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Effectiveness of an Educational Intervention to Reduce Preanalytical Specimen Errors

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Abstract

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MSN, Walden University, 2013

ADN, Oakland Community College, 2009

Project Submitted in Partial

Fulfillment of the Requirements of the

Doctor of Nursing Practice Degree

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Abstract

A rejected blood specimen can be very costly to a hospital as well as to the patient. Many errors occur in the preanalytical phase in which nurses and assistive personnel are often involved because they are usually not trained to do so. This staff education project was designed to decrease the number of laboratory rejections of blood specimens in a local hospital setting. Knowles's adult learning theory was combined with the knowledge translation framework, proposed by Fredericks, Martorella, and Catallo, so that evidence-based changes in practice could occur more readily. There is a 20-minute in-service educational intervention followed by an orientation in the outpatient laboratory to gain phlebotomy experience and competency. The proposed project has elements of intervention, data collection and assessment. A pretest and posttest, developed for this project, would be administered prior to, and 6 weeks after, the educational intervention, respectively. A competency checklist would be completed by a phlebotomy preceptor in the lab for the employee file. Data collection would occur in the laboratory for 3 months prior to the educational intervention and then resume for 3 months after the phlebotomy competencies are complete. Pre- and post-intervention data would be compared to determine project success. A panel of experts conducted a formative review of the project via a five-question, Likert scale questionnaire. The data compiled from this review revealed that the project has merit and is a relevant solution to fill the current gap in practice. Further research is necessary to determine the full benefit of its implementation; however, this staff educational project could be put into practice in any hospital that is experiencing a significant number of rejected blood specimens. The implementation would provide the data to analyze to determine the full potential of the project.

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Dedication

I dedicate this project to my husband, Craig, for all of the tremendous support you provided to me throughout my program helping to make all of this possible. You picked up much more than your share of responsibility for our household and I appreciate you more than you know for that. I also dedicate this to my family, who were always understanding when I was not available to them because I was busily working on this project. I love all of you and thank you for sacrificing for my goals and helping me achieve them!

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Section 1: Nature of the Project

Introduction

When a patient's blood specimen is rejected, the patient, in most cases, will be subjected to an additional needle stick, thus increasing his or her infection risk. Because these rejections can cause a delay in obtaining laboratory results, there is an additional risk of delaying diagnoses and/or treatment of these patients. There may also be an increased risk of patient dissatisfaction due to the need to redraw the specimen, in addition to the extra costs incurred by the institution. Therefore, correcting this problem can increase patient safety and satisfaction. The focus of this Doctor of Nursing Practice (DNP) project was to develop an innovative educational/training intervention aimed at reducing the number of specimen rejections in a hospital setting. The curriculum was based on teaching basic phlebotomy techniques to registered nurses (RNs) and assistive personnel (AP) and was designed to reduce the number of preanalytical specimen errors in health care facilities.

This educational project was based on the principles of the adult learning theory proposed by Malcom Shepherd Knowles (1970). These principles include involving students in the planning and evaluation process, ensuring that experience is the basis for learning, providing content that has immediate relevance to the learner's job, and confirming that the learning is problem-centered (Knowles, 1970). This framework was chosen to guide the design of this educational intervention to provide the learners with the best possible educational experience.

Problem Statement

The focus of this doctoral project was to reduce the number of rejected blood specimens drawn by RNs and AP in a local hospital setting. A thorough investigation of this problem showed that this issue has been experienced by many different hospitals around the world and has been studied by a significant number of clinical laboratory science professionals over the past 30 years; however, there were relatively few nursing studies on this subject. This was unexpected because there is a much higher impact on nursing in this particular situation than there is on laboratory professionals.

Each laboratory rejection requires an RN or AP to obtain another specimen, which decreases efficiency and increases cost of care. Costs to the patient include additional pain due to the need to collect the specimen again, increased risk of infection, and decreased satisfaction with the health care system (Green, 2013). The danger of improper treatment based on invalid test results or delays in processing and reporting can also increase the cost of care (Green, 2013). Green (2013) calculated the cost to hospitals for each preanalytical error, and the results are an average of $208.00 per patient. Should this project provide a useful solution to decreasing the number of rejected blood specimens, it could be implemented in similar institutions around the globe to increase patient safety and satisfaction as well as decrease health care costs.

There are three main phases of laboratory testing. The preanalytical phase is first and consists of all procedures that occur prior to the actual testing of the specimen, such as gathering the equipment, identifying the patient, drawing the specimen, and transporting the specimen to the laboratory (Chawla, Goswami, Tayal, & Mallika, 2010).

