

Running Head: Capstone Manuscript

Emergency Bedside Ultrasound Guided Intravenous Access
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Introduction

Emergency bedside ultrasound is a useful tool that has been utilized for over two decades by emergency and critical care physicians. Its growing popularity in emergency medicine has continued to expand to a rapidly useful tool for a wide range of diagnostic and procedural applications. As this technology develops and becomes more readily available, more institutions should understand its risks and extensive benefits. The purpose of this proposed area of study is to institute a training program to institute more widespread emergency bedside evaluation in which to create a more thorough assessment and plan of care for patients.

The topic of emergency bedside ultrasound use is not new in healthcare, yet it also is not widely accessed by all healthcare systems. Smaller hospitals especially in more rural areas lack the tools and educational access to implement bedside ultrasound in their practices. Most emergency departments using ultrasound report that they follow American College of Emergency Physicians (ACEP) emergency ultrasound guidelines. Compared with community Emergency Departments, academic facilities are more likely to use bedside ultrasound, have providers that are credentialed in its use, and have quality assurance programs. Yet, not all facilities fall into this list.

Numerous uses of bedside ultrasound have been identified. In patients with major trauma, early detection and treatment are vital in the survival and long-term prognosis. As the volume of emergency department patients continues to grow and the number of exploratory tests also grows twofold. Usually in emergency departments, time is of the utmost importance and causes of illnesses need to be identified quickly, efficiently, and in the least invasive way possible. Use of bedside

ultrasound has been shown to increase patient satisfaction, decreased ED length of stay, aid in ED patient flow, lower healthcare cost, and most importantly, save lives.

There are many uses for bedside emergency ultrasound to be incorporated in emergency care. Bedside ultrasound can be useful in the diagnosis of renal colic, intrauterine pregnancy to confirm gestation or an ectopic pregnancy, central or peripheral intravenous or arterial cannulation, diagnosis of hydronephrosis, aortic aneurysm, soft tissue studies, deep vein thrombosis, pneumothorax, traumatic haemoperitoneum, or basic echocardiography in life support (Moghekar, Ajit. (2013). Bedside applications of ultrasound).

This research will focus on emergency department nurse-driven ultrasound-guided peripheral intravenous access. Ultrasound-guided peripheral intravenous access (referred to as USGPV) is a bedside approach to those that have poor peripheral access and need a line for emergency care. This program is a more efficient way to train nurses to provide IV access than to rather rely on other means such as a central line; which are more expensive, are not available quickly in smaller hospitals, and are a large reservoir for impending infections.

Purpose

The purpose of this proposal project is to educate nurses to use bedside intravenous access ultrasound in Emergency Departments and acute care scenarios. The Independent variable is represented by identifying whether the educational program to teach nurses improves the dependent variable. The Dependent variable; which what is being tested, is represented by; whether an ultrasound increases the ease and efficiency of accessing IV's. This is the variable being measured in the purpose statement.

The learning theory identified is the Experiential Learning theory by David A. Kolb. This is a four-stage cyclical theory of learning and introducing a new perspective that is holistic and based off a sequence of four stages. The first stage is the concrete experience (the “Do” stage), the second is reflective observation (or “Observe” stage), abstract conceptualization for the third stage (known as the “Think” stage) and lastly the active experimentation (the “Plan” phase). See Appendix I (Kolb. 1984). Kolb’s four-stage learning cycle is based on reflection of new opportunities and experiences. The first stage, the concrete experience, is where the student or the learner experiences an initial educational session. The second stage, the reflective observation is when the learner reflects back onto the context of the experience. The third stage; abstract conceptualization, occurs when the student attempts to model the learned educational experience. Lastly, in the fourth and final stage, the active experimentation stage occurs when the student employs the education into a plan for future experiences to come.

These steps that Kolb identified are very similar into the learning process employed within this educational thesis. In the proposed educational protocol of emergency guided ultrasound intravenous access steps were taken in the same fashion as Kolb’s learning theory. The first step is the education is to introduce the educational program. Secondly, a teaching session was completed. Thirdly, after the education was provided, nurses are then able to put what they learned into practice, which flows into the fourth step. For the fourth step, once the educational tool has been mastered, nurses plan to use it on additional patients that need ultrasound guided IV insertion in the future.

