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EVALUATION OF INTRAVENOUS CATHETER INSERTION SKILLS AND CONFIDENCE LEVELS OF NURSES IN THE ACUTE CARE SETTING

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EVALUATION OF INTRAVENOUS CATHETER INSERTION SKILLS AND
CONFIDENCE LEVELS OF NURSES IN THE ACUTE CARE SETTING

A Scholarly Project Submitted to the Graduate School in Partial Fulfillment of the
Requirements for the Degree of Doctor of Nursing Practice

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EVALUATION OF INTRAVENOUS CATHETER INSERTION SKILLS AND
CONFIDENCE LEVELS OF NURSES IN THE ACUTE CARE SETTING

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EVALUATION OF INTRAVENOUS CATHETER INSERTION SKILLS AND
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An Abstract of the Scholarly Project by
Kelly Mishmash

The use of IVs for medication administration is an essential component in healthcare and benefits the patients (Castro-Sanchez, Charani, Drumright, Sevdalis, Shah, & Holmes, 2014). Obtaining intravenous access is a specialized nursing skill that requires a combination of clinical knowledge and psychomotor coordination (Ramer, Hunt, Ortega, Knowlton, Briggs, & Hirokawa, 2016). Difficulties created by vein size, obesity, and tortuosity can make even a skilled staff member struggle which then can lead to delays in treatment (Idemoto, Rowbottom, Reynolds, & Hickman, 2014). A single phase survey was conducted in a rural southwest Missouri hospital in order to assess confidence levels in IV skills, the approximate percentage of IVs successfully started, and to examine the willingness to learn how to use an assistive device, such as an ultrasound, in order to administer difficult to start IVs. Sixty-six nurses were surveyed with a 41% response rate. Confidence levels of IV skills were high among all participants along with percentage of successful IV starts. However, the willingness to learn how to utilize an assistive device in order to start IVs was also high. The information gathered could lead to implementing ultrasound training and use for more nurses when starting difficult IVs in order to expedite medical care, improve nurses' confidence levels with IV skills, and improve overall patient satisfaction.

TABLE OF CONTENTS

LIST OF TABLES

TABLE   PAGE

LIST OF FIGURES

CHAPTER I

Introduction

The use of IVs for medication administration is an essential component in healthcare and benefits the patients (Castro-Sanchez, Charani, Drumright, Sevdalis, Shah, & Holmes, 2014). It is essential to successfully obtain IV access in a timely manner not only for emergency medications, but also for routine, scheduled medications as well. It is important for medication administration timing to be within certain parameters in order for maximum effectiveness of the drug which can lead to overall improved patient outcomes. Administering intravenous catheters (IVs) in patients is a skill that all nursing students learn about and anticipate during their academic schooling. Obtaining intravenous access is a specialized nursing skill that requires a combination of clinical knowledge and psychomotor coordination (Ramer, Hunt, Ortega, Knowlton, Briggs, & Hirokawa, 2016). Difficulties created by vein size, obesity, and tortuosity can make even a skilled staff member struggle which then can lead to delays in treatment (Idemoto, Rowbottom, Reynolds, & Hickman, 2014).

Another aspect of efficient IV access examines the patient's perspective. With recent changes in healthcare reimbursement, patient satisfaction is being examined very closely (Kenen, 2015). Up to 70% of patients in the acute care setting require IV access

(Idemoto et al., 2014). Nurses with excellent IV skills can help decrease patient anxiety and improve the patient's perspective of the healthcare setting. Enhancing IV skills among all nurses can potentially decrease length of stay, improve overall patient outcomes, and improve patient satisfaction.

Background and Problem

Healthcare providers frequently hear statements from patients regarding being more fearful of needles than actual treatment, diagnosis, or even major surgery. Addressing these fears and mastering IV techniques is an important skill but the specialized nature of hospital nursing means that some nurses may find this skill declines with lack of use. Consequently, finding ways to continually improve nurses' IV technique is an important part of maintaining an excellent nursing staff.

According to the Emergency Nurses Association (ENA) on average, each successful IV access requires 1.1 to 1.4 attempts and the average time requirement for placement of an IV is 2.5 to 16 minutes (Valdez et al., 2015). This average time requirement goes up among patients with difficult venous systems.   Approximately 50% of IV lines require replacement before completion of therapy, leading to medication delays, higher risk for infections, overall complications, and poor patient satisfaction (Idemoto et al., 2014). In addition, multiple failed attempts at IV access leads staff to insist on more invasive IV access devices, such as peripherally inserted central catheters (PICC) and central lines. These methods of IV access require specially-trained nurses or surgeons to perform, create an increase in cost, cause treatment delay, and increase the risk of infection and complications such as pneumothorax and deep vein thrombosis.

The Affordable Care Act (ACA) has made many changes to the way hospitals are reimbursed by Medicare. One of the changes involves linking a part of hospital reimbursement to patient satisfaction (Kenen, 2015). With so many patients being apprehensive about needles and IVs, limiting the number of needle sticks being administered is more important than ever. The nursing staff is being examined not only by administration but also by patients in order to perform at the highest level of functioning possible. Having exceptional IV skills helps put patients at ease from the moment they step foot in a hospital. This skill leads to less stress within patients and staff, better patient satisfaction scores and, most importantly, better patient outcomes.

Purpose

The purpose of this study is to understand nurses' attitudes toward learning and utilizing an assistive device to start IVs and confidence levels in their IV skills. Based on the information gathered in this study, suggestions will be made that could lead to implementation of a tool or tools to allow nurses to practice IV skills repetitively or to integrate technology devices to improve their confidence levels and skills. The objective will be to 1) evaluate nurses' confidence levels in their own IV skills 2) determine the approximate number of successful and unsuccessful IV starts over a one week period, and 3) assess willingness to implement assistive devices to improve IV skills. Variables to be examined include reasons for failed venous access, nurses' years of experience, and the primary department the participants work.

