for many different procedures, performed both internally with endocavitary use of transducers, and externally on the skin with percutaneous applications. Percutaneous procedures, such as peripheral or central venous catheter placement, are performed through intact skin with needle punctures into a vein. While endocavitary and percutaneous procedures differ in terms of the level of risk, the higher risk with endocavitary ultrasound, the consistent link between the two procedures is that the transducer is typically covered with nonsterile or sterile covers used during the invasive aspect of either procedure to prevent direct contact with the mucous membrane or skin. Simple ultrasound assessment through intact skin is commonly performed without transducer covers with the assumption that low-level disinfection of the transducer was performed prior to the assessment and following the procedure.

The determination of low-level or high-level disinfection has frequently been made according to the Spaulding Classification, or in consideration for patient risk with the procedure. Ultrasound guided peripheral catheter insertion (UGPIV) is considered a non-critical application that is sometimes confused with semi-critical according to the ISPP and thus, within the Spaulding recommendations would require high-level disinfection in all instances. Low-level disinfection is recommended for non-critical percutaneous procedures and intended to include UGPIV insertions as a clean process where transducer low-level disinfection has eliminated up to 99% of pathogens. Ultrasound manufacturers list recommended agents for disinfection that can safely be used and avoid damage to transducers.

High-level disinfection is considered appropriate for sterile semi-critical and critical procedures that involve agents or disinfecting processes designed to sterilize the surface of the transducer. These substances and processes take considerable time, may damage the transducer, and represent a significantly higher cost for the process. According to the ISPP on transducer disinfection, low-level disinfection is adequate for percutaneous procedures, especially when transducer covers are included in the invasive portion of the procedure.

In the ISPP the recommendations describe ultrasound transducers used for percutaneous procedures as similar to handwashing where hands are not sterilized prior to glove application, the covering for the transducer providing the same type of adequate protection during the procedure as gloves for the hands. Transducer covers, both non-sterile and sterile, afford considerable protection from procedural contamination, but must be used in conjunction with

gel on the skin, in most cases. Acoustic couplant gel is used for UGPIV insertions and can be a source of contamination when care is not taken in choosing the type, sterile or non-sterile, and packaging, multi-use bottle or single packet gel. New types of transducer covers, and separating dressings, provide options that eliminate or remove gel from the needle puncture site. Procedural areas free from gel eliminate a level of infection risk, reduce post insertion contamination, and can significantly speed clean-up.

The aseptic no-touch or non-touch technique (ANTT) is gaining acceptance as a safe and consistent practice for percutaneous procedures. In a critical review of Infection Control Policies by Daugherty and Blebea in 2021, they supported the use of low-level disinfection and the aseptic no-touch technique with transducer/probe cover protection and gel removal or separation prior to puncture. The goal of ANTT is to maintain asepsis of the prepared skin puncture area, needle, tip of the syringe, and other key covered device parts, while performing the clean procedure, as applicable to ultrasound guided peripheral catheter insertions. The ANTT framework of practice, created by Stephen Rowley and Simon Clare, provides a method to teach clinicians the foundational aspects and practical application of aseptic technique, an area of practice and education that can aid infection control and prevention.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:
1. Abdelfattah R, Al-Jumaah S, Al-Qahtani A, Al-Thawadi S, Barron I, Al-Mofada S. Outbreak of Burkholderia cepacian bacteremia in a tertiary care centre due to contaminated ultrasound probe gel. J Hosp Infect 2018;98(3):289-94.
2. Adhikari S, Blaivas M, Morrison D, Lander L. Comparison of infection rates among ultrasound-guided versus traditionally placed peripheral intravenous lines. J Ultrasound Med 2010;29(5):741-7.
3. AIUM. Guidelines for Cleaning and Preparing External and Internal-Use Ultrasound Transducers and Equipment Between Patients as well as Safe Handling and Use of Ultrasound Coupling Gel; 2020. https://www.aium.org/officialStatements/57.
4. American Institute of Ultrasound in Medicine Practice Parameter for the Performance of Selected Ultrasound Guided Procedures. 2014; www.aium.org/resources/guidelines/usguidedprocedures.pdf. Accessed December 16, 2020.
5. American Institute of Ultrasound in Medicine. Guidelines for Cleaning and Preparing External- and Internal-Use Transducer and Equipment Between Patients as well as Safe Handling and Use of Ultrasound Coupling Gel. http://www.aium.org/OfficalStatements/57.
6. Bahl A, Hijazi M, Chen NW, Lachapelle-Clavette L, Price J. Ultralong versus standard long peripheral intravenous catheters: a randomized controlled trial of ultrasonographically guided catheter survival. Annals of emergency medicine. 2020 Aug 1;76(2):134-42. https://doi.org/10.1016/j.annemergmed.2019.11.013
7. Basseal J, Westerway S, Hyett J. Analysis of the integrity of ultrasound probe covers used for transvaginal examinations. Infection, Disease, and Health. 2020; 25:77-81.

8. Blanco P. Ultrasound-guided peripheral venous cannulation in critically ill patients: a practical guideline. The ultrasound journal. 2019 Dec;11(1):1-7. https://doi.org/10.1186/s13089-019-0144-5
9. Carrico R, Furmanek S, English C. Ultrasound probe use and reprocessing: Results from a national survey among U.S. preventionists. American Journal of Infection Control. 2018; 46:913-20.
10. Centers for Disease Control. Chemical Disinfectants, Guideline for Disinfection and Sterilization in Healthcare Facilities (2008). www.cdc.gov/infection control/guidelines/disinfeciton/disinfection-methods/chemicals.html. Accessed May 25, 2021.
11. Centers for Disease Control. Guideline for Ultrasound Transducer Cleaning and Disinfection. https://www.cdc.gov/infectioncontrol/guidelines/disinfection/cleaning.html. Accessed May 25, 2021
12. Cervini P, Hesley G, Thompson R, Sampathkumar P, Knudsen J. Incidence of Infectious Complications After an Ultrasound-Guided Intervention. AJR 2010; 195:846-50.
13. Clare S, Rowley S. Implementing the Aseptic Non Touch Technique (ANTT®) clinical practice framework for aseptic technique: a pragmatic evaluation using a mixed methods approach in two London hospitals. J Infect Prev. 2018 Jan;19(1):6-15. doi: 10.1177/1757177417720996. Epub 2017 Aug 4. PMID: 29317909; PMCID: PMC5753945.
https://doi:10.1177/1757177417720996
14. Costantino T, Parikh A, Satz W, Fojtik J. Ultrasonography-guided peripheral intravenous access versus traditional approaches in patients with difficult intravenous access. Annals of Emergency Medicine, 2005, 46(5):456-461.
https://doi.org/10.1016/j.annemergmed.2004.12.026
15. Daugherty SF, Blebea J. The Need for Participation in Development and Critical Review of Recommendations for Infection Control Policies Involving Vascular Ultrasound. Journal of Vascular Surgery: Venous and Lymphatic Disorders. 2021 Mar 15.
https://doi.org/10.1016/j.jvsv.2021.02.017
16. Drafz M, Goeller K, Dizon B, Buc D, Moureau N. Efforts Toward Standardization of UGPIV Insertion through Quantitative Clinical Product Evaluation (UltraDrape). Association for Vascular Access Annual Scientific Conference; Scientific Abstract Poster October 5, 2019; Las Vegas, NV.
17. Egan G, Healy D, O'Neill H, et al. Ultrasound guidance for difficult peripheral venous access: systematic review and meta-analysis. Emergency Medicine Journal 2013;30:521-526.
https://emj.bmj.com/content/30/7/521
18. Gorski L, Hadaway L, Hagle M, Broadhurst D, Clare S, Kleidon T, Meyer B, Nickel B, Rowley S, Sharpe E, Alexander M. (2021) Infusion Therapy Standards of Practice, 8th Edition. Journal of Infusion Nursing. 2021;44(1S):S1-S224. https://doi:10.1097/NAN.0000000000000396
19. Guideline for Ultrasound Transducer Cleaning and Disinfection [policy statement]; 2018. https://www.acep.org/patient-care/policy-statements/guideline-for-ultrasound-transducer-cleaning-and-disinfection/ Accessed May 25, 2021.
20. Moureau N, Gilbert GE. Survey of ultrasound-guided peripheral intravenous practices: a report of supply usage and variability between clinical roles and departments. J Assoc Vasc Access. 2020;25(3):1–11; https://doi:10.2309/java-d-20-00021
21. Oleszkowicz S, Chittick P, Russo V, Keller P, Sims M, Band J. Infections Associated with Use of Ultrasound Transmission Gel: Proposed Guidelines to Minimize Risk. Infection Control and