According to Bhat, Tiwari, Chavan, and Kelkar (2012), the preanalytical phase is the most error-prone. Atay et al. (2013) identified the rate of preanalytical errors as being much higher for specimens collected by nonlaboratory staff due to the lack of training and practice that is typically experienced by phlebotomists. Wallin et al. (2010) asserted that most of the errors occurring in venous blood sampling happen in the preanalytical phase and are mainly due to human error. Chawla et al. (2010) confirmed that the main cause of preanalytical error is linked directly to the collection of the specimen, such as hemolysis, using an incorrect tube, insufficient volume, and/or clotting. Aarsand and Sandberg (2014) stated that failure to make appropriate patient identification prior to obtaining a blood sample could produce a negative, if not fatal, outcome for the patient. Chawla et al. added that diagnoses and treatment decisions are made utilizing laboratory results, making it crucial for these results to be reliable.

Preanalytical errors have been a problem affecting laboratory specimens for many years (Simundic & Lippi, 2012). This is a global problem that has a wide-ranging associated cost to both the patient and the health care organization. According to Karcher and Lehman (2014), rejected laboratory specimens cause patient discomfort, delay the availability of critical laboratory results, and may significantly compromise patient safety.

Oftentimes, RNs and AP are expected to obtain blood samples from patients without possessing the knowledge and/or competency to do so. This can result in difficulty for the RN/AP, the patient, laboratory personnel, and other medical professionals waiting to diagnose and/or treat patients based on delayed laboratory results

due to specimen rejection (Green, 2013; Karcher & Lehman, 2014). McCarthy, Cornally, and Courtney (2011) asserted that RNs perform a variety of clinical functions with varying competency levels that are positively affected by additional education and experience.

The idea for this project developed as a result of the numerous blood specimen rejections occurring at a community hospital that is part of a five-hospital health system. The hospital protocol required that RNs and AP draw patient blood specimens as ordered and send them to the laboratory for analysis. Prior to this project development, the hospital was having about 250 blood specimens rejected per month in just one hospital within the system. It was determined that most of these rejections were due to preanalytical errors. This project was designed to determine the impact an educational/training intervention would have on decreasing the number of rejected blood specimens in a hospital setting. Since RNs and AP draw patient blood specimens on a regular basis in hospital settings, the implications of this doctoral project could save health care dollars, make nursing practice safer and more efficient, and provide patients with safer and more satisfactory care.

The analytical phase follows and involves preparing the specimen for testing, performing quality control on the testing equipment, and running the specimen through the testing process (Abdollahi, Saffar, & Saffar, 2014). The post-analytical phase, according to Abdollahi et al. (2014), consists of reporting the results in an accurate and timely fashion. These two phases will not be addressed in this project because the error rate is much lower than that for the preanalytical phase of testing.

Purpose

The purpose of this project was to provide RNs and AP with education and experience regarding proper phlebotomy technique and knowledge about preanalytical specimen error prevention as well as filling requirements for each specimen tube. The goals and corresponding objectives for this project were as follows:

- Decrease the number of RN/AP-drawn blood specimens rejected by laboratory personnel.
    - To educate nursing staff on phlebotomy techniques and the importance of preventing errors.
    - To reduce preanalytical errors by increasing nursing knowledge.
- Increase patient safety and comfort.
    - To provide nursing staff with additional skills and knowledge to increase competency in proper phlebotomy techniques.

The question this project attempted to address is, “Would an educational intervention reduce the number of preanalytical patient blood specimen errors collected by RNs and qualified AP in patient care areas of a health care facility?” I performed a significant review of the current literature and found many clinical lab science studies that address this issue, but only a select few nursing studies. As a result, there is a large gap in practice that is yet to be resolved. It was the intent of this project to address this gap.

A successful outcome of this doctoral project would benefit the microsystem, nursing unit personnel and patients, by reducing the number of repeat blood draws due to

rejections as well as failed attempts at obtaining blood samples. The patients would experience less pain and risk of infection as well. The macrosystem, the other departments of the hospital system affected by the problem, would benefit by experiencing a reduction in the added duties by laboratory personnel relative to rejecting blood specimens, and the health care system would save thousands, if not millions, of dollars per year relative to inefficient use of time and patient safety issues.

Nature of the Doctoral Project

Whenever a blood specimen was rejected by the laboratory personnel at the hospital where this project originated, staff recorded the date and time, as well as the reason for rejection of each specimen, on a log in the laboratory. This information was then entered into a software program used to report incidents that occur so that they can be investigated and tracked for patient and employee safety issues as well as other types of concerns that could be utilized to provide a safer and more enjoyable experience for employees and patrons. This rejection data was transmitted to the various nurse managers on a daily basis so they could investigate the incident and apply corrective measures when necessary. The incident reports from the software program would be compared before and after the intervention by the nurse managers to determine if the educational intervention was effective in decreasing the number of rejections. Additionally, the laboratory personnel would record the rejection reason on a form to be tallied daily and emailed to the person compiling the data for 3 months immediately prior to and 3 months directly after the educational intervention is completed. An anonymous pre- and post-test will be given to the attendants of the presentation. Numbers will be issued to each person

prior to the pretest being administered. The same number will be recorded on the post-test after the presentation so the scores can be compared.