Theoretical Framework

The theoretical framework utilized for this study is nursing theorist Patricia Benner's "from novice to expert" theory. This concept describes how nurses develop

skills over time from a combination of a strong educational background and experiences (Alligood, 2014). The five stages of Benner's theory include novice, advanced beginner, competent, proficient, and expert. At the novice stage of skill acquisition, the person has no background experience of the situation (Alligood, 2014). At the advanced beginner stage, the person can demonstrate marginally acceptable performance and can recognize the recurring meaningful components of the situation (Alligood, 2014). The next stage, competent, develops through learning from actual practice situations and by following the actions of others (Alligood, 2014). During the proficient stage, the performer perceives the situation as a whole rather than in terms of aspects, and the performance is guided by skilled performance (Alligood, 2014). The final stage expert, is achieved when the performer no longer relies on analytical principle to connect an understanding of the situation to an appropriate action (Alligood, 2014). The expert nurse has the ability to recognize patterns as the result of experience and background (Alligood, 2014). This theory will guide the study and show the levels of competency and confidence among the participants.

Benner's concept describes how nurses gain knowledge and skills without actually learning a theory (Petiprin, 2016). She describes nursing as a development of knowledge in a field that is made up of the extension of knowledge through research and of understanding through clinical experience (Petiprin, 2016). It is not unusual for nurses to have a low level of confidence in starting IVs if they do not have much experience or if they feel they are incompetent with this particular skill set. Encouragement is sometimes needed to persuade a novice nurse into attempting a new skill. Repetition is how nurses learn their craft and become eventual experts in their field

of work. It is important to guide novice and advanced beginner nurses and to encourage

them to continue trying, even after failed attempts have been made. This leads to success

in the end and is how expert nurses are developed.

Project Questions

The research questions for this study are:

1. What level of confidence do nurses have in their IV skills?

2. How many successful and unsuccessful IV starts are completed in one week?

3. How willing are the nurses to learn how to use an assistive device?

Definition of Key Terms

- Intravenous catheter – a catheter that is inserted into a vein for supplying
  medications or nutrients directly into the bloodstream or for diagnostic
  purposes such as studying blood pressure, (Mosby's Medical Dictionary,
  2009).

- Tortuous – having many curves; full of turns and twists as related to veins,
  (Farlex Partner Medical Dictionary, 2012).

- Thrombosis – clotting within a blood vessel that may cause infarction of
  tissues supplied by the vessel, (Farlex Partner Medical Dictionary, 2012).

- IV start – insertion of a needle into a peripheral vein for the purpose of
  intravenous infusion of fluids, blood, or medications, (Miller-Keane
  Encyclopedia and Dictionary of Medicine, 2003).

Logic Model

Figure 1. Adapted from Community Tool Box, (https://www.ctb.ku.edu, 2018).

This logic model depicts how the actions of nurses starting IVs in the acute care setting, with proper training, increases confidence levels and decreases the need for more invasive lines. This ultimately leads to long-term effects of improved patient satisfaction, improved patient outcomes, decreased hospital costs, and decreased risk of infection.

Summary

In the field of nursing, skills must be practiced and refined to provide patients with the best possible care. Patients entering hospitals are anticipating many procedures, tests, scans, and usually have high anxiety levels from the very beginning of admission. Patients have confidence and trust in nurses to perform the tasks that they are trained for. Patients will receive IVs more than any other procedure in a hospital setting; therefore, nurses must refine this skill to the best of their ability. This can lead to expedited medication administration, increased nursing confidence, improved patient satisfaction, and better patient outcomes.

CHAPTER II

Review of the Literature

Using Summon, a systematic literature search was completed regarding IV skills and techniques among registered nurses and other qualified clinical staff providers. This review examines current and recent research on approaches to IV placement, approaches to teaching IV techniques, and the impact of nurse practice area on maintaining IV skills. Much of the research found focused only on IV skills using the palpation method taught in nursing schools. Other research articles focused on the need for improvement of IV skills and included tools and other methods for increasing success rates. These tools often included IV starts guided by ultrasound along with other methods and tools. Both quantitative and qualitative studies were included in this review. The participants studied varied from registered nurses to resident physicians and army corps men. A few articles focused on starting IVs on the pediatric population and not only adults.

IV Skills Using Palpation Method

According to Piaget's notion of constructivism, learning through interactions help nurses construct knowledge and skills (Hulse, 2013). This applies strongly to IV skills and repetition of this skill. In a study of skill retention among third year medical students, Friederich, Brouwer, Marschall, and Weissenstein (2016) found that while 97% of students earned an acceptable rating when tested immediately after instruction, only

74.5% passed a retest given one week later. This suggests regular and repeated practice is essential to maintaining IV skills.

A similar study focused on the outcomes of a continuing education course on IV catheter insertion among experienced registered nurses rather than medical students. This particular study provided a continuing education course designed to enhance the knowledge, skills, and confidence levels of experienced nurses (Lyons & Kasker, 2012). The participants completed a pre- and post-test and data was collected eight to twelve weeks following the education (Lyons & Kasker, 2012). After completion of the certification course, knowledge and skill levels improved from an average score of 77.88 pretest to 96.67 posttest (Lyons & Kasker, 2012). The follow-up evaluation at eight to twelve weeks showed decreased test scores with an average score of 90.38 (Lyons & Kasker, 2012). In this study, the knowledge was retained in contrast to the participants in the Friedrich et al (2016) study. This led the researchers to conclude that experienced nurses could be taught new skills (Lyons & Kasker, 2012). Similarly, as with the previous study, limited research is available regarding the frequency of IV attempts the nurses had during the eight to twelve weeks following the education provided. Also, limited information is available about what department or specialty area these nurses work in. As noted earlier, there are different skill levels among nurses depending on the specialty area of work.