Kolb identified four learning styles, which correspond to these stages. The styles highlight conditions under which learners learn better. These styles are as follows; assimilators, convergers, accommodators, and divergers. Assimilators are those who learn best when shown sound theories to consider. Convergers are those who learn by studying and conceptualizing concepts and theories. Accommodators are learners in which this educational protocol was established for; learning hands on. Lastly, divergers are those that stand away from situations and observe, collect information, and take the entire event in.

Kolb's learning theory validates the structure of USGPI identifying the learning steps, and ways in which people learn. Using this learning theory, the educational protocol was developed to help best assist the learner with the new education.

Chapter Two: Learning Theory

For the last fifty years medical providers in Emergency Departments have required imaging tests which required sending patients to another department with imaging staff and high cost medical imaging systems.

The uses of bedside ultrasound in emergency departments are widely being pursued as they enhance patient safety in commonly performed procedures. The American Institute of Ultrasound in Medicine (AIUM) and the American Medical Association (AMA) have developed policy statements that outline the use of ultrasound and even training recommendations for bedside ultrasound. Bedside ultrasound is also being included in many mid-level and primary care providers educational curriculum, so many new graduates have been exposed to the benefits and training to put to use the modality. The use of ultrasound in the rapid

assessment of the emergency setting has new research that has been well studied and validated, as well as the role of ultrasound to facilitate procedures that can diagnosis quickly at the bedside, save the patient and health system money, and improve patient safety.

The scope of clinical applications of emergency ultrasonography continues to grow. There are endless possibilities to its benefits. Researches have described bedside ultrasound as an ‘ “extension of the palpating hand” ’ and ‘ “a visual stethoscope.” ’ (Chan, Stewart Siu-Wa.(2008). The value of this research has pointed to the multiple uses of bedside ultrasound and the low scale of invasiveness it posses in comparison to others. It can easily be used in critically ill patients that show considerable risk in being moved to go for testing. For example, in the research article “Using ultrasound to assess blunt abdominal trauma” by Thomas Levins, they displayed the FAST approach which uses four views in trauma patients which allows the medical provider to assess trauma quicker, allocate treatment, and appropriate interventions quicker. The FAST approach includes; an epigastric view, right upper quadrant view, left upper quadrant view, and a suprapubic view (Levins, Thomas.2000).

Sergio Kobal, Shaul Atar, and Robert j Siegel co-wrote an research article in which they studied if carrying a handheld ultrasound would improve the bedside cardiovascular exam. Diagnostic accuracy was assessed; parameters such as LV function, LV hypertrophy, Pericardial effusion, and AAA were looked. The results of the article found hand carried ultrasound (HCU) device has the potential to promote better and more efficient health care centered care. When trained properly, a

through assessment of cardiac functioning was done quickly and efficiently with the HCU (Kobal, Sergio L; Atar, Shaul; Siegel, Robert J. (2004).

Overall, the impact proposed in this research is to institute emergency bedside ultrasound in institutions that have not yet begun to adhere to this new technology. The American College of Emergency Physicians classifies bedside ultrasound into four functional clinical categories; *Resuscitative*: ultrasound use as directly related to an acute resuscitation, *Diagnostic*: ultrasound utilized in an emergent diagnostic imaging capacity, *Symptom or sign-based*: ultrasound used in a clinical pathway based upon the patient's symptom or sign (eg, shortness of breath), *Procedure guidance*: ultrasound used as an aid to guide a procedure, and *Therapeutic and Monitoring*: ultrasound use in therapeutics or in physiological monitoring. Using these categories mid-level providers, physicians, and nurses can institute bedside ultrasound to patients on multiple occasions in order to provide the upmost quality of care that our health care system allows. This new technology is at our fingertips, it is a non-invasive look into the human anatomy that can benefit the total health care picture and should be readily available to all medical institutions.

The use of vein viewers and "IV teams" have been the standard of practice in Emergency departments for an array of tools used to place intravenous access. However, with the advances in medical technology; ultrasound and miniaturization; medical imaging has been able to come to the bedside at a fraction of the cost to the patient, providing a non-invasive and less time and monetary consuming tool. A comprehensive view into smaller community hospital use of ultrasound at the bedside is lacking to provide a new paradigm shift. Thus, this educational protocol is

meant to demonstrate the positive results of bedside ultrasound and demonstrate the higher efficiency and broader use for nurses, providers and patients.