Hospital Epidemiology. 2012; 33:1235-7.
22. Rutala W, Weber D. Guideline for Disinfection and Sterilization in Healthcare Facilities (2008).
23. Society of Diagnostic Medical Sonographers. Guidelines for Infection Prevention and Control in Sonography: Reprocessing the Ultrasound Transducer. J Diag Med Sonog 2020; 36:381-403.
24. Solaimalai D, Ragupathi N, Ranjini K, Paul H, Verghese V, et al. Ultrasound gel as a source of hospital outbreaks: Indian experience and literature review. Indian J Med Microbiol. 2019;37(2):263-7.
25. Spaulding E. Chemical disinfection and antisepsis in the hospital. Hosp Res 1957;9:5-31.
26. Thompson J, Garrett JH. Transducer disinfection for evaluation and insertion of peripheral and central catheters for vascular access teams and clinicians. J Vasc Access 2018; 23:141–146.
27. Thorn S, Gopalasingam N, Bendtsen TF, Knudsen L, Sloth E. A technique for ultrasound-guided blood sampling from a dry and gel-free puncture area. J Vasc Access. 2016;17(3):265-268.
28. US Food and Drug Administration. Safety communication: bacteria found in other-sonic generic ultrasound transmission gel poses risk of infection. http://dhhs.ne.gov/han%20Documents/Advisory042012.pdf. Accessed May 25, 2021.

Consistent Competency Assessment as a Reflection of Quality and Safety

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

This column originally appeared in the May 2021 issue of Healthcare Hygiene magazine.

To continue with the theme from last month that focused on the value of education for infection prevention, competency assessment to validate clinician performance is also a method to insure a high level of quality and patient safety with highly invasive procedures. In terms of nursing and medical staff performance competency or credentialing for procedures, the process for evaluation is often completed initially, and then not consistently reevaluated. In this era of electronic medical record implementation, many prior data collection reports with procedures for patient outcomes are still awaiting reinstitution. Outcome monitoring, through data collection reporting and analysis, functions to evaluate clinician performance or deficits. Competency assessment through observational checklists, outcome monitoring, and to some degree, professional certification constitutes much-needed level of evaluation of adequate performance and facility quality that reflects a commitment to patient safety.

As technologies and product complexities have increased more and more procedures require a prior demonstration of understanding and performance that reflect adequate competency with the steps, supplies and necessary equipment used in the procedure (Hulse, 2013). As previously noted in the column on education, adequate education leads to better outcomes. But how do we evaluate adequate education and how can procedural competencies be measured consistently? Equipment manufacturers used to take a more active role in the provision of

education, prior to country wide concerns over the influence on purchasing and agreements (McMahon, 2017). Hospitals are hesitant to allow sales representatives into hospitals to train or supervise, as a result some hospitals have seen a decline in clinician education. But who is evaluating and who is watching?

With patient safety and liability concerns on the rise, it is imperative that standardized processes and tools be developed that will ensure the competency of practitioners performing invasive procedures (Moureau, 2013). Defining a competent practitioner is a difficult task. Initial competence is often determined following a pre-determined number of procedures and subjective assessment by a supervisor who may or may not be qualified. An alternative method is a process that includes the completion of a written test that assesses the practitioner's level of cognitive knowledge of the procedure, in conjunction with supervised practice to test the practitioner's ability to perform the procedure to a satisfactory standard. Following successful completion and supervised competency assessment for patient insertions, the inserter should be responsible to seek out on-going competency assessment by a supervisor or peer at least every two years and registering the completion of the process in the employee documentation.

We know from the literature that an inverse relationship exists with healthcare professional experience and their rate of complications (Moureau, et al., 2013). Procedures performed less frequently and by less experienced physicians and nurses are more likely to have complications. Patient outcomes improve with education, hands-on training, and adequate procedural volume. Validation of understanding and performance through Global Rating Scales or checklists can provide some level of assurance of competency with the procedures. A more accurate level of assessment can be added to the competency assessment checklist in the form of outcome monitoring of procedures performed and associated complications.

Highly invasive procedures, such as central line insertions, should have automatic reporting of complications to the inserter and to the department head. Feedback to the inserter provides the opportunity for self-improvement. Feedback to the department head allows allocation of educational resources to correct any demonstrated deficits and address the problems to prevent reoccurrence. While central line-associated bloodstream infection (CLABSI) committees perform root or common cause analysis (RCA/CCA), they rarely involve the inserter or report back to the inserter.

Improvement is most effective when the inserter is involved in the process of identifying potential sources of contamination.
Inserter responsibility and commitment to high quality may be reflected in professional certification. According to one report by Chopra and associates noted that certified inserters were more likely to apply evidence-based practices known to reduce complications (Chopra, et al., 2017). Certification and re-certification require the clinician to renew on a two- or three-year cycle of renewal, complete education, and in some cases, require insertion procedure documentation and competency assessment. Certification requirements that include inserter competency assessment provide the employers with consistent documentation which can form the foundation for the completion of competency policy requirements. Maintaining

certification status reflects a level of professional accountability and may demonstrate their commitment as a life-long learner.

Insertion procedures performed on patients are highly invasive and constitutes a level of risk that should be monitored through competency assessment and monitoring of patient outcomes. These procedures require highly trained and skilled staff to perform safe procedures, but also require oversight to insure the integration of key infection prevention and safety practices (Moureau, 2019). Hospitals that apply recommendations, guidelines, current standards, and competency assessment of inserters provide patients with the highest quality care. Provision of consistent education, competency assessment and outcome monitoring improve outcomes, limit liability, and serve to reduce the cost of healthcare, while providing the patient with safe treatment delivery.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:
Chopra V, Kuhn L, Vaughn V, Ratz D, Winter S, Moureau N, Meyer B, Krein S. CE: original research: does certification in vascular access matter? An analysis of the PICC1 Survey. Am J Nurs. 2017 Dec 1;117(12):24-34.
Hulse AL. Clinical competency assessment in intravenous therapy and vascular access: part 2. British J Nurs. 2013;22(17):1008-13.
McMahon GT. Independence from industry cannot be compromised. Journal of European CME. 2017 Jan 1;6(1):1393296.
Moureau N. Safe patient care when using vascular access devices. British Journal of Nursing. 2013 Jan 24;22(Sup1):S14-21.
Moureau N, Lamperti M, Kelly LJ, Dawson R, Elbarbary M, Van Boxtel AJ, Pittiruti M. Evidence-based consensus on the insertion of central venous access devices: definition of minimal requirements for training. British journal of anaesthesia. 2013 Mar 1;110(3):347-56.
Moureau NL. Vessel health and preservation: the right approach for vascular access. Springer Nature; 2019.