A report showing the total number of blood specimen collection orders for each pilot unit would also be obtained to determine accurate percentages of the rejected specimens for both the pre- and post-intervention time periods. This data would be collected, correlated, and sorted by each pilot nursing unit for analysis. The analysis would include the number and types of rejections noted both pre- and post-intervention and would be sorted and categorized by the nurse manager, educator, or administrator who is in charge of compiling the data. This would provide information regarding which units may need additional training, if necessary. If the number of rejected blood specimens decreases after intervention relative to the number reported prior to the intervention, it could be assumed that this program was effective in filling the gap in practice described above.

The implementation phase of this project would begin by the stakeholders choosing two or three medical/surgical nursing units as pilot units. The nurse manager of each unit would then appoint at least four resource people from each to attend an educational presentation, spend time in the outpatient laboratory, shadowing a phlebotomist and performing venipuncture, while being supervised by a trained individual until competency can be demonstrated. Ideally, this group would consist of RNs and AP who work different shifts so they could serve as resource persons in their respective units throughout the project as the other unit members repeat the processes. Once all the RNs and AP in the pilot units complete the training, nurse managers and

laboratory personnel would begin to track the number of rejected specimens. This data would then be compared to pre-intervention data to determine the success of the project. If the post-intervention numbers show a significant decrease in the percentage of rejected blood specimens, the project could be considered successful and should be added to the current evidence base as a potential solution to this gap in practice.

Significance

Making RNs and AP aware of the threats to patient safety caused by improper blood specimen collection may have an impact on how they view the procedure. Instruction on proper phlebotomy technique and skill practice may also provide knowledge and competence that will lead to decreased specimen rejection. It is likely that an understanding of the reasons behind specimen rejection by the RNs and AP, as well as all the stakeholders, such as hospital administrators, the chief nursing officer, and nurse managers, can provide adequate motivation to perform the task utilizing proper phlebotomy techniques. A successful project outcome would mean that these interventions could be implemented in other health care systems across the country and around the world that are experiencing similar problems with preanalytical specimen errors.

This project would contribute to the nursing knowledge base in several ways. It is anticipated that more effective communication would occur between laboratory professionals and nursing staff as well as AP. This is because RNs and AP in patient care areas would have a better overall understanding of laboratory specimen requirements. As a result of gaining new knowledge and more experience, it is expected that RNs and AP

would have increased competence and confidence in obtaining blood specimens from their patients. This would be evidenced by a competency assessment that each RN and AP would have to complete, get certified by their phlebotomy preceptor, and provide to their nurse manager to add to their employee file.

Health care costs could also decrease when there is a decline in the number of blood specimens being rejected. The patients would likely have better outcomes because their treatments would be based on more accurate and timelier laboratory testing results due to increased specimen quality. Patients would also benefit by not being subjected to an increased risk of infection caused by excessive needle sticks by staff members who may lack adequate skills to perform phlebotomy in the proper manner. Savings would be realized by the health care system by having far fewer rejected blood specimens, which would decrease health care costs significantly, as suggested by Green (2013).

Evidence-Based Significance of the Project

Even though the nursing staff is responsible for collecting many venipuncture samples, and re-collecting if the sample is rejected, this topic is not common in the nursing literature. The preanalytical phase of testing specimens is comprised of all steps prior to the actual analysis of the sample and is the most common cause of laboratory error, although this phase is usually outside of the laboratory's control (Bölenius et al., 2013; Sharp, 2013). Chawla et al. (2010) stated that preanalytical errors are a result of several causes ranging from careless attitudes of the person collecting the specimen to a lack of knowledge about proper phlebotomy procedures. Sharp (2013) asserted that clinical decisions are based, in large part, on laboratory test results. If these results are not

accurate, the consequences to the patient could be harmful or even fatal (Bölenius et al., 2013; Sharp, 2013).

Many studies have been conducted to determine the types of sampling errors that are causing specimens to be rejected by the laboratory. Other studies have focused on educational interventions in an attempt to reduce preanalytical errors. The study by Sharp (2013), however, did not indicate whether or not there were any changes in preanalytical errors as a result of the educational intervention, only that the information learned had been retained for a 2-week period. This doctoral project was designed to demonstrate changes in preanalytical errors and provide a much longer time frame for retention of information learned.