There have been several studies to support emergency bedside-guided ultrasound IV access, but few are aimed at creating an educational institutionalized program. A similar study was created in 2007 to compare the traditional method of peripheral intravenous (IV) cannulation vs. IV access with ultrasound guided placement (Aponte, Hector, CRNA, MSN; Acosta, Said, CRNA, MSN; Rigamonti, Donald, PhD.; Sylvia, Barbara, RN, PhD.; et al. (2007)). The study showed Ultrasound was efficacious as the traditional method of IV placement. Results of the study found ultrasound placed IV seemed to take longer than peripheral placed IV. It also noted that the use of ultrasound is still advantageous as it lacks adverse biological effects, provides real-time images, gives quantitative imaging, measures blood flow, and size of vein.

Another recent article was published which was an evidence base study conducted to institute a nurse-driven ultrasound guided IV access in an emergency department setting. The study identified the need of USGIVP by identifying a subset of the population most in need for access. It stated the most difficult access to place is in those who have chronic illness, such as chronic renal failure, diabetes, IV drug users, immunocompromised individuals, those with poor vascular accessibility, and those suffering from cancers. The study stated 51%-75% of their patients were admitted to an inpatient unit, most of which required additional IV access at one point during their hospitalization. Thus, they found it crucial to get access during the

emergency visit in order to secure initial access, and using USGPiV was key to this (Moore, Cindi, MBOE, BBA,R.N., C.E.N. (2013)).

According to the American College of Emergency physicians, a September 2008 study showed the overall success rate for patients with ultrasound-guided IV was 98%. Consequently, after viewing this and numerous other studies, ultrasound-guided PIV catheter placement statically shows higher overall and first-pass success rates, with low complication rates (Evans, J. (2008)). Consequently, great support has been placed on USGPiVP, with its low complication rates and high success rates, this is a painless procedure that more and more intuitions are coming on board with.

Chapter Three: Methods

As with any new educational initiative there comes ethical implications. All new protocols within a hospital setting require assurance there is no potential harm to patients. Considering ultrasound is a non-invasive, painless, and quick method to place intravenous access, there is very little potential harm. Possible harm identified would be; allergy to the gel used, and the side effects in accordance with all intravenous attempts. These include but are not limited to, infection from puncture of the needle into the skin, infiltration, hematoma, air embolism, phlebitis, extravascular drug administration, and intraarterial injections (although they are rare).

Patient confidentiality and privacy were taken into consideration for this study. No patients were used in the educational protocol, which avoided issues such as violating HIPPA and trying to not use any type of patient identifiers or populations. Instead, this was an educational program for nurses, avoiding the use of patients as samples. Another potential concern was the consent for nurses. Thus, the study was made to be self-

selective, meaning nurses who desired the education, completed it. Those that did not, did not have to complete the training. Another complication that arose was permission to complete the study at the institution. Permission was obtained from the Chief of Medicine in the Emergency and also the Chief Nursing Officer of the hospital.

The targeted audience was directed at emergency department nurses and also includes floor nurses and intensive care nurses. This specific population was targeted due to their patient subset. Emergency nurses are at the forefront of placing intravenous access and should be adequately trained in all facets that employ a successful intravenous placement. Most of the time, patients that enter through the emergency department are crucially ill and need immediate access, thus there is no extra time to worry about difficult access. With this technology, patients that are known or are found to have difficult access by nurses can use USGPiV technology in order to place IV's and begin a quick course of care.

In many small and rural facilities, there are not always available resources to employ if an IV is not able to be placed. For example, Interventional Radiology who usually place central lines and PICC lines are not in house after normal business hours. Thus, at night having USGPiV is a very valuable asset, and can save resources, time, and pain for the patient instead of having multiple unsuccessful IV sticks.