Aseptic Technique and Back to the Basics With ANTT Best Practices

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

This column originally appeared in the April 2021 issue of Healthcare Hygiene magazine.

In today's world of healthcare there is so much distracting information, about products and new policies, downsizing to manage costs, and necessary activities to manage crises like COVID-19, that we have little time to focus on basic safety practices. Basic practices like attention to good cleaning of skin and access points prior to procedures are often overlooked or given brief action. While education in healthcare curriculum intends to cover asepsis and sterile

procedures, many of the foundational concepts of clean hands and establishing a clean working area are forgotten as we give attention to the equipment and the need to hurry through the procedure and be ready to move to the next patient. Concerns over infection associated with peripheral intravenous insertions and management, as noted in the recent ECRI Safety Report, require us to reassess our monitoring practices and educational efforts that ensure the best outcomes for our patients.

We can learn much from our colleagues in the United Kingdom (UK) who emphasize an educational process known as Aseptic Non Touch Technique, or ANTT, as required training for all clinicians interacting with patients and procedures, in keeping with the information available at the Association for Safe Aseptic Practices (ASAP www.antt.org/ANTT_Site/home.html).

The ANTT model and principles were originally developed by Stephen Rowley and Simon Clare, received fast adoption by the National Health System (NHS) of the UK, are incorporated into all NHS hospital policies, and generally accepted across Europe within healthcare practices. Some standard language within the ANTT policies are as follows: “The hospital has adopted a specific type of aseptic technique known as ‘Aseptic Non Touch Technique’ (ANTT) as the chosen method for any aseptic procedure that breeches the body’s natural defenses (The ASAP, 2015). All staff involved in aseptic procedures must complete ANTT training and be assessed as competent or provide written evidence of ANTT competence from another NHS organization. All staff have a role in ensuring their own and others’ compliance with ANTT.” These principles of ANTT include the concepts that asepsis is the aim for all invasive clinical procedures and should be standardized with training incorporated within all healthcare worker training.

ANTT education is achieved with attention to patient procedures and supplies used within those procedures for key-site and key-part protection from microorganisms. Basic precepts of always washing hands prior to the procedure, never contaminate covered key parts, touch other supply items as needed within the clean field and take appropriate infection prevention precautions, are emphasized in ANTT training. Within this ANTT model procedures are identified as Standard ANTT and Surgical ANTT which serve to establish the type of procedure for general asepsis or surgical critical sterile practices.

The Standard ANTT approach is applied to procedures such as peripheral intravenous (IV) catheter insertions, venipuncture, and wound care, that are considered general critical procedures, short in duration (>20 minutes), not significantly invasive or technically complicated, and involve minimal key parts. The focus of Standard ANTT is that key sites and key parts are protected during the procedure, but maximum sterile barriers are not required. Key sites to avoid touching without sterile gloves include insertion and puncture areas of skin, subcutaneous port (port) access sites, and any open wounds. Key parts that should not have touch contamination include all items that must remain sterile without touching such as steel needles, IV catheter needles, syringe tips, IV tubing male connections, port access site, and any supply item with extra capped end designed to maintain sterility. With Standard ANTT an micro critical field is established for all supply items, but clean gloves, supplies and clean procedures are used, with attention to not touching key sites and parts. Even with these procedures, if

touching is necessary, as with touching the skin after skin antisepsis for a peripheral IV, sterile gloves should be used.

Surgical ANTT approach is a higher-level practice used for longer clinically invasive procedures when maintaining sterility is vital using sterile gloves, a critical aseptic and sterile field with sterile drapes, and maximum sterile barriers may be required. Examples of Surgical ANTT are critical fields that are used during central catheter insertions, surgical procedures, and extensive debridement of a wound. Only sterilized equipment and supplies are added to the critical field for Surgical ANTT.

Each facility should consider implementing ANTT training for all clinical staff in accordance with the 2021 Infusion Nursing Standards of Practice Standard 18 that provides greater detail of the ANTT framework and definitions. Research supports the use of simulation for reducing contamination, increasing understanding and performance compliance with patient procedures. Much confusion is present among clinicians for the management of procedures, when to use sterile versus clean gloves, how to establish a clean working area, and when to use sterile drapes. Education on ANTT would provide clearer direction allowing practice and explanation of the application of Standard versus Surgical ANTT, noncritical and critical fields, key sites, and parts to patient procedures resulting in improved safety.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:

Association for Safe Aseptic Practice. The ANTT Approach. http://www.antt.org/ANTT_Site/ANTT-Approach.html
Clare S, Rowley S. Implementing the Aseptic Non Touch Technique (ANTT®) clinical practice framework for aseptic technique: a pragmatic evaluation using a mixed methods approach in two London hospitals. Journal of infection prevention. 2018;19(1):6-15.
Flynn J, Keogh S, Gavin N. Sterile v Aseptic Non-touch Technique for Needleless Connector Care on Central Venous Access Devices in a Bone Marrow Transplant Population: A Comparative Study. European Journal of Oncology Nursing. Jun 6 2015;19(6):694-700. doi:10.1016/j.ejon.2015.05.003
Gorski LA, Hadaway L, Hagle ME, et al. Infusion Therapy Standards of Practice, 8th Edition. Journal of Infusion Nursing. 2021;44(1S):S1-S224. doi:10.1097/nan.0000000000000396
Rowley S, Clare S. Improving Standards of Aseptic Practice Through and ANTT Trust-wide implementation Process: A Matter of Prioritisation and Care. Journal of Infection Prevention. 2009;10(1_suppl):S18-S23.
Rowley S, Clare S. Aseptic Non Touch Technique (ANTT): Reducing Healthcare Associated Infections (HCAI) by Standardising Aseptic Technique with ANTT across Large Clinical Workforces. American journal of infection control. 2011;39(5):E90.
Rowley S, Clare S. ANTT: a standard approach to aseptic technique. Nursing times.

2011;107(36):12-14.
Rowley S, Clare S. Standardizing the Critical Clinical Competency of Aseptic, Sterile, and Clean Techniques with a Single International Standard: Aseptic Non Touch Technique (ANTT®). Journal of the Association for Vascular Access. 2019;24(4):12-17.
Rowley S, Clare S, Macqueen S, Molyneux R. ANTT v2: An Updated Practice Framework for Aseptic Technique. British Journal of Nursing. 2010;19(5):S5.

Survey Reflects Clinicians' Struggles with UGPIV Practices and COVID-19

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

This column originally appeared in the March 2021 issue of Healthcare Hygiene magazine.