Nurses and laboratory personnel must work together to solve this problem because it involves both professions. Plebani, Sciacovelli, Aita, Padoan, and Chiozza (2014) suggested that the focus of laboratory errors has shifted over the past 20 years from a "laboratory-centered" position to that of being centered on the patient which shifts the emphasis onto the entire process of testing. This shift, however, has not resulted in any long-term solutions to this problem because there is still a significant number of patient safety issues surrounding blood specimen collection and testing that have yet to be addressed when RNs and AP are responsible for collecting those specimens. Because the problem occurs between the nursing unit personnel and the laboratory personnel, it stands to reason both sides should be consulted, and the solution that utilizes current evidence is produced by both. This doctoral project attempted to bridge the interdisciplinary gap that has existed for many years by encouraging communication and

cross-training of nursing unit personnel by phlebotomists in the laboratory, and incorporating the current evidence surrounding this issue from both a clinical lab science perspective, as well as that of nursing. Chawla et al. (2010) suggested that it is crucial to apply clinical knowledge to reduce the number of human errors that occur in the preanalytical phase of testing. Plebani et al. suggested that quality indicators be used to identify errors, monitor and decrease their occurrences, and increase conformity in preanalytical processes. Although much is known about this problem, there have not been many attempts at a resolution. In this doctoral project, I sought to incorporate the current knowledge from both the clinical lab science and nursing professions into a program that brings phlebotomy knowledge and skills to the bedside. This project was also designed to encourage interdisciplinary communication and understanding through the interactions between phlebotomists and RNs and AP during the competency checkoff stage of the project.

Assumptions and Limitations

It is assumed that increasing knowledge and experience of nursing professionals will decrease the number of specimen rejections by laboratory personnel. Atay et al. (2014) asserted that RNs produce more rejected specimens due to insufficient training and lack of experience as compared to phlebotomists. Bölenius et al. (2013) discovered that an educational intervention produced significant improvements in the practical performance of phlebotomists. The results of this project may very well have the same effect on nursing staff.

It is also assumed that fewer rejected specimens will result in safer and more efficient care of patients. Green (2013) stated that patients who required re-collection of blood specimens faced an increased risk of infection, a decrease in satisfaction with the health care system, and additional pain. These patients were also at risk of receiving improper treatment based on a processing or reporting delay or invalid test results (Green, 2013). According to Lillo et al. (2012), more positive patient outcomes can be experienced if the preanalytical errors decrease. The efficiency of patient care will increase because RNs and AP will not have to take additional time to repeat the drawing of blood specimens that were rejected by the lab.

Fewer rejected blood specimens, it is assumed, could save the hospital system thousands, if not millions, in the annual budget in addition to potentially increasing patient satisfaction scores. As stated above, Green (2013) proposed that each specimen rejection costs the hospital an average of $208.00. Patient dissatisfaction caused by the increased pain experienced due to specimen rejection could cost the hospital thousands, if not millions, in lost future revenue.

Limitations of this study would be the lack of time and adequate staffing available to produce a system-wide educational program. A pilot project could be introduced to determine if the results could warrant a full-scale implementation across the health system. Although this project was designed as a pilot study, the number of specimens could be sufficient to determine if the intervention was successful or not.

Another limitation of this study would be the short length of time allotted for data collection. It may be feasible to collect the same data at 9-12 months after the

intervention and again at 21-24 months. This information may help determine long-term success or the need for additional study.

Summary

Nurses and support personnel are responsible for performing several different tasks for which they have varying levels of confidence and competence to perform. As a result, there is an increased number of preanalytical errors causing blood specimen rejections. This project was designed to provide RNs and AP with new knowledge, skills, and competence in phlebotomy technique to address this problem. Ideally, these new skills will be used to reduce the number of specimen rejections by laboratory personnel. It is anticipated that, at the completion of the project, patient safety and satisfaction will improve, RNs and AP will have fewer tasks to repeat, and the hospital will save a significant amount of money. Consulting the scholarly evidence provides a basis for any doctoral project. This project utilized evidence from both the nursing profession as well as clinical laboratory science. A comprehensive search of the current best evidence is provided in the next section.

Section 2: Background and Context

Introduction

Oftentimes, RNs and AP are expected to draw blood samples from patients without any formal phlebotomy training. This can cause difficulty for the person drawing the specimen, the laboratory personnel, the patient, as well as the medical professionals who may be waiting on the laboratory results to diagnose and/or treat patients (Green, 2013; Karcher & Lehman, 2014). McCarthy, Cornally, and Courtney (2011) stated that RNs routinely perform a variety of clinical functions that are positively affected by additional education and experience. The research question this project seeks to address is, "Would an educational intervention reduce the number of preanalytical patient blood specimen errors collected by RNs and qualified AP in patient care areas of a health care facility?" The purpose of this project was to provide RNs and AP with education and training regarding proper phlebotomy technique as well as knowledge about preventing preanalytical specimen errors.