In some instances, skill sets can be psychological in nature. In one particular study, the researchers looked at IV skills among pediatric and internal medicine-pediatric residents (Acharya, Weaver, Li, Tang, & Miquel-Verges, 2013). In this situation, the participants completed baseline surveys assessing personal knowledge, confidence, and

successful IV's in pediatric patients (Acharya et al., 2013). The residents attended a training session that included a didactic session followed by a demonstration on mannequins (Acharya et al., 2013). Primary outcomes showed successful demonstrations of skills and competency (Acharya et al., 2013). Secondary results showed increased confidence, self-reported scores of knowledge, and success (Acharya et al., 2013). After three months, confidence in IV placement, and self-reported knowledge improved, but confidence continued to remain low and there was no overall increase in success of IV placement (Acharya et al., 2013).

A method commonly used among nursing schools and hospital training sessions is the use of mannequins, as mentioned in the previous study. One study compared the IV skills of nursing students using a rubber mannequin training arm to a live human (Jones, Simmons, Boykin, Stamper, & Thompson, 2014). In this particular study, one group trained on the mannequins and a second group trained using each other to start IV's (Jones et al., 2014). The researchers examined 260 participants who watched a 12-minute training video covering standard IV placement and procedures (Jones et al., 2014). Afterward, both groups practiced on an assigned group. The results showed that the confidence level was statistically significantly higher among those that started IV's on the human arm (Jones et al., 2014). However, there was no difference in the groups' performance of the procedure based on using a human or the mannequin (Jones et al., 2014). This study concluded that using rubber mannequin IV arms for IV skills training may be just as effective as using a live human (Jones et al., 2014). Knowing there are many types of mannequins and technology available, this study did not mention the exact type of mannequin used or the level of technology supplied with the mannequin.

When looking at patient satisfaction and IV skills, it is ideal to make the patient as comfortable as possible and use simple techniques to lessen the discomfort is recommended. A study conducted by Kahre, Fortune, Hurley, and Winsett (2011) compared two types of pain relief for IV starts, bacteriostatic normal saline and 1% buffered lidocaine before starting the IV. This random double-blinded post-test-only intervention required subjects to receive both treatments of bacteriostatic normal saline (BNS) in one arm and 1% buffered lidocaine (Lido) in the other arm using the intradermal method as a pre analgesic prior to the IV being started (Kahre et al., 2011). The study included 56 participants who were RNs and reported overall low pain for both the BNS and Lido. There was no clear difference in pain relief during the procedure that warranted a change in the current hospital policy being used, however, when the participants were asked which arm was preferred, 89% chose the arm pre-medicated with Lido (Kahre et al., 2011). This study had an adequate sample size for analysis based on the estimate needed to provide an adequate sample size for subgroup analysis that benefited the overall results. However, there is still the factor of a needle stick with the pre analgesic followed by the IV needle and catheter. There was no mention of the participant's overall thoughts concerning this factor and it is important to consider this point.

Another technique used for many years prior to starting IV's was the application of heat on the arm or extremity being cannulated. The heat causes vasodilation to the veins therefore creating easier venous access and provides a source of comfort for the patient. An article by Fink, Hjort, Wenger, Cook, Cunningham and Orf (2009) looked at this technique in detail, and the technique is still applied and used today. This two-group,

11

randomized, controlled study had 136 participants with hematologic cancer or other malignancies (Fink et al., 2009). Participants were assigned to have either dry heat or moist heat with warmed towels wrapped around their arms for seven minutes prior to the start of the IV. The number of IV insertion attempts, time to achieve IV insertion, patient anxiety levels pre- and post-heating and patient comfort levels were all determined (Fink et al., 2009). The conclusion found that dry heat application, rather than moist heat, decreased the likelihood of multiple insertion attempts, procedure time, and is comfortable and safe to use (Fink et al., 2009). However, the heat type had no effect on patient anxiety overall (Fink et al., 2009). This technique can improve overall patient satisfaction and is a safe and economical way to improve IV skills (Fink et al., 2009).

Hospitals tend to change types of IV catheters used based on a variety of issues, therefore providing nurses with a multitude of catheters to learn from and also causing learning curves to be observed. The authors Idemoto, Rowbottom, Reynolds, and Hickman (2014) looked at an IV catheter Accucath® system with a retractable coiled tip guidewire. According to this study, current first attempt with traditional IV catheters success rates average 47%, complications are 47%, completion of therapy is 34%, dwell times are 44 hours, and patient satisfaction is an average of 3 on a 5-point Likert scale (Idemoto et al., 2014). This device has the same feel and look of a traditional IV catheter, however a coiled wire tip is deployed just after accessing the vein, followed by the catheter.

Guidewires have been used successfully in central lines and PICC lines for years and the same technology is being used in this device (Idemoto et al., 2014). The training requirements were minimal since the Accucath's® aesthetic is similar in feel to a

traditional IV catheter, therefore reducing the learning curve (Idemoto et al., 2014). The

Accucath® system catheters were compared with conventional IV catheters in adult

patients (Idemoto et al., 2014). The study included 248 adult patients over a four-month

time period. The results showed statistically significant improvements in first attempt

success (89%), less complications (8%), completion of therapy (89%), longer dwell time

(105 hours), and an overall increase in patient satisfaction (4.5 out of 5 on a Likert scale)

(Idemoto et al., 2014). The patented guidewire that is deployed prior to the catheter

being inserted improved the ease of insertion and subsequently limited vessel damage

resulting in overall improved results than traditional IV catheters (Idemoto et al., 2014).

The cost of these catheters is higher than traditional IVs, however, there is a hard

cost savings from using fewer IVs because of increased success and longer dwell times

(Idemoto et al., 2014). The data for this research shows a potential annual cost savings of

more than $298,000 (Idemoto et al., 2014). Overall, this product has minimal negative

factors and should be examined further due to such positive outcomes.