The setting of the targeted audience takes place in a small rural hospital within all clinical care arenas, with focus on emergency care. The largest element within the setting is the support and impact placed within the protocol. Of note, the more support the educational protocol gleamed, the more people voiced interest for the training and support of the use within the emergency department. Also of note, this location like many

other rural communities have a large population with a wide variety of chronic medical ailments which make it difficult at baseline to obtain intravenous access for them. Thus, this setting makes it applicable to initiate such programs. Also of note, this setting has limited resources during evenings and nights for alternative intravenous making USGPV a needed resource. This in itself validates the need for not only the program, but also the support of nurses, providers, and administration. If organizational support was not successful met, the educational protocol would not be able to be implemented. Consequently, if there was no USGPV protocol instituted there will be no assistance for patients with difficult access making the plan of treatment more complicated and delayed.

The target audience is emergency department nurses. This education was built and based off of barriers to patient care and satisfaction, not placing attention on a nurses inability to obtain an IV site. A barrier to learning could be the possibility some nurses believe this education is focused on them and an inability to gain IV access in some patients. Rather, notable this is an asset to all nurses, as patients present with multiple medical conditions and baseline poor vascular status so obtaining an IV for even the experienced nurse is difficult. Another barrier presents itself with some experienced nurses not employing the new technology because of their accomplished skill set, they may not find the addition of new technology helpful in their practice or they may not feel comfortable employing the new technology and new equipment due to fear of difficulty of use.

With any introduction of new technology there are potential barriers for recruitment of learners. Yet, many nurses were open to the new idea and

approachable for this new non-invasive technology to better equip staff for USGPiV. Thereafter permission to complete the project at the facility was granted, a needs assessment was completed including a literature review. The literature review entailed accessing all relevant data and evidence based practices on USGPiV and seeing where the need for improvement and success in the intervention should be placed. Only one other similar article was found, by Cindi Moore, RN in 2013 titled; "An Emergency department nurse-driven ultrasound-guided peripheral intravenous line program." This study had great over success rates not only with their intravenous accesses but also left without being seen times, and adequate pain control coverage all of which were attributed to their USGPiV program. Many factors influence the time to admission to the time being admitted into the inpatient bed. Of note, this period of time is often spent waiting for reliable IV access and blood work, and subsequent treatment, which can lengthen the time in the department.

One of the benefits of implementing USGPiV into the emergency department is the availability of ultrasound machines. Two machines are available for use within the department, which also allows one extra at all times to be taken to the intensive care unit or medical surgical floors for use. USGPiV is a relative new tool in the medical world, yet it is not lacking support. Agencies such as the American College of Emergency Physicians, the American Association of Nurse Anesthetists, Journal of Emergency Nursing, and the Emergency Nurses Association all support the use of USGPiV.

The goal of the educational program is to institutionalize the USGPiV in a useful and easy to learn fashion. A comprehensive literature review was completed to demonstrate the impact on workflow in the ED by changing the evaluation strategy.

Interviews with current providers that implore this technology were studied along in accordance with patient perspectives, and cost-effectiveness in performing imaging at the bedside. Literature was also reviewed on the best educational methods to utilize for education of adult health care providers.

The educational modules will be developed and reviewed by appropriate expert reviewers and recommendations implemented. The second phase of the project will include administering the offering to participants in a local rural hospital emergency department, and neighboring units to educate as many as possible.

The initial training course consisted of several processes. Firstly, 49 nurses in the hospital were given via an on-line format their educational component of watching didactic podcasts on-line. The course content is based on Infusion Nurses Society standards. The pod-cast was all encompassing including a video to fulfill the full educational commitment of the learner to bedside ultrasound in the emergency. After successful completion of the podcasts, the learner then completed a post-test to assess their knowledge and skills after the educational component. A hands-on practice session was also held to re-enforce concepts demonstrated during the online teaching sessions. Those that could not attend the class were sat down with one-on-one to go over the education. Informational education was also passed out during all phases of the program to insure success.

The objectives for the educational program were clearly stated and instituted within an eight month span. The steps as stated were; firstly getting access and permission to complete the program. Secondly the educational pilot was build,

including training with a skilled ultrasound teacher, making instructional materials, building the tests, the video, and the research. From there the program was submitted to the hospital for placement on their “intranet” which is a homepage for all employees to use for educational purposes. Thereafter, nurses had one month to complete the on-line education and post-test after that they were able to have the hands on teaching.