In this section, the concepts, models, and theories utilized to guide this project are discussed. The relevance to the practice of nursing, as well as the background and context of the issue, are addressed. This section concludes with the roles of the DNP student and the project team being outlined.

Concepts, Models, and Theories

The knowledge translation (KT) framework suggested by Fredericks, Martorella, and Catallo, (2015) was used as a foundation of this project. This was combined with the evidence-based practice model developed by Rosswurm and Larrabee (1999). KT is a

framework designed to transition research from those who produce it to those who use it to bridge a gap in practice. This involves the researcher partnering with the stakeholders to develop educational activities that meet the needs of the learners, assist in the development of research questions, aide in the collection of research data, and help disseminate results (Fredericks et al., 2015). This framework will involve anonymous feedback at the end of the educational intervention sessions as well as after the phlebotomy training in the form of documentation of competency. The nurse managers will be expected to assist in data collection by providing the total numbers of rejected specimens as well as the reason stated by the laboratory to the data analyst and disseminating the progress made toward achieving post-intervention project goals to the staff. Rosswurm and Larrabee's model involves collecting internal and external data, linking interventions and outcomes, investigating current best evidence, designing and implementing a change in practice, evaluating the outcomes, and integrating the change into current practice. These two models, when combined, will provide the most suitable framework to investigate the project question, strengthen the knowledge base, and help bridge the gap between research and practice.

Relevance to Nursing Practice

For this project, I performed a literature search using CINAHL Plus and MEDLINE. The publication dates were limited to January 1, 2009, to May 17, 2015. The search phrases entered were *phlebotomy AND training AND nurse*, *preanalytical AND error*, and *preanalytical AND error AND nurse AND blood AND phlebotomy*. These searches produced 64 different articles. The most relevant ones are included here.

Most pre-analytical errors can be avoided when proper phlebotomy protocol is utilized. According to Lillo et al. (2012), it is essential that correct procedures in the preanalytical phase of laboratory testing are adequately practiced to achieve more reliable results and promote patient safety. Jacobsz, Zemlin, Roos, and Erasmus (2011) added that between 60% and 70% of clinical decisions determining admission, discharge, and medication are influenced by laboratory results. Thirty patient charts were randomly audited by Jacobsz et al. to determine the potential clinical impact to the patient as a result of preanalytical errors. The researchers found that these rejections impacted patient care in 40% of the cases (Jacobsz et al., 2011). Kaushik and Green (2014) stated that preanalytical errors significantly increase health care institutions' operating costs, damage their reputation, and decrease confidence in health care services rendered. Kaushik and Green added that laboratory professionals must be proactive in ensuring patient safety, even though many sources of preanalytical errors fall outside of their direct control.

Numerous studies have been conducted with preanalytical errors as the focus of attention. Many of these involve large hospital laboratories. Preanalytical errors are the leading cause for rejection of the blood specimen by laboratory personnel in most studies (Atay et al., 2014; Bhat et al., 2012; Carraro, Zago, & Plebani, 2012; Chawla et al., 2010; Guimarães, Wolfart, Brisolara, & Dani, 2012; Jacobsz et al., 2011; Kaushik & Green, 2014; Lillo et al., 2012; Romero, Cobos, Gómez, and Muñoz, 2012; Upreti, Upreti, Bansal, Jeelani, & Bharat, 2013). Clotting was found to be the most common cause in some studies (Guimarães et al., 2012; Jacobsz et al., 2011). Other studies named

hemolysis as the major cause of preanalytical errors (Chawla et al., 2010; Goswami et al., 2010; Upreti et al., 2013). Atay et al. (2014) determined insufficient specimen volume to be the cause of most of the rejections in their study. Upreti et al. (2013) found that more inpatient samples were being rejected than outpatient and determined that this may be due to poor phlebotomy techniques by the nurses and paramedics collecting the samples. The study by Carraro et al. (2012) had similar results, and the same conclusions were made.

Education and technology, when combined, can also help decrease pre-analytical errors. A study conducted by Lillo et al. (2012) focused on how new technology and an educational intervention affected the number of preanalytical errors in a hospital setting. In this study, outpatient blood sample data was studied in three phases (Lillo et al., 2012). The first phase included data collection and an educational program for the nurses (Lillo et al., 2012). The second phase involved the implementation of a custom labeling program, and the third included a mentoring program where new nurses were paired with experts for the first month of employment (Lillo et al., 2012). Lillo et al. put a set of quality indicators in place to monitor the specimens for rejection, and a significant reduction in all preanalytical error types was experienced. Patient satisfaction scores also increased with respect to phlebotomy procedures and the laboratory (Lillo et al., 2012).