IV Skills Using Assistive Devices

Techniques that allow for better visualization of veins are being used in hospitals

and among skilled IV teams to help reduce the need for more invasive IV access and

increase patient satisfaction. One device used was a VeinViewer®. A study done by

Ramer, Hunt, Ortega, Knowlton, Briggs, and Hirokawa (2016) discussed the benefits of

this device among pediatric hematology oncology patients. The VeinViewer® is a

noninvasive, electro-optical device that detects superficial blood vessels directly under

the skin (Ramer et al., 2016). An image is then projected onto the surface of the skin

using a camera with an infrared filter and computer interface (Ramer et al., 2016). The

study examined the effect VeinViewer® had on the number of attempts made, venous access procedural time and patient and nurse satisfaction (Ramer et al., 2016). There were 53 participants that were randomly assigned in this study. The results showed patients required significantly less time to access a vein, patients rated nurses as having higher skill levels and a significantly high score given was for "overall experience" when it came to starting the IV (Ramer et al., 2016). In this study, the nurses that participated in using this device were all very experienced in IV skills, so it is hard to determine if success would be the same among more novice nurses (Ramer et al., 2016). The cost of this device is also not discussed, as in the previous study regarding the Accucath®. The length of time needed to train nurses on how to use the device is also not mentioned in this study. There was discussion for further studies to be done regarding consistencies in how data is gathered and methodology is used to benefit this device, but overall positive results were gathered from the study itself (Ramer et al., 2016).

Another technique is to utilize ultrasound (US) to detect veins that are deeper or difficult to visualize when starting IVs. One study focused its research among emergency room nurses and starting IVs on difficult to access patients (Bahl, Pandurangadu, Tucker, & Bagan, 2016). This was a randomized, prospective single-site study that involved two phases (Bahl et al., 2016). The first phase involved education and training of the nurses that performed this technique of US guided IVs. The second phase involved patient enrollment and performance by nurses of the skill of starting IVs using US (Bahl et al., 2016). There were 124 patients enrolled for this study. Success rate was 76% for the ultrasound guided technique compared to a success rate of 56% with the standard palpation method without US (Bahl et al., 2016). The average time for placement in the

US technique was 15.8 minutes compared to 20.7 minutes for the traditional method (Bahl et al., 2016). Overall nurses were more successful at obtaining IV access among difficult to access patients and less time was spent obtaining access when using the US device (Bahl et al., 2016). This study had a larger population than previous studies reviewed and showed a statistically significant difference in techniques giving US guided IV access a positive outcome. Training nurses on the anatomy and use of the US can be done fairly quickly and easily, however, learning how to use two hands while guiding the needle and looking at the US simultaneously takes time and patience. This may create a learning curve that could deter nurses from attempting, but overall results show great promise.

A similar study examined the same type of emergency room patients and the participating staff included physicians, nurses and corpsmen (technicians) at a military hospital. In this situation a program was initiated and an observational study of emergency room providers was done (Oliveira & Lawrence, 2016). After a training session was completed including complications, location of access, choices of transverse or longitudinal views of US there was a high success rate of IV placement among the staff (Oliveira & Lawrence, 2016). This study showed that developing a program to train more staff in the technique of US-guided IVs is viable, easy and safe (Oliveira & Lawrence, 2016). This study was only observational but led the authors to conclude that further training should be pursued needs due to the high success rates of successful US-guided IVs. This information also leads the authors to believe there will be less need for central line placement and physician involvement therefore reducing cost, decreasing complications and increasing autonomy among the nurses and corpsmen (Oliveira &

Lawrence, 2016). This is another very positive study that shows the benefits of US-guided IVs for future research and consideration along with increasing patient satisfaction and expediting medical care resulting in better patient outcomes.

Testing IV Skills and Training Using Qualitative Methods

A recent study done discusses the lack of published, psychometrically validated, short peripheral IV catheter insertion skills checklist developed for use (Schuster, Stahl, Murray, Keleekai, & Glover, 2016). Schuster et al. noted there is no standardized training process for IV skills and developed a short checklist for training purposes (Schuster et al., 2016). There is a 30-step checklist that has been used since 2009, so this list was modified to a 28 item checklist and used for the evaluation process (Schuster et al., 2016). A panel of three vascular access experts reviewed the checklist for validity using DeVellis's qualitative process to guide the assessment and development (Schuster et al., 2016). The checklist used trained raters that attended a three-hour classroom-based training program and were required to achieve a 90% or better passing grade to be able to ensure consistency of results (Schuster et al., 2016). The checklist measured short IV insertion skills of nurses utilizing a simulated arm (Schuster et al., 2016). The results were obtained from 63 nurses and 94 observations (Schuster et al., 2016). During this study, the checklist was found to have solid reliability and validity and is the first published checklist for short IV insertion skills (Schuster et al., 2016). This study is great for creating a defined, standardized checklist for IV starting skills, however, it is still 28 steps, only decreased two steps from the original 30. This is not a significant change from the original checklist utilized.

Another qualitative study examines not only IV skills, but also direct observation of clinical skills overall. The authors Kogan, Conforti, Bernbeo, Iobst, and Holmboe (2015) explored the experiences of faculty and staff with two rater training approaches. These researchers used a performance dimension training (PDT) and a modified approach to frame of reference training (FoRT) to demonstrate how faculty development can be designed to benefit clinical skills (Kogan et al., 2015). This study used 45 outpatient faculty preceptors who were interviewed before and after focus groups to find out how the training influenced their approach to assessment (Kogan et al., 2015). The results showed that rater training using PDT and a modified FoRT approach can provide faculty with assessment skills based on criteria, competency and also allowed a focus on individual clinical skills (Kogan et al., 2015). Some issues with this particular study directly relate to research as a qualitative study overall. Rating competence, or any skill, on a scale is very subjective and can diminish the authenticity of the study. However, the participants felt that this helped them administer high quality patient care they had not been attentive to before the training process (Kogan et al., 2015).

Summary of Review

In the nursing field, skills must be practiced and refined to provide patients with the best possible care. Patients entering hospitals are anticipating many procedures, tests, scans, and usually have high anxiety levels. Patients have confidence in nurses to perform the tasks for which they are trained. Patients will receive IVs more than any other procedure in a hospital setting, therefore calling for nurses to refine this skill to the best of their abilities. This can provide patients with lower anxiety levels and create a better overall experience and outcome for the patient.