In an effort to gain a greater understanding of the education, policies and impact of the COVID-19 pandemic issues associated with ultrasound guided peripheral catheter (UGPIV) insertions and safety practices, a follow-up survey was conducted by this author and distributed as an adjunct to a previously published survey (Moureau 2020). More than 1,400 voluntary responses were received including a remarkable 1,171 text (SMS) comments from clinicians describing their clinical experiences. This overwhelming and unexpected response suggested the need to share feelings and frustrations that ran high, during this past, unprecedented year.

While there was no expectation that UGPIV education practices for clinicians would continue during the crisis of COVID-19, there was interest in understanding the preparation that occurred prior to the outbreak. The question to clinicians was: prior to performing UGPIV insertions did you receive education/training? And, as a follow-up, what type of training was received (selection of all that applied)? Included choices were: No training, on the job, online, lecture, hands-on, supervised insertions, and/or competency measurement of success. The vast majority (85.8 percent yes, 14 percent no) stated yes, they had received training, however 90 percent selected "on the job training," or "no training/learned it myself."

With the ability to select multiple types of training, most indicated supervised insertions and hands-on simulation as part of their education. Almost half responded that they had received online education (43.4 percent), with less than one-third (27 percent) mentioning a lecture format. It was encouraging to see that almost half (44.4 percent) of respondents commented that their training included a measurement of competency associated with successful insertions. As the number of UGPIV insertions increase, and more and more clinicians take on this skill, there will be a need for consistent education and measurement of competency with the hope that this will become the norm and be standardized in terms of educational requirements.

As with education, this researcher was interested in whether or not facilities had policies for UGPIV practices. In this survey 61 percent stated yes (there were policies in place), and 38

percent no to policies on this practice. A quarter of the group (23%) felt that UGPIV policies were not needed, and 47 percent said UGPIV were included within the peripheral intravenous catheter policies. Another 51 percent stated their policy had an educational requirement, while 44 percent also said success and competencies were included. Notably, 25 percent of respondents skipped this question, leaving us to wonder if they didn't know, or would have responded there were not any policies for UGPIVs. While policies may not be a requirement for all procedures, it seems reasonable to assume a relatively new skill and invasive procedure would have specified guidance and policies for who is qualified, how they become qualified, and safety practices that guide each UGPIV insertion. Among these safety practices are the standard aseptic technique measures, disinfection of equipment, and use of protective supplies used during the procedure.

The survey further explored the impact of COVID-19 on the availability and use of safety and protective measures for UGPIV insertions. In this section the responses included not only answers to the questions but a high number of text responses. Answers to the question on increases in number of UGPIV insertions during COVID-19 were somewhat split, no (57 percent) and yes (43 percent). While 88 percent said aseptic supplies were available, half of the respondents stated there were greater challenges with aseptic technique during the pandemic. A large number (65 percent to 73 percent) said the level of transducer/probe protection and disinfection did not change.

But 535 participants responded by explaining their experiences and what did change. Comments included: "Due to short supplies of cleaners we changed brands and/or methods of cleaning and also had to choose very carefully who needed UGPIV insertions," and "We were unable to get sterile probe cover sleeves so we ordered sterile gel packets and used large [dressings] to cover probe" or "for UGPIV we could use either [a dressing] in our start kit or a sterile probe cover. The factors and changes cited were "lack of supply, staff, and management support; working under pressure; quantity vs quality." It appears, based on the comments, that many adjustments were required, not all positive such as "we are not provided probe covers due to cost; using some makeshift or leftover probe covers from PICC insertions on known COVID patients" and "probe covers not always kept in stock; team members not disinfecting ultrasound as required."

Many responses reflected good or improved practices "enough PPS and supplies; always thorough cleaning" and we were always using aseptic non touch technique ANTT and had dedicated equipment for COVID unit; difficulty getting sterile gel but borrowed from other units; having everyone masked helped with infections during insertions." These comments displayed thought and attention to the need for protection and application of guidelines, even during a crisis.

The last question in the survey asked for comments about the impact of COVID-19 and their experiences. Almost half responded (636 statements) such as "made most more diligent in care and maintenance of ultrasounds," "I learned to love my mask," "very challenging but we made it through," "always practice safety measures all the time," "our overall patient volume

increased dramatically during COVID-19, we always had necessary supplies but could have used more trained clinicians," takes a bit longer to get everything ready and we are unable have additional supplies close at hand taking longer to have someone bring you something to the door," "increased time with preparation and cleaning," "force the clinician to be a little more aware of their sterile technique and practice," "at some point I felt overwhelmed," "more courage to help that patient who needed vascular access, meticulous about infection control and maintaining sterile technique," "to limit repetitive vascular access visits we placed extended dwell as much as possible," no formal education or expectation for staff wanting to use ultrasound for PIV insertions, ER staff begging for education, but hours are not supported due to cost, they pass bad habits on to each other, many variable supply practices," and "masks required for all, number of visitors educed and feel like we did not change our care of patients."

So many heartfelt responses, with positives and negatives, showed the level of concern and feeling for the situation, the patients and the staff. Statements like "very difficult time, stress levels have made work harder, nurses are angrier with each other and burnout has significantly increased" compel us all to consider the impact on the daily struggles of the clinician within this pandemic.

While this follow-up survey provided a look into the education, policies and practices with UGPIV, it also gave us a much closer look into the inner workings and feelings of those on the forefront of patient care with COVID-19. The thoughts and concerns expressed in the added text responses were too many to include but offered opportunities for improvement and hope that safety practices were thoughtfully applied whenever possible and that concern for the patient was ever present. Education and policies help to establish a foundation for those safety practices. But, in the end, the basic concepts of asepsis, the need for protection and disinfection must be ingrained into everyday activities, especially during a pandemic.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the CEO of PICC Excellence, Inc., adjunct associate professor, Alliance for Vascular Access Teaching and Research (AVATAR) Group, Menzies Health Institute Queensland, Griffith University Brisbane.

Reference: Moureau N, Gregory E G. Survey of ultrasound-guided peripheral intravenous practices: a report of supply usage and variability between clinical roles and departments. British Journal of Nursing. 2020 Oct 22;29(19):S30-8.

Reducing Catheter Occlusions and Failure

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the February 2021 issue of Healthcare Hygiene magazine.

Catheter occlusion and related complications are estimated to affect nearly 80 percent of peripheral and central vascular access catheters (Steere, 2018). Obstruction complications

include loss of patency, phlebitis, and infiltration in PIV catheters. Blood is the first body fluid which touches vascular access catheter materials, such as urethane and Teflon. When the synthetic catheter material meets blood, a layer of plasma proteins absorbs onto the catheter surface and triggers a complex series of biological responses including protein absorption, platelet adhesion, coagulation and thrombosis.

The thrombotic deposits of platelets and fibrin mesh that develop within and around catheters are the result of a natural process that impact catheters upon insertion and throughout treatment as the catheter is used for infusions and blood draws. When blood is pulled back into the catheter, intentionally or functionally, during syringe connection/disconnection, patient movement, or pressure changes, red blood cells adhere to the inside of the catheter creating suboptimal flow. Such occlusions can lead to patency loss and device replacement or removal, all of which can negatively impact therapeutic outcomes. Blood coagulation and platelet adhesion to intraluminal catheter surfaces remain one of the largest contributors to vascular access catheter dysfunction by producing partial and total IV catheter occlusion.