Many studies have been performed to identify rejection causes as well as investigate interventions designed to fix them. A study conducted by Carraro et al. (2012) consisted of observation of blood sample collection processes in three different clinical areas for a week and then of all rejected specimens for the next 6-month period with the

intent to develop a quality improvement program. Bhat et al. (2012) performed a root cause analysis on the rejections and developed an educational intervention designed to train staff regarding phlebotomy techniques and preventing preanalytical errors. A computerized barcoding system was also implemented in this study (Bhat et al., 2012). Bhat et al. (2012) discovered a reduction in the number of preanalytical errors after the intervention, especially in the critical care areas. Romero et al. (2012) performed a descriptive study of preanalytical errors in a clinical laboratory in which the nursing staff was given a series of 1-hour educational sessions regarding preanalytical errors. After the intervention, the incidence of hemolyzed samples increased, but the clotted and missed samples decreased (Romero et al., 2012).

Research suggests that rejected specimens can be decreased when practices such as adequate staffing, proper training, education, competency, technological advances, standardization, interdisciplinary communication, and compliance monitoring are put into place. Ashakiran, Sumati, and Murthy, (2011) stated that adequate staffing, standard education, on-the-job training, continuing education, and regular competency testing must be implemented, along with barcode scanners, to assist with patient identification in an attempt to decrease preanalytical errors. Kaushik and Green (2014) agreed and added that initial training and continuing education should be mandatory for all employees who collect blood specimens. Atay et al. (2014), as well as Upreti et al. (2013), also agreed with these points and added that communication between the laboratory personnel and patient care staff should be part of the solution. Guimarães et al. (2012) concurred and proposed the need for continuous process standardization and corrective actions to ensure

the accuracy of results as well as patient safety also may be helpful. Carraro et al. (2012) added that monitoring compliance to prevent errors in the preanalytical phase of the testing process. Goswami et al. (2010) agreed and also suggested that these errors were decreased significantly as a result of proper training of staff, automation implementation, and adoption of quality control programs. Lillo et al. (2012) recommended that patient safety and more positive outcomes can be experienced by implementing a program to address the problems. Romero et al. (2012) agreed with this and proposed that an educational intervention may not be enough to fully solve the problem. Chawla et al. (2010) implied that encouraging proper transporting and collecting of specimens may correct some of these errors. They also agreed that better communication between members of the health care team is necessary (Chawla et al., 2010).

General Literature

Standardization has been proven to decrease the number of errors made in the pre-analytical phase of testing. In the study conducted by Bölenius, Brulin, and Graneheim (2014), 30 phlebotomists were interviewed after participating in an educational intervention. This intervention resulted in the phlebotomists working in a more standardized manner and increasing their accuracy (Bölenius et al., 2014). According to Bölenius et al. (2014), an educational intervention should not only seek to increase knowledge of proper phlebotomy techniques but also focus on the patient identification process as well as ways to decrease environmental distractions during a phlebotomy procedure.

Local Background and Context

For many months prior to this subject being addressed by nursing, the laboratory director had been raising the topic of preanalytical errors in meetings. The problem was discussed by the nursing administration, and many potential programs to address this issue were debated, but no viable solutions were found. The current evidence suggested that this may be an educational issue, so the nursing administration supported the need for an educational intervention, such as is the subject of this project.

Role of the DNP Student

Prior to becoming a nurse, I had completed nearly all the course work required to earn a Baccalaureate degree in clinical laboratory science. This background provided me with a unique skillset and perspective surrounding this topic, which prevented any professional biases from being present. This, coupled with my Master of Science degree in Nursing, equipped me with the appropriate credentials to undertake this type of intervention. When this project was initially suggested, I was skeptical about whether the topic was one that would be relevant to any other institution. What I found in the literature was that it is a global problem that had been occurring for many years with no real resolution. This problem was extensively addressed by clinical laboratory science journals but scarcely mentioned in the nursing literature. This was surprising because RNs and AP are greatly affected by this issue. They are also increasing their patients' risk of infection by having to obtain repeat blood specimens. As a result, I took on the responsibility of developing this project with the goal of greatly decreasing the number of preanalytical specimen errors experienced by this community hospital's laboratory and

nursing staff and providing it to the hospital for implementation. According to Aarsand and Sandberg (2014), working in cooperation with other professionals and practicing effective communication is crucial. If a breakdown is experienced in either of these areas, an increase in error rates can produce more patient safety concerns (Aarsand & Sandberg, 2014).