There are numerous studies regarding IV skills and tools that can help nurses to successfully start IVs in all kinds of patients. The traditional method of starting IVs using the palpation method is the first way of training all nursing students. According to literature, training and repetition of this skill is key to success. This traditional method is the first way all nurses assess patients to begin IVs and for most situations is the easiest and the fastest way to gain venous access. However, there are many patients that have underlying health issues, obesity, dehydration, etc. that create difficulties in accessing their veins. In the hospital setting, it is not unusual to have patients with such issues. Therefore, using other methods or tools to help access veins easily and timely is important. Training nurses to use all these tools or methods will increase not only their skill level and confidence, but also decreases the patient's anxiety and increases overall satisfaction of the healthcare system.

Taking a deeper look at these tools and methods would be a great place to start to increase IV starts and satisfaction. Training nurses on how to use new devices will be a challenge due to the mindset of learning something new and the fear of the unknown. The learning curve could be drastic based on resistance and the overall time of setting up devices and tools to achieve successful IVs, however, research is showing less overall time spent on starting IV's using tools and other methods compared to traditional methods. This information is vital to inform and educate nurses on the benefits of these methods.

CHAPTER III

Methodology

Introduction

Previous research shows IV skills are lacking among nurses working in acute care in hospital settings. Patient treatments are delayed resulting in adverse effects, lengthened hospital stays and overall decreased patient satisfaction (Idemoto et al., 2014). This project's aim was to understand a rural setting RNs attitudes and confidence levels in their own IV skills to lead to a potential implementation of a tool to allow nurses to practice IV skills repetitively, or integrate technology devices to improve their confidence and skills. The purpose of this study was to examine RNs skill levels, confidence levels and attitudes in starting IVs in an acute care setting. From the information gathered in the survey, suggestions of methods or technology support in order to improve their skills were made.

Design

A mixed methods survey design was utilized to determine RNs confidence level and success rates of their IV starting skills. During the collection data time period, it was discovered there were licensed practical nurses who were IV certified (LPN-IV) working in the departments and they were included in this study. The concurrent qualitative and quantitative survey was collected in a single phase from nurses who worked at a rural

southwest Missouri hospital. Demographic information was collected, as well as data on successful IV attempts, reasons IV attempts were unsuccessful, willingness to learn about assistive devices, confidence levels with starting IVs, and gauge of needle utilized most often for IV attempts. The qualitative information asked for suggestions or ideas to improve IV skills.   Based on the results of this survey, increased training, a hands-on tool, or technological assistive device was recommended to improve IV skills among nurses in acute care settings.

Population and sample

The project was conducted in a rural hospital in southwest Missouri. The hospital has 25 in-patient beds, two trauma rooms with four beds, one triage room and eight exam rooms. An infusion center has nine chairs and one bed. There are approximately 50 total RNs and LPN-IV certified nurses trained to start IVs within all departments of the hospital. The three targeted departments for this study were the medical department, emergency room, and the infusion center. Also included in the study was the surgery department nurses which included another eight RNs who prepare patients for surgery. These departments were targeted for the research due to the number of IVs started in these areas. Other inclusion criteria included male and female RNs and LPN-IV certified nurses who were able to read and understand the English language and ages 18 years and older. Exclusion criteria were age of less than 18 years of age and non-English speaking. The survey was offered to all RNs and LPN-IV certified nurses employed by the hospital working in acute care settings, emergency department, surgery center or the IV infusion center during a random and convenient two week time period of December 2nd through 16th, 2019.

Instrumentation

An anonymous survey created by the researcher was offered to all RNs and LPN-IV certified nurses' working in the medical department, IV infusion, surgery center, and the emergency department for two consecutive weeks in December 2019. The survey supplied to the RNs and LPN-IV nurses consisted of fourteen questions asking about success rates, confidence levels, experience levels, primary gauge of needle used, department worked, length of nursing career, gender, and suggestions for improvements on IV insertion training.

Procedure

Data collection for the project began after receiving approval from Pittsburg State University's Institutional Review Board (IRB) and approval from the hospital administration. Verbal permission was granted from the nurse manager and compliance officer. The survey was offered for two random consecutive weeks in December 2019. The nursing manager was notified of the survey dates and a verbal reminder was given to the nurses by the manager during rounds describing the study and asking them for participation. Flyers were put up in the break room, with permission, asking all RNs and LPN-IV certified nurses to fill out the survey. The questionnaire was available in the break room in order to encourage the participants to fill out the survey during their break time. The nursing manager was asked to encourage nurses to take the survey during down time or on break. To maintain confidentiality, surveys were collected by an RN not associated or participating in the project. This nurse retrieved the surveys in a confidential envelope at the end of the survey. No identifying information was attached to the surveys and the surveys were kept completely anonymous. A $25 Amazon gift

card was given to one random participant at the end of the two weeks along with candies offered to all participants to encourage participation in the study.

Analysis Plan

The survey questions were designed to gather information about RNs and LPN-IV certified nurses' skill levels and confidence levels while obtaining career level, department worked, and other demographic data. The questions will be analyzed using percentages. The single open ended question's answers were grouped together by examining the over-all theme or themes that developed.

Assumptions

The major assumption of this project is that the survey questions were answered honestly to the best of the participant's knowledge. It was assumed confidentiality and anonymity were maintained throughout this project in order to obtain the best sample possible. No names or identifying information were traced to the participants. It is also assumed the participants can withdraw or refuse participation at any time during the project.

Limitations

One limitation of this study was the small sample size from a single rural hospital. The survey was also on a voluntary basis and this should be taken into consideration given the small sample size to begin with. The survey was only offered for two weeks, possibly hindering participation from nurses who work on an as needed basis. These limitations must be considered if the study is to be performed in a larger hospital setting or in an urban setting.

Summary

This project was conducted in order to understand and determine registered nurses', who work in an acute care rural setting, confidence and skill levels of starting successful IVs in order to expedite healthcare and improve patient satisfaction. The results of this study will be useful in improving training methods or utilizing technological resources for nurses who work in acute care settings where IV skills are utilized for patient care.