Other complications associated with build-up within a catheter include vein thrombosis, venous inflammation, and catheter-related bloodstream infections (CRBSIs). Reflux of blood into the catheter, especially small diameter catheters, contributes to partial and complete occlusions, has a relationship to catheter associated infection, and may be a contributing factor in venous thrombosis development. Preventing occlusions, then, becomes a chain of events that presents an opportunity for improving both patient outcomes and catheter function that impacts healthcare facilities' bottom line.

The literature contains studies that have examined various methods to reduce catheter failure caused by blood reflux including the use of thrombolytics (Dillon, et al. 2008; Ernst, et al. 2014; Helm, 2015 and 2019). Other studies have sought to evaluate the impact of blood reflux-controlling valves on occlusions and infiltrate complications (Jasinsky, 2009; Johnston, et al. 2014; Steere, et al. 2018). Still others have examined the various design features of how valves function to limit or eliminate blood reflux into catheters (Steere, 2016; Schilling, et al. 2006). A Cochrane Protocol published in 2019 established reflux-controlling valve function by outlining a systematic review process for validating catheter materials and reduced complications (Schults, et al. 2019).

According to Rosenthal, in 2020, anti-reflux needlefree connector designs incorporate a bidirectional fluid-control valve designed to restrict fluid movement on connection and prevent unplanned reflux into the intravascular catheter during infusion, connection, disconnection and patient changes in intra-thoracic pressure. A reflux-controlling valve is an internal mechanism engineered into catheters and/or needleless connectors; these valves are designed to control fluid movement, most notably to prevent backwards flow. Design and performance vary by device type. Whether the valve technology is integrated into the catheter, or integrated into the needleless connector technology, these devices reduce clinician dependency on proper clamping sequence that blocks reflux and greatly reduces the blood movement from physiological pressure changes that naturally occur inside the patient's vasculature. More

research is needed to establish more substantial conclusions on occlusion causation, the impact of reflux on occlusion, and the prevention of reflux-related occlusion.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the owner and chief executive officer at PICC Excellence, Inc., an active clinician with Infinity Infusion Nursing, a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

Bibliography:

Barreras F, Cabeza M, de Terán LC. Clinical efficacy and safety of Securflux®, an anti-reflux device for intravenous infusion. J Vasc Access. 2013;14(1):77-82.

Btaiche I, Kovacevich D, Khalidi N, Papke L. The Effects of Needleless Connectors on Catheter-related Bloodstream Infections. Am J Infect Control. 2011;39(4):277-283. doi:10.1016/j.ajic.2010.07.011.

Buehrle DC. A prospective, randomized comparison of three needleless IV systems used in conjunction with peripherally inserted central catheters. JAVA. 2004;9(1):35-38.

Cabrero J, Orts MI, López-Coig ML, Velasco ML, Richart M. Variability in the clinical practice of maintaining the patency of peripheral intravenous catheters. Gac Sanit. 2005;19:287-293.

Casey AL, Karpanen TJ, Nightingale P, Elliott TS. (2018). The risk of microbial contamination associated with six different needle-free connectors. Br J Nurs. 2018;27(2):S18-S26.

Chernecky C, Casella L, Jarvis E, Macklin D, Rosenkoetter M. Nurses' Knowledge of Intravenous Connectors. J Res Nurs. 2010;15(5):405-415.

Dillon MF, Curran J, Martos R, et al. Factors that affect longevity of intravenous cannulas: a prospective study. QJM. 2008;101(9):731-735.

Elli S, Abbruzzese C, Cannizzo L, Lucchini A. In vitro evaluation of fluid reflux after flushing different types of needleless connectors. J Vasc Access. 2016;17(5):429-434. doi:10.5301/jva.5000583.

Ernst FR, Chen E, Lipkin C, Tayama D, Amin AN. Comparison of hospital length of stay, costs, and readmissions of alteplase versus catheter replacement among patients with occluded central venous catheters. J Hosp Med. 2014;9(8):490-6.

Hadaway L. Needleless Connectors: Improving Practice, Reducing Risks. JAVA. 2011;16(1):20-33.

Hawthorn A, Bulmer AC, Mosawy S, Keogh S. Implications for maintaining vascular access device patency and performance: Application of science to practice. J Vasc Access. 2019;20(5):461-470.

Helm RE, Klausner JD, Klemperer JD, Flint LM, Huang E. Accepted but unacceptable: peripheral IV catheter failure. J Infus Nursing. 2015;38(3):189-203.

Helm RE. Accepted but Unacceptable: Peripheral IV Catheter Failure: 2019 Follow-up. J Infus Nursing. 2019;42(3):149-50.

Hitchcock J. Preventing intraluminal occlusion in peripherally inserted central catheters. Br J Nursing. 2016;25(19):S12-S18.

Hull GJ, Moureau NL, Sengupta S. Quantitative assessment of reflux in commercially available needle-free IV connectors. J Vasc Access. 2018;19(1);12-22. doi:10.5301/jva.5000781

Jasinsky L, Wurster J. Occlusion reduction and heparin elimination trial using an antireflux device on peripheral and central venous catheters. J Infus Nurs. 2009;32(1):33-39. doi:10.1097/NAN.0b013e3181921c56

Johnston AJ, Streater CT, Noorani R, Crofts JL, Del Mundo AB, Parker RA. The effect of peripherally inserted central catheter (PICC) valve technology on catheter occlusion rates--the 'ELeCTRiC' study. J Vasc Access, 2012;13(4):421-425. doi:10.5301/jva.5000071

Macklin, D. (2014). The Impact of IV Connectors on Clinical Practice and Patient Outcomes. JAVA. 2014;15(3):139. doi:10.2309/java.15-3-4

Rosenthal VD. Clinical impact of needle-free connector design: A systematic review of literature. J Vasc Access. 2020;0(0):1129729820904904.

Schilling S, Doellman D, Hutchinson N, Jacobs BR. The impact of needleless connector device design on central venous catheter occlusion in children: a prospective, controlled trial. JPEN J Parenter Enteral Nutr. 2006;30(2):85-90.

Schults JA, Kleidon T, Petsky HL, Stone R, Schoutrop J, Ullman AJ. Peripherally inserted central catheter design and material for reducing catheter failure and complications. Cochrane Database of Systematic Reviews. 2019(7). DOI: 10.1002/14651858.CD013366.

Steere L, Rousseau M, Durland L. Lean Six Sigma for Intravenous Therapy Optimization: A Hospital Use of Lean Thinking to Improve Occlusion Management. JAVA. 2018;23(1):42-50.

Steere L. Reduction in Central Venous Catheter Occlusions: Impact of a Pressure Activated Anti-reflux Connector With a Vascular Access Nurse Algorithm in Assessing Occluded Catheters. JAVA. 2016;21(4):256-257.

Williams A. Catheter occlusion in home infusion: the influence of needleless connector design on central catheter occlusion. J Infus Nursing. 2018;41(1):52-57.

The Value of Research and Education: Impact on Patient Safety

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

This column originally appeared in the December 2020 issue of Healthcare Hygiene magazine.

Research and education are essential components of any healthcare organization to provide clinical knowledge to healthcare workers that establish practices and procedures ensuring patient safety. Research is used to identify gaps in practice that indicate the need for improvement, to answer questions for the best practice procedures, and to validate practices and products used within healthcare settings. Investigation of clinical practices for incidence and causes of negative patient outcomes often yields solutions that can be applied in the clinical setting. In addition, many new products are available claiming to solve problems and reduce complications. Product evaluation must be performed to validate claims in the clinical setting. This product research provides additional value to other institutions, when results are published, assisting them in establishing a value basis for products.