The teaching strategies were picked for ease of learning, encompassing written exam, on-line videos, and hands on competency. The variety of learning strategies were picked to ensure all nurses had an array of teaching to avoid any oversights in learning abilities.

The method for evaluating learning was subset into two categories. The first was the pre-test at the end of the education format on-line. The second was hands-on through verbal feedback. The summative evaluation from the hands-on competency noted to have surprisingly good feedback. Users stated assessing and finding a patent vein was easily obtained using ultrasound. The difficulty lied in what angle and depth was best for puncturing the skin with the catheter; this seemed to be an acquired skill, best developed with practice of several attempts.

In evaluation of the program, there were several areas of strengths and several areas of weakness. The strengths of the program include the wide range of educational values used; this combats excluding a person because their personal learning style was not focused on. Another strength was the support received from the facility. The more support a facility renders, the more successful the program will likely become as more nurses are apt to participate. Another strength was the

willingness of the learners. This facility has limited the amount of non-mandated funded education. Thus, nurses are very eager to learn new approaches that benefit their patients.

Several negative factors also contribute to the study. Small sample size coincide with the location and size of this rural hospital. The hospital also is not a certified trauma center, so the majority of trauma patients are diverted elsewhere. Lastly, the fact that this is a new technology not employed by many adjoining facilities can be prohibitive to skeptical learners.

Internal validity is combated within one use of a new learner. An obese man presented to the emergency department with bilateral lower extremity cellulitis. This man had peripheral vascular disease and obesity, making intravenous access difficult at best. Several IV attempts later, a new nurse who had been trained in ultrasound was able to access an IV and blood work with the ultrasound guidance with one attempt. External validity was gained by employing the practice to emergency medical services. A large number of patients at this facility are brought in by EMS services; of which do not currently use this practice. Since the introduction of this, the two main EMS providers to the hospital have voiced interest in training programs as they have difficulty with the same patients we see obtaining IV access.

Chapter Four: Results

Of the 49 nurses tested,

Chapter 4: Results

Demographics

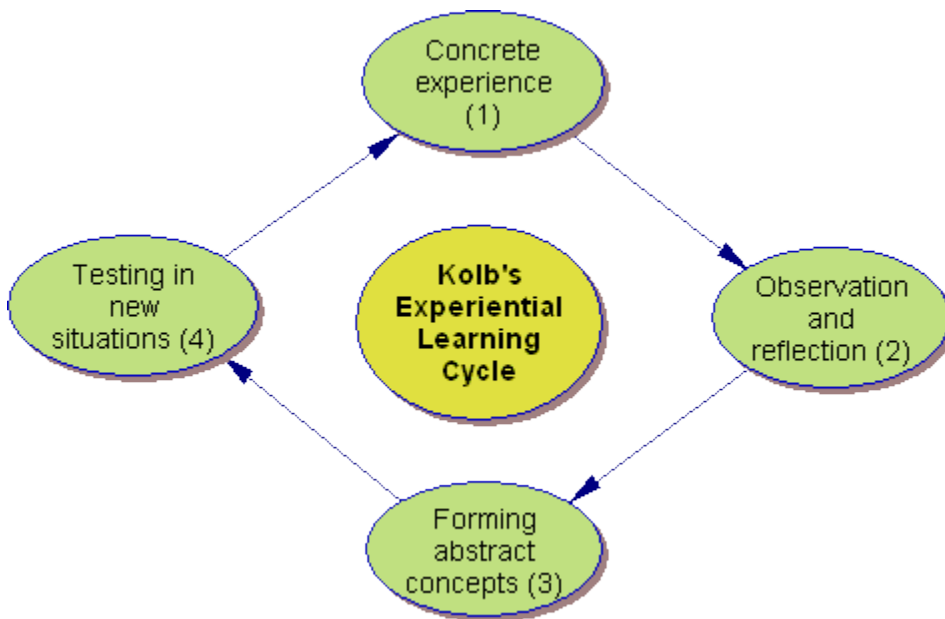
- Describes demographic characterizes relevant to the learners

Program Implementation

**Advisor Comments S/U/N/A Second reader
Comments**

- Explains the actual course of the educational program
- Documents degree of success in implementing the proposed educational program components

Appendix I



<http://www.learning-theories.com/experiential-learning-kolb.html>

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Acknowledgments

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