CHAPTER IV

Results

Introduction

The goal of this research was to examine the skill levels of RNs' and LPNs', confidence levels and attitudes in starting IVs in a hospital setting. This was accomplished via an anonymous voluntary survey to the RNs and LPN-IV certified nurses during a two week period in December of 2019. The quantitative and qualitative survey examined demographic information, the nurses' skill levels, confidence levels and attitudes in starting IVs in the acute care setting. The anonymous survey also included an open ended question about suggestions or ideas to assist nurses in improving IV skills. From the information gathered, suggestions of methods or technology support in order to improve their IV skills were made.

Demographics

The survey was made available to 66 RNs and LPN-IV certified nurses at a rural southwest Missouri hospital. The departments where participants worked included medical, surgical, operating room (OR)/endoscopy center, IV infusion center, emergency department, and the float pool, who are the nurses that work in various departments based on need. Twenty-seven participants filled out the survey which resulted in a forty-one percent participation rate. The age of respondents ranged from 30-69 with nine of the

participants being in the 50-59 age category followed closely by the 30-39 age category.

Twenty-four (89%) of the participants were female and three (11%) were male. Fourteen

(52%) of the participants had associate degrees followed with nine (33%) nurses who had

obtained bachelor degrees. Twenty-five (93%) participants were full time employees of

the hospital. Of the 27 participants, eight (30%) of the employees had between 6-10

years of experience in nursing followed closely with seven (26%) having more than 30

years of experience. Eleven (41%) of the participants worked in the medical/surgical

department. Please refer to Table 1 for more specific demographic information.

Table 1. Demographics of Respondents
(N=27)

Characteristic	n	%
Age		
20-29	4	14.8
30-39	8	29.6
40-49	3	11.1
50-59	9	33.3
60-69	3	11.1
Gender		
Female	24	88.9
Male	3	11.1
Education Level		
Associate	14	51.8
Bachelor	9	33.3
Diploma	2	7.41
LPN	1	3.70
Masters	1	3.70
Length of Career in Years		
0-5	4	14.8
6-10	8	29.6
16-20	4	14.8
21-25	3	11.1
26-30	1	3.70
>30	7	25.9
Work Status		
Full-time	25	92.6
PRN (as needed)	2	7.41

Primary Department		
Medical/Surgical	11	40.7
Emergency Dept.	6	22.2
OR/endoscopy	5	18.5
Float Pool	3	11.1
Infusion center	2	7.41

Quantitative

The questionnaire was developed in order to assimilate information about nurses'

IV skills, the nurses feelings about their own strengths and weaknesses regarding starting

IVs, and to identify possible interventions to improve IV skills. The participants had a

high degree of confidence in their ability to start IVs. The confidence levels were either

strongly agree or agree indicating they perceived their IV skills to be good. This is

consistent with the high successful IV start rates of the participants. The study showed

20 (74%) of the nurses had 90-100% successful attempt rate over the past seven days and

16 (59%) of the nurses used primarily 20 gauge needles to start the IVs. All the

participants had a willingness to learn about using assistive devices except for one person

who strongly disagreed. A majority (52%) of the surveyed nurses had not ever used an

assistive device and (48%) had used a device in the past to start an IV. Refer to Table 2

for more specific data.

Table 2. Quantitative Data
(N=27)

Category	n	%
Confidence level		
Strongly Agree	14	51.9
Agree	13	48.1
Number of Attempts Made in past 7 days		
0-2	10	37
3-5	4	14.8
6-8	2	7.41
9-11	1	3.70

12-14	4	14.8
15-17	1	3.70
18-20	1	3.70
>20	4	14.8
Percent of Successful IVs in past 7 days		
0 (n/a)	3	11.1
70	1	3.70
80	2	7.41
90	8	29.6
100	12	44.4
Unsuccessful Reasons		
Valve	6	22.2
Vein blew	8	29.6
Small crooked vein	3	11.1
Unable to capture	1	3.70
N/A 100% success	6	22.2
N/A no attempts	3	11.1
Gauge Primarily Used in past 7 Days		
18	4	14.8
18 & 20	1	3.70
20	16	59.3
22	4	14.8
n/a (no attempts)	2	7.41
Willingness to Learn How to Use Assistive Device		
Strongly Agree	12	44.4
Agree	13	48.1
Strongly Disagree	1	3.70
History of Using Assistive Device		
No	14	51.9
Yes	13	48.1

Qualitative

The study had one open-ended question asking for suggestions or ideas to assist

nurses to improve IV skills. Out of the 27 participants, 14 responded. The most common

suggestion and overall theme for improvement given was to practice: "Practice, watch

Youtube videos, shadow multiple nurses to see different techniques," "increase

frequency," "the more the merrier," "do more of them. It is a skill that comes with practice." Other suggestions made were to "not be afraid to put the tourniquet on tightly," "more training on how to choose a vein, how to palpate the vein and what you are feeling for when choosing a vein," "training with an ultrasound or Veinfinder," and "don't be afraid to go somewhere other than the arm if approved by the doctor."

Knowledge Gained

This study used a mixed methods approach to assess the confidence levels and skills with starting IVs among acute care nurses in a rural hospital. There was also a large percentage of nurses who had been working for more than 30 years and were 50-59 years of age. The confidence levels among this population were very high with their IV skills, but their willingness to increase their skill levels by using assistive devices is also very high. The percentage of successful IV attempts was high however, the most common category for attempts made was 0-2 IVs attempted in the past 7 days. Four of the respondents had not started any IVs in the past 7 days, however their confidence levels about their skills were high.

Summary

The goal of this research was to assess nurses' confidence levels and skills of starting IVs in order to evaluate implementing IV skills training or incorporating assistive devices as needed in order to improve patient outcomes. The information was analyzed from the data obtained from an anonymous survey regarding IV skills in a small rural Missouri hospital. The results from the survey obtained, showed high confidence levels among all the participants, but they are also very willing to increase their skill levels by learning how to use assistive devices such as a vein viewer/vein finder or an ultrasound.