Patient complications increase the cost of healthcare. Research provides valuable insights, based on the results of investigations, that often have a considerable impact on cost reduction, improving efficiency of care and other positive effects of improved patient satisfaction. Education, performed in conjunction with research, has been shown to have significant value in reducing complications and cost. Inconsistencies in procedures, failure to follow policies, lack of standardization all contribute to poor quality and negative outcomes which drive up cost. With the increase in technology and essential requirements for vascular access devices for most patients the cost of health care is rising and the impact of serious complications increasing.

Educational program initiatives have been shown to be necessary to outcome improvement and cost-effective components of high-quality healthcare. Nursing and medical professionals receive education in the academic setting and during orientation to a new healthcare facility. Whether initiated by the individual or the institution, frequency and type of education and training following graduation and completion of orientation is often sporadic without defined requirements. Provision of education and clinical training within healthcare facilities are dictated by policy changes and performance improvement initiatives. As noted by Bianco and associates and supported by Marschall, et al. guidelines on strategies to prevent infections, well organized educational programs to continually train and increase competence of clinicians, for those involved with insertion and care of vascular access devices, is critical to the success of infection prevention methods. As research is incorporated into guidelines and standards, education provides a means to disseminate the information to the working clinician promoting application at the bedside.

The infrastructure of healthcare facilities should include resources to provide consistent education, training and procedural simulation to all staff including programs on basic practices

of asepsis, infection prevention, insertion, and maintenance of all intravenous and intra-arterial devices. More emphasis is needed to expand the role and responsibility of all clinicians to include research and increase the emphasis on education within their current job functions. Periodic re-training should be performed following gap analysis of deficiencies in procedures or practices. In addition, clinicians should be provided information on device indications and appropriateness to aid in selection of the lowest risk access device that will effectively deliver the therapy. Encouraging application of research and accountability for education, training, and competency with credentialing requirements initially, prior to independent insertions, and periodically as a means of evaluation will improve and increase patient safety with procedures.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:
1. Bianco A, Coscarelli P, Nobile CG, Pileggi C, Pavia M. The reduction of risk in central line-associated bloodstream infections: knowledge, attitudes, and evidence-based practices in health care workers. American journal of infection control. 2013 Feb 1;41(2):107-12.
2. Coopersmith CM, Rebmann TL, Zack JE, Ward MR, Corcoran RM, Schallom ME, Sona CS, Buchman TG, Boyle WA, Polish LB, Fraser VJ. Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit. Critical care medicine. 2002 Jan 1;30(1):59-64.
3. Eggimann P, Harbarth S, Constantin MN, Touveneau S, Chevrolet JC, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. The Lancet. 2000 May 27;355(9218):1864-8.
4. Forsetlund L, Bjørndal A, Rashidian A, Jamtvedt G, O'Brien MA, Wolf FM, Davis D, Odgaard-Jensen J, Oxman AD. Continuing education meetings and workshops: effects on professional practice and health care outcomes. Cochrane database of systematic reviews. 2009(2).
5. Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, O'Brien MA, Johansen M, Grimshaw J, Oxman AD. Audit and feedback: effects on professional practice and healthcare outcomes. Cochrane database of systematic reviews. 2012(6).
6. James BC, Savitz LA. How Intermountain trimmed health care costs through robust quality improvement efforts. Health Affairs. 2011 Jun 1;30(6):1185-91.
7. Lobo RD, Levin AS, Gomes LM, Cursino R, Park M, Figueiredo VB, Taniguchi L, Polido CG, Costa SF. Impact of an educational program and policy changes on decreasing catheter-associated bloodstream infections in a medical intensive care unit in Brazil. American journal of infection control. 2005 Mar 1;33(2):83-7.
8. Marschall J, Mermel LA, Classen D, Arias KM, Podgorny K, Anderson DJ, Burstin H, Calfee DP, Coffin SE, Dubberke ER, Fraser V. Strategies to prevent central line–associated bloodstream infections in acute care hospitals. Infection Control & Hospital Epidemiology. 2008 Oct;29(S1):S22-30.
9. Mohapatra S, Kapil A, Suri A, Pandia MP, Bhatia R, Borkar S, Dube SK, Jagdevan A, George S, Varghese B, Dabral J. Impact of Continuous Education and Training in Reduction of Central Line-associated Bloodstream Infection in Neurointensive Care Unit. Indian Journal of Critical Care

Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2020 Jun;24(6):414.
10. O'Brien MA, Rogers S, Jamtvedt G, Oxman AD, Odgaard-Jensen J, Kristoffersen DT, Forsetlund L, Bainbridge D, Freemantle N, Davis D, Haynes RB. Educational outreach visits: effects on professional practice and health care outcomes. Cochrane Database of systematic reviews. 2007(4).
11. Rosenthal VD, Guzman S, Pezzotto SM. Effect of an infection control program using education and performance feedback on rates of intravascular device-associated bloodstream infections in intensive care units in Argentina. American journal of infection control. 2003 Nov 1;31(7):405-9.
12. Sherertz RJ, Ely EW, Westbrook DM, Gledhill KS, Streed SA, Kiger B, Flynn L, Hayes S, Strong S, Cruz J, Bowton DL. Education of physicians-in-training can decrease the risk for vascular catheter infection. Annals of internal medicine. 2000 Apr 18;132(8):641-8.
13. Warren DK, Zack JE, Mayfield JL, Chen A, Prentice D, Fraser VJ, Kollef MH. The effect of an education program on the incidence of central venous catheter-associated bloodstream infection in a medical ICU. Chest. 2004 Nov 1;126(5):1612-8.

Patient-Focused Care with Vascular Access Bundles

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the November 2020 issue of Healthcare Hygiene magazine.

Most patients entering acute-care receive therapies via an intravenous access device. The success of therapy is, to some degree, contingent on the success of the device used to deliver the medications. Improving success and function of vascular access device is done through the application of research for key practices points by clinicians and administrators. Research can be effectively integrated into a bundle of patient care measures to establish, maintain, and insure the most positive outcomes. Best practice bundles for vascular access devices have resulted in infection reduction, minimized supply usage, improved through-put of patient care and reduced length of stay that puts the well-being of the patient first for a patient focused care approach.

A care bundle is a structured way of applying research and recommendations for improving the processes of care and patient outcomes. The care bundle is described as a small, straightforward set of evidence-based practices of generally three to five components that, when performed collectively and reliably, have been proven to improve patient outcomes according to the Institute for Healthcare Improvement (IHI) (http://www.ihi.org/Topics/Bundles/Pages/default.aspx).1 Most important to this issue is the concept that a bundle is a cohesive unit of steps must all be completed to succeed; the “all or

none" feature is the source of the bundle's power.2-4 Other bundle criteria include that only practices based on level 1 or A graded evidence should be included in a bundle.