Role of the Project Team

The project team would consist of two or three resource people on each of the pilot units. These resource people would be given extra instruction regarding phlebotomy technique as well as phlebotomy practice in the outpatient laboratory under the preceptorship of a skilled phlebotomist until competency could be established. The resource team members would then be available to assist RNs and/or AP who would be responsible for obtaining blood specimens on their respective units. This would include answering questions as well as obtaining specimens if an RN or AP has difficulty.

Summary

In many instances, RNs and AP are required to obtain blood samples without the proper training in phlebotomy technique. Many studies have been conducted on this topic and possible solutions to this issue have been identified; however, few have been successfully implemented. The current literature seems to favor interventions aimed at increasing the knowledge and experience of RNs and AP relative to proper phlebotomy techniques.

The role of the DNP student in this situation was to develop an educational/training intervention aimed at increasing nursing and support personnel's

level of knowledge and experience with proper phlebotomy techniques. A successful intervention would yield fewer preanalytical errors. It is likely that a decrease in laboratory rejections of blood samples will improve patient satisfaction, reduce infection risk, and contribute to a decline in health care costs.

This program was subjected to a formative review by a panel of masters-degreed expert nurses. Any and all suggestions received by the formative review panel were considered and incorporated into the project, when applicable. This project would then be submitted in entirety to the hospital, where the project was initiated along with a plan for implementation and evaluation.

The gap in practice identified here was that RNs and AP are expected to perform tasks that they lack the knowledge and/or skills required to properly do so. The current best evidence was reviewed to determine the best approach to solving this problem. The next section highlights the evidence used to provide the basis for this project that was designed to bridge this interdisciplinary gap in practice.

Section 3: Collection and Analysis of Evidence

Introduction

The clinical problem this doctoral project was developed to solve is to reduce the number of rejected blood specimens drawn by RNs and AP in a local hospital setting. This problem impacts nursing much more than it does laboratory personnel; however, the topic was consistently raised in numerous meetings by the laboratory director prior to this subject being addressed by nursing at this local hospital. An investigation into the current best practice demonstrates this same trend. The problem was discussed by the nursing administration, and many potential programs to address this problem were debated, but no viable solutions were found. The current evidence suggested that this was an educational issue, so the nursing administration supported the need for an educational intervention, such as is the subject of this project.

This section includes a discussion of the problem and gap in practice. Also included are the sources of evidence used to address the practice-focused question. Analysis and synthesis of the evidence generated from the project will be the final topic discussed here.

Project Design

The project would be conducted in three phases that include a pre-intervention data collection phase (Phase I), an educational intervention implementation phase (Phase II), and a post-intervention data collection phase (Phase III). During Phase I, all of the institution’s preanalytical error rates would be categorized by type and recorded by the laboratory personnel on a Specimen Rejection Form (see Appendix A). The rejections

would be tallied by type and reported to the person in charge of data compilation via daily email. The data would be analyzed by this team member to determine the number and types of rejections that occurred prior to Phase II and will act as a baseline for comparison with the post-intervention data collected in Phase III. Phase III would consist of a 3-month data collection period, which would begin immediately after the Phase II is complete. The data would be collected by the laboratory personnel in both Phase I and Phase III. The totals would then be entered into the data spreadsheet (see Appendix B) under the corresponding reasons and date of collection, by the person compiling the data, so that the data collected in each of the phases could easily be compared and trends could be identified.

An expert panel was formed to conduct a formative review of the project during Phase I. The panel members all completed an anonymous questionnaire (see Appendix C) designed to gather their expert opinions regarding the appropriateness of the intervention, ability of the project to address the gap in practice, legitimacy of presented material, simplicity of Phase II, Phase II's support of the project goals and objectives, and its projected increase in the knowledge/skill of the participants. Additional comments were encouraged as well.

The current evidence was used to develop the project's main intervention (see Appendix D) in the form of a nursing education program that includes an overview of proper phlebotomy techniques, information regarding preanalytical errors, and how to prevent such errors. In Phase II, the educational class would be taught by the nurse educator to those identified as resource people on the various pilot units as well as those