CHAPTER V

Discussion

The goal of this research was to obtain nurses' confidence levels in their own IV skills, examine the approximate number of successful and unsuccessful IV starts over a one week period, and determine willingness to implement assistive devices to improve IV skills. After analysis of the survey responses, it has been determined that the nurses' confidence levels in their own IV skills were reported to be very high. The percentage of successful IV starts within the given time frame of one week was also high with the majority being 90-100% successful. However, when asked about willingness to implement or learn about using an assistive device to start IVs, the majority of the participants were in favor of this idea.

According to the demographics of this sample, approximately a third of the participants were in the 50-59 age range and almost 26% of the nurses had more than thirty years of nursing experience. According to authors Lyons and Kasker (2012), experienced nurses can be taught new skills. With this in mind, implementing an assistive device in order to improve IV success rates could be a successful option for all nurses, including those nurses who have much more experience. From the nurses who had worked in nursing for thirty or more years, six of them reported willingness to learn

or implement an assistive device to start IVs and two strongly agreed with their willingness to learn a new skill.

The overarching theme of the open-ended suggestion or ideas to improve IV skills was overwhelmingly "practice." This correlates with the study done by authors Friederich, Brouwer, Marschall, and Weissenstein (2016) who looked at medical students who had testing done immediately following an IV skills intervention. The performance levels dropped significantly after one week showing consistency and repetition improved IV skills (Friederich et al., 2016).

Another theme that was noted in the open-ended question suggested different techniques. These included how tightly to place the tourniquet, tapping the vein, using the fingertips to feel for the vein and not just relying on vision alone, and also using patience when looking for a good vein option. Different techniques utilized when starting IVs is nothing new. Looking back at the study conducted by authors Fin et al. (2009), they explored using heat on the extremity being cannulated in order to cause vasodilation and creating more comfort for the patient. Another study done by Kahre et al. (2011) compared normal saline and 1% buffered lidocaine injected as a bleb before starting the IV in order to decrease the amount of discomfort for the patient. These are just a few methods that can be utilized in order to improve successful IV outcomes.

Evaluation of Theoretical Framework

Patricia Benner's From Novice to Expert theory was utilized in this study by examining the experience levels of the nurses and their skill levels with starting IVs. This theory describes how nurses develop skills over time from a combination of a strong educational background and experiences (Alligood, 2014). The concept of how nurses

gain knowledge and skills without actually learning a theory describes nursing as a development of knowledge (Petiprin, 2016).

Within this study, four of the participants had been a nurse for 0-5 years placing them in the novice stage of development. All four of these participants responded to the survey with "agree" when asked about their confidence level of their current IV skills. Looking at the next cohort of nurses who have worked in nursing for 6-10 years, only one participant responded with "agree" with the same question and the other seven responded "strongly agree" when it comes to their confidence levels in starting IVs. When examining the seasoned nurses who have worked for more than thirty years and would be considered expert level in the nursing field, five responded "agree" and only two responded "strongly agree." Looking at this data one can assume the novice nurses' (0-5 years of experience) confidence levels are not as high as those who have been working just a year to five years longer. However, as the nurses have worked longer, (more than 30 years) the confidence levels once again wain slightly. Age, vision, and/or fine motor skills may play a part in the confidence levels as the nurses get older. Out of the seven respondents who worked more than thirty years, four had 100% success rates with IV starts, one had 90% success rate, one had 0% success and one did not answer the question. Out of the four novice nurses (0-5 years of nursing experience), two had 90% successful IV starts, one had 80% and one had 0%. In the 6-10 years of nursing experience cohort, five respondents had 100% success rates and three had 90% success rates. Again, this demonstrates having just one year to five years more experience than the novice nurses, increases confidence rates and successful IV rates. Benner's theory of novice to expert shows that the expert level may in fact be a little sooner than expected in

a nurses career and may wain slightly as nurses get older but have the most experience in starting IVs.

Limitations of the Study

The small sample size for this study was a limitation that is important to note. Twenty-seven nurses out of the sixty-six solicited for this survey is equivalent to only 41% of the nursing staff in the small rural hospital where the survey was offered. The time frame given to take the survey was for only two weeks, which may not have captured every nurse, especially those nurses who only work as needed or part-time.

Another very important limitation of this study to consider is the subjectivity of the survey questions. The questions wanted approximate percentages of successful IV starts, and the information provided by the respondent may not have been completely accurate or truthful. A comparison to the electronic medical record (EMR) documentation could be conducted in order to establish accuracy.

Recommendations for Future Research

One recommendation for future research in this area, would be to give the survey in a larger hospital to capture more data. A larger hospital may have more specialized departments, including an IV team. This could give a better representation of IV success.

Another question that would be interesting to examine, is the number of times the respondent had to have another staff member attempt or had to refer to outside sources such as anesthesiology or an IV team. The survey did not address the issue of consultation for a PICC line or for a surgeon to place a central line if no IV access could be obtained. This would lead to delay in treatment, increased resources, and increased costs.

As previously mentioned, a comparison of the success rates given by the respondent and what was documented in the EMR would be interesting to evaluate in the future. The accuracy of documentation of IV starts may vary depending on accurate record keeping and the nurses' reliability in keeping track of all IV attempts, successful and unsuccessful. Depending on the EMR, the documentation may not include or track attempts made and may be very time consuming for the nurses to document. However, if the information is not documented, this infers the event(s) did not occur. Detailed documentation, or lack thereof, can lead one to believe successful IV rates may be inaccurate according to documented sources.

Implications for Practice

The clinical significance for this study was to examine nurses' IV skills, confidence levels, and to evaluate the need for an assistive device to be implemented in the hospital setting. Given the high confidence levels and skill levels that were determined from this sample, the desire to learn about using an assistive device was very high with 96% agreeing or strongly agreeing when asked about willingness to learn. This information can be a valuable tool for a hospital to implement the training and education of assistive devices in order to improve IV skills, lower the number of attempts made, and decrease unnecessary invasive methods such as placing central lines or PICC lines.