Evidence is expanding in support of specialized vascular access assessment, selection, insertion of vascular access devices with practices and teams that reduce the number of unsuccessful insertion attempts, catheter failure, and minimize complications. A recent study "Reaching One Peripheral Intravenous Catheter (PIVC) Per Patient Visit With Lean Multimodal Strategy: the PIV5Rights Bundle" reported how a bundle of practices led to improved patient outcomes with PIVCs and significant financial savings.5 Elements of the bundle that contributed to their success included the right proficient nurse inserter, the right insertion method, the right vein and catheter selection, the right supplies and technology, and the right assessment for care and maintenance. Each of these right practices are supported by a body of A through D graded evidence.6 The evidence for each of the individual components of the care bundle must be considered separately, but ultimately the bundle is a combination of actions, that when all are applied, result in better outcomes for the patient and healthcare facility.

Integration of a skilled and proficient inserter to assess, select the best insertion site and method, choose the best catheter and length for the therapy and individual patient characteristics, organize the most appropriate supplies, and use ultrasound when needed, creates the best scenario for patient intravenous access. The results of the PIV5Rights study are consistent with these components and reflect a positive impact of the proficient ultrasound trained nurses for fewer number of attempts, longer dwell time for intravenous catheters, with meaningful differences in fewer complications or failed PIVCs when comparing the specialist to the generalist nurse.

Financially, this type of proficient nurse and care bundle makes sense. The impact of the use of the generalist model for peripheral catheter insertions represents lost revenue and waste in terms of high supply usage with multiple attempts and shorter dwell time. The global financial burden for premature PIVC failure is conservatively estimated to range from $9.8 to $17.5 billion annually by calculating the reported PIVC failure rates of 35%-50%, multiplied by the estimated 1- billion PIVCs inserted each year worldwide, and integration of the published uncomplicated PIVC procedure cost range of $28-$35.6.7,8 Hospitals are under intense pressure to improve the quality of patient care while reducing total cost of care. One of the primary strategies to accomplish this is to use evidence-based practices such as the care bundle to minimize the unnecessary clinical variation that regularly occurs with invasive procedures.

Application of these type of bundled patient focused approaches result in the overall improvement of the patient experience. The goal in provision of healthcare is to promote health. The best practices identified in the PIV5Rights care bundle demonstrate a process for improving patient satisfaction, while reducing complications and cost. The Alliance for Vascular Access Teaching and Research (AVATAR), a research group based in Australia, says it best with their 'Making Complications History' campaign. 9 This group performs randomized controlled trials and research designed to guide practices to improve patient safety with vascular access devices. Care bundles and education for clinicians on the results of this type of research

contribute to healthcare improvement establishing a patient focused approach that may lead to the eradication of vascular access complications.

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:
1. Sacks G, Diggs B, Hadjizacharia P, Green D, Salim A, Malinoski D. Reducing the Rate of Catheter-associated Bloodstream Infections in a Surgical Intensive Care Unit Using the Institute for Healthcare Improvement Central Line Bundle. American Journal of Surgery. 2014;207(6):817-823.
2. Lavallée JF, Gray TA, Dumville J, Russell W, Cullum N. The effects of care bundles on patient outcomes: a systematic review and meta-analysis. Implementation Science. 2017;12(1):142.
3. Sayin Y. What is A Care Bundle? Florence Nightingale Hemşirelik Dergisi. 2017;25(2):145-151.
4. Fulbrook P, Mooney S. Care bundles in critical care: a practical approach to evidence-based practice. Nursing in critical care. 2003;8(6):249-255.
5. Steere L, Ficara C, Davis M, Moureau N. Reaching One Peripheral Intravenous Catheter (PIVC) Per Patient Visit with Lean Multimodal Strategy: the PIV5Rights™ Bundle. Journal of the Association for Vascular Access. 2019;24(3):31-43.
6. Moureau N, and Steere L. Theoretical Methodology and Systematic Evidence Review of the PIV5Rights Care Bundle. Association for Vascular Access at Your Fingertips Virtual Conference 2020. Poster Presentation.
7. Helm RE, Klausner JD, Klemperer JD, Flint LM, Huang E. Accepted but Unacceptable: Peripheral IV Catheter Failure. Journal of Infusion Nursing. 2015;38(3):189-203.
8. Alexandrou E, Ray-Barruel G, Carr PJ, et al. Use of Short Peripheral Intravenous Catheters: Characteristics, Management, and Outcomes Worldwide. Journal of hospital medicine. 2018;13(5).
9. AVATAR. The High Five Campaign: Making Vascular Access Complications History. 2017; accessed 2020 http://www.avatargroup.org.au/the-high-five-campaign.html

Patient Safety Enhanced Through Vascular Access Specialist Care

By Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC

Editor's note: This column originally appeared in the October 2020 issue of Healthcare Hygiene magazine.

Vascular access devices (VAD) are used daily in almost all inpatient settings with a range of healthcare professionals sharing the responsibility for insertion, management, and removal of VADs. Vascular access catheter insertions are accepted as common invasive clinical procedures that expose patients to risks such as procedural pain, bruising, bleeding, vessel depletion, nerve injury, or infection, and, in extreme cases, death.(1,2,3) There is much variation and fragmentation in practices suggestive of opportunities to reduce risk and improve patient

care.(4) One action to achieve positive outcomes is by shifting vascular access ownership to specially trained clinicians for (i) assessment, (ii) insertion, (iii) care maintenance, and (iv) education as is seen with vascular access or infusion teams. We have seen in the COVID-19 crisis an increased urgency for VAD placement and innovation in maintaining infusions outside patient rooms. Ensuring the placement of a reliable intravenous device in an optimal location designed to perform without complications was a high priority during this time of crisis.

We know the Centers for Disease Control and Prevention (CDC) has emphasized specialized teams as a method to reduce infections, complications, and cost of infusion therapy.(5) A Cochrane systematic review defines vascular access specialists and teams (i.e., VAS or VAST) as any of the following; infusion teams, intravenous teams, individual specialists (nurse, doctor, respiratory therapist, radiological technologist, nurse practitioner, and physician assistant) who have knowledge and skills, formal training, and who frequently perform insertion or manage VADs.(6) Teams and individual specialist functions will vary, but commonly include the insertion and maintenance of some or all vascular access devices. Given the growing complexity in patient needs, a unique specialist discipline, namely the vascular access specialist (VAS), is needed to deliver efficiently and safely the prescribed intravenous treatment plan.

The No. 1 fear of patients entering a hospital is fear of pain associated with needles. The evidence to date is suggestive that the highest achieving system of initiating and delivering treatment to patients in acute care is tied to a purpose-driven group of skilled individuals and the processes that guide their practices.(7) Starting an intravenous device is often associated with repeated attempts following insertion failures leading to increased patient risk of complications. Evidence supports the value of specially trained individuals that have greater first-time success with fewer insertion attempts, and lower infection rate associated with intravenous or arterial device insertion.(11) Patients indicate that inadequate skill level of those performing these types of procedures is a source of great dissatisfaction, while use of technology and increased skills of the VAS promotes higher satisfaction.(8,9) According to da Silva in 2010, use of a specialized team increased first attempt success achieving 84 percent with one peripheral intravenous catheter (PIV) attempt and lower complications.(10) Complications associated with VADs relate to the skill and knowledge of the operator for insertion(11-14) and for post-insertion complications relate to maintenance by knowledgeable clinicians and patient specific risk factors.(15-18) Specialized education has led to infection prevention practices that reduce complications.(19-21) Advanced practice nurses and those teams receiving specialized training to perform insertions of all CVADs, working in collaboration with medical providers, offer valuable contributions to patient safety by performing ultrasound guided insertions with low incidence of complications.(22-27)

Standards for infusion therapy call for an increase of teams to perform CVAD insertion, ultrasound guided peripheral insertions for difficult access patients, maintenance, and removal of devices when no longer needed to promote patient safety and better outcomes. Other functions embraced by these specialists may include patient access for difficult blood draws, use of ultrasound guidance for any or all of the insertion and assessment functions, dressing changes for central catheters, careful daily assessment and monitoring of dressing and insertion

site for complication identification, and daily evaluation of catheter necessity with removal of unnecessary catheters. Additionally, they provide a professional point of care for education and resource of VAD queries for device maintenance and management.