responsible for obtaining specimens on the same units. The resource people would receive all of the educational information first and will then act as resource persons on their prospective units during the balance of the project. Their competency in proper phlebotomy techniques and causes/prevention of preanalytical errors will be determined by the person in charge of implementing the project as well as experienced phlebotomists in the outpatient lab. A pretest (see Appendix F) would be given to the participants upon entry into the presentation room and would be collected before the presentation begins. The presentation consists of PowerPoint slides (see Appendix D), a web document that can be accessed from the notes, a phlebotomy video that can also be accessed from the presentation notes, and a list of scenarios and questions (see Appendix E) designed to encourage discussion and further questioning on the subject matter. A posttest (see Appendix F) would be administered about 6 weeks after the initial educational intervention to determine if learning had occurred and whether or not that knowledge was retained. It could also be included as a quiz in some type of annual mandatory learning module. The curriculum for the educational intervention (see Appendix H) outlined how long each segment should require and who will be responsible for each segment. A time would be established for each participant to spend 2-6 hours with a phlebotomist and perform blood draws. A competency sheet (see Appendix G) would then be signed by both the preceptor and the participant once competency has been established. The participant would return this form to his/her nurse manager upon returning to his/her unit.

Phase III consists of a final data collection, using the same collection forms used in Phase I, along with an analysis phase that would continue for three months after the

intervention phase is complete. This process was designed to evaluate the impact of the intervention on error rates. The data collected in Phase I and Phase III will consist of the date of the occurrence, the type of specimen, the reason for the rejection, and the nursing unit responsible for the specimen collection. No personal information from patients or personnel will be recorded. This information will then be transferred into The Data Collection spreadsheet (see Appendix B) by the person in charge of analyzing the data for ease of comparison to determine if the intervention was successful.

The project design chosen was a retrospective, intervention, and prospective data analysis focusing on decreasing the preanalytical error rates related to venous blood samples rejected by the laboratory personnel. This would consist of the collection of quantitative data from the laboratory, implementation of an intervention with the nursing staff, more collection of quantitative data from the laboratory, and promotion of quality indicators to track progress in the pilot units. According to White and Dudley-Brown (2012), the follow-up model is utilized when qualitative data are necessary to clarify quantitative results.

There was no initial budget for this program. The nursing units involved would provide copies of handouts for their staff, and the documents would be provided to them by the author of the project either electronically or in printed form. It is likely that this project, due to time constraints and limited resources, would begin as a pilot in two different nursing units. Following the anticipated successful outcome, the plan could then be to implement the project on a larger scale within the hospital. The educational/training intervention could be modified to be included in the new nursing orientation program as

well as that of new support staff. The program could be modified to fit the specific needs of the Emergency Department as well. Annual competency testing would be designed for all patient care staff responsible for collecting blood specimens from patients.

Student Population

The focus of this project was education and training. Participants would be RNs and AP who work in pilot units within a hospital. Nurse managers would be asked to volunteer to take part in the pilot program and mandate their entire staff to participate in the educational and skill-building interventions. These employees would be cross-trained by the laboratory staff, and their competency regarding phlebotomy skills would be established and documented. The change in rate and/or type of preanalytical errors experienced after-intervention would be compared to pre-intervention data to determine whether or not this project was effective.

Data Collection

The data recorded by the hospital laboratory professionals would be utilized to determine the preanalytical error rate and type of errors experienced. The nurse managers would document the number and reasons for rejection based on the safety reports generated by the laboratory personnel. Data collection would begin prior to the start of the education/training intervention but may be analyzed during the second or third phase of the project. The data would span 90-days from the start of the project until the beginning of Phase II. The amount of time required to complete Phase II of the project would be approximately three months, and the final data collection, Phase III, would span the 3 months after the completion of Phase II. The data would be further divided into the

various types of errors, and a total calculated for each category. No names would be associated with the data. The data would be compiled, analyzed, and reported by a nurse manager, administrator, or educator to the stakeholders and the DNP student, if applicable.

The participants in the intervention would have to complete a pre-test and post-test (see Appendix F) to determine if learning had occurred. The pre-test would consist of a series of multiple-choice questions related to phlebotomy technique and preanalytical error causes and prevention. The participants would take this test, anonymously, prior to receiving any educational/training intervention. The same test would be given to all participants who completed the program and would be the final step of the intervention prior to the issuance of the Certificate of Completion. These pre- and post-test scores could be compared to determine if any additional learning needs could be identified.

Data Analysis

The number and type of blood specimens rejected by laboratory personnel would be collected as data to be analyzed for this project. All nurse managers would continue to be informed of the rejections for their unit, but only the data that relates to the pilot units would be the initial focus of this project. The pre-intervention specimen rejection data would be analyzed by both number and type and be compared to the post-intervention rejection data.

Project Evaluation Plan

The evaluation plan for this project was to enlist the assistance of the laboratory personnel who are responsible for rejecting the specimens as well as phlebotomists who

would be involved in training and evaluating the RNs and AP from the pilot units. The goal with the laboratory personnel would be to obtain the rejection criteria and assure all criteria are uniform. The phlebotomists would be consulted about the specific criteria related