Utilizing ultrasound for IV placement could also improve confidence levels within novice nurses and even expert nurses as this study showed nurses who had worked for more than thirty years' confidence levels were not as high. Poor vision or decreased fine motor skills may be a contributing factor to their decreasing confidence and skill

levels. Utilizing ultrasound for IV guidance could improve this aspect of IV placement considerably.

Conclusion

As the need for healthcare increases and good patient satisfaction is sought after, having proficient nurses who can successfully start IVs in a timely manner is very important. This will expedite medical care, improve patient outcomes and improve patient satisfaction. This study was conducted in order to assess nurses' confidence levels, find out the approximate number of successful IV starts done in one week, and assess the interest level of learning how to utilize an assistive device when starting IVs. The findings in this study suggest the overall confidence levels of the nurses who completed the survey were high and the success rates of IV starts were also high. However, there was a strong desire to learn how to use an assistive device in order to be more proficient. Although the study had a small sample size and short timeframe, utilizing devices such as ultrasound or a VeinViewer® in order to improve patient outcomes may be worth having more hospitals implement in the future.

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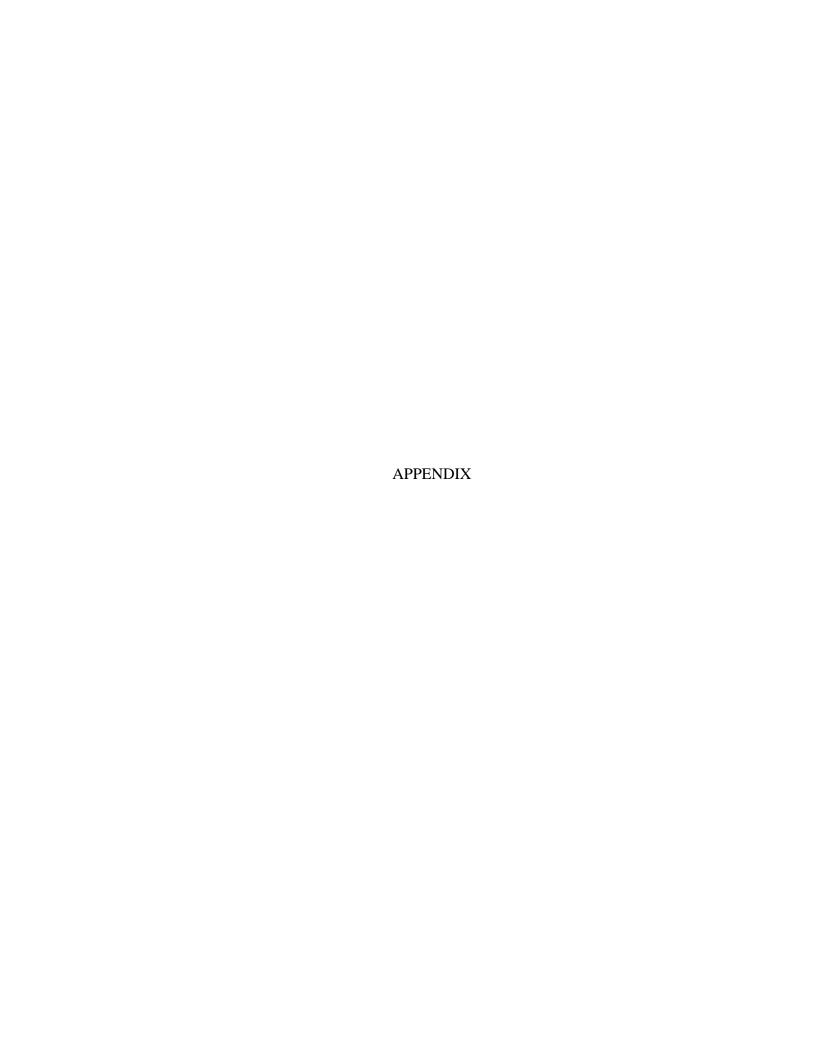IV start. (2003). In *Miller-Keane Encyclopedia and Dictionary of Medicine* (7th ed.).

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APPENDIX

Appendix A

IV Skills Survey

This survey is being conducted for a doctoral program scholarly project to examine and evaluate the IV skills among registered nurses in the acute care setting. The objective is to establish a baseline assessment of IV skills and evaluate if training tools or assistive devices would be beneficial for improved patient outcomes.

Please circle your responses for the following:

1. **I am confident in my current IV skills.**
   Strongly agree   Agree   Disagree   Strongly disagree

2. **How many times in the past 7 days have you attempted an IV? (Please include successful and unsuccessful.)**
   0-2
   3-5
   6-8
   9-11
   12-14
   15-17
   18-20
   >20

3. **Out of those attempts, how many IV attempts were successful? (Please circle only one)**
   0%---10%---20%---30%---40%---50%---60%---70%---80%---90%---100%

4. **In the last 7 days, when an IV was unsuccessful, what was the primary reason?**
   Small crooked vein
   Valve
   Vein blew
   Unable to capture vein
   Other (Please specify) _____

5. **What gauge of IV did you use primarily in the past 7 days?**
   18 gauge
   20 gauge
   22 gauge
   24 gauge

6. **I am willing to learn about and use an assistive device such as an ultrasound.**
   Strongly agree   Agree   Disagree   Strongly disagree

7. **Have you ever used an assistive device such as ultrasound or VeinViewer ® to assist with starting IVs? If so, what type of device was used?**
Yes or No If yes, please specify: _____

8. **Suggestions or ideas to assist nurses to improve IV skills:**

   _____
   _____
   _____

9. **How long have you been a registered nurse?**
   0-5 years
   6-10 years
   11-15 years
   16-20 years
   21-25 years
   26-30 years
   >30 years

10. **What is your work status?**
    Full-time   Part-time   PRN

11. **What department do you <u>primarily</u> work?**
    Emergency room
    Medical/Surgical
    Infusion Center
    Float pool

12. **Age (please circle):**   20-29   30-39   40-49   50-59   60-69   70 and above

13. **Gender:** _____

14. **Educational level of nursing degree (please circle):**   Associate   Bachelor