Patient-focused safety initiatives should apply evidence of improved outcomes such as those represented in establishing and maintaining effective vascular access teams. (28) The value of specialized teams for insertion and management of vascular access is demonstrated through numerous publications in a variety of research designs. (6,10,15,16) Although there are currently no randomized controlled clinical trials that support the benefits of teams, the recommendation of the CDC and others worldwide guidelines continue to support specialists as a method to reduce infections and complications associated with vascular access devices.(29) Supported by the concepts of vessel health and preservation, the application of vascular access individuals or teams as a consultative specialists in every hospital for insertion and management of vascular access devices could significantly aid the pursuit of making Central Line Associated Bloodstream Infections (CLABSIs) and VADs complications history.(30)

Nancy Moureau, RN, PhD, CRNI, CPUI, VA-BC, is the chief executive officer at PICC Excellence, Inc., a research member of the Alliance for Vascular Access Teaching and Research (AVATAR) Group, and an adjunct associate professor at Griffith University in Brisbane, Australia.

References:

1. Brunelle D. Impact of a dedicated infusion therapy team on the reduction of catheter- related nosocomial infections. J Infus Nurs. 2003;26(6):362-366.
2. Hawes M. A proactive approach to combating venous depletion in the hospital setting. J Infus Nurs.. 2007;30(1):33-44.
3. Sato A, Nakamura I, Fujita H, et al. Peripheral venous catheter-related bloodstream infection is associated with severe complications and potential death: a retrospective observational study. BMC Infect Dis.2017;17(1):434.
4. Castro-Sanchez E, Charani E, Drumright L, Sevdalis N, Shah N, Holmes A. Fragmentation of care threatens patient safety in peripheral vascular catheter management in acute care--a qualitative study. PLoS One. 2014;9(1):e86167.
5. O'Grady N, Alexander M, Burns L, et al. Centers for Disease Control and Prevention: Guidelines for the Prevention of Intravascular Catheter-related Infections. Clin Infectious Diseases. 2011;52(9):e162-e193.
6. Carr P, Higgins N, Cooke M, Mihala G, Rickard C. Vascular Access Specialist Teams for Device Insertion and Prevention of Failure. Cochrane Database of Systematic Reviews 2014. 2014(12).
7. Hadaway L, Dalton L, Mercanti-Erieg L. Infusion teams in acute care hospitals: call for a business approach: an infusion nurses society white paper. J Infus Nurs. 2013;36(5):356-360.
8. Kelly L. The experience of patients living with a vascular access device [Internet]: IVUPDATE; 2017. Podcast. Available from: https://us.ivoox.com/en/the-experience-of-patients- living-with-a-vascular-audios-mp3_rf_20838415_1.html
9. Harpel J. Best practices for vascular resource teams. J Infus Nurs.2013;36(1):46-50.

10. da Silva GA, Priebe S, Dias FN. Benefits of Establishing an Intravenous Team and the Standardization of Peripheral Intravenous Catheters. J Infus Nurs. 2010;33(3):156-160.
11. Fong N, Holtzman S, Bettmann M, Bettis S. Peripherally inserted central catheters: outcome as a function of the operator. J Vasc Interv Radiol.2001;12(6):723-729.
12. McGee D, Gould M. Preventing complications of central venous catheterization. N Engl J Med. 2003;348(12):1123-1133.
13. Lennon M, Zaw N, Pöpping D, Wenk M. Procedural complications of central venous catheter insertion. Minerva Anestesiol.2012;78(11):1234-1240.
14. Mourad M, Kohlwes J, Maselli J, Auerbach A. Supervising the supervisors—procedural training and supervision in internal medicine residency. J Gen Intern Med.2010;25(4):351-356.
15. Gianino M, Brunt L, Eisenberg P. The impact of nutritional support team on the cost and management of multilumen central venous catheters. J Infus Nurs. 1992;15(6):327-332.
16. Scalley R, Van C, Cochran R. The impact of an IV team on the occurrence of intravenous-related phlebitis: a 30-month study. 1992;15(2):100-109.
17. Maki D, Ringer M. Risk Factors for infusion-related phlebitis with small peripheral venous catheters: a randomized controlled trial. Ann Intern Med.1991;114(10):845-854.
18. Soifer N, Borzak S, Edlin B, Weinstein R. Prevention of peripheral venous catheter complications with an intravenous therapy team: a randomized controlled trial. Arch Intern Med.1998;158(5):473-477.
19. Coopersmith C, Rebmann T, Zack J, et al. Effect of an education program on decreasing catheter related bloodstream infections in the surgical intensive care unit. Crit Care Med. 2002;30(1):59-64.
20. Eggiman P, Harbarth S, Constantin M, Touveneau S, Chevrolet J, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. Lancet. 2000;355(9218):1864-1868.
21. Eggiman P, Pittet D. Overview of catheter-related infections with special emphasis on prevention based on educational programs. Clin Microbiol Infect. 2002;8(5):295-309.
22. Alexandrou E, Murgo M, Calabria E, et al. Nurse-led central venous catheter insertion-procedural characteristics and outcomes of three intensive care placement services. Int J Nurs Stud.2012;49(2):162-168.
23. Alexandrou E, Spencer T, Frost S, Mifflin N, Davidson P, Hillman K. Central venous catheter placement by advanced practice nurses demonstrate low procedural complication and infection rates--a report from 13 years of service*. Crit Care Med.2014;42(3):536-543.
24. Cotogni P, Barbero C, Garrino C, et al. Peripherally inserted central catheters in non-hospitalized cancer patients: 5-year results of a prospective study. Support Care Cancer. 2015;23(2):403-409.
25. Galloway M. Insertion and placement of central catheters in the oncology patient. Paper presented at: Seminars in Oncology Nursing2010.
26. Pittiruti M, Emoli A, Porta P. A new area of competence for the vascular access nurse: the PICC port. J Assoc Vasc Access. 2013;18(4):217-218.
27. Curto-García N, García-Suárez J, Chavarria MC, et al. A team-based multidisciplinary approach to managing peripherally inserted central catheter complications in high-risk haematological patients: a prospective study. Support Care Cancer. 2016;24(1):93-101.
28. Steere L, Ficara C, Davis M, Moureau N. Reaching one peripheral intravenous catheter

(PIVC) per patient visit with lean multimodal strategy: the PIV5Rights™ bundle. J Assoc Vasc Access. 2019;24(3):31-43.
29. Flodgren G, Rojas-Reyes MX, Cole N, Foxcroft DR. Effectiveness of organisational infrastructures to promote evidence-based nursing practice. Cochrane Database Syst Rev.2012;2:CD002212.
30. AVATAR. The High Five Campaign: Making Vascular Access Complications History. 2017; accessed 2020 http://www.avatargroup.org.au/the-high-five-campaign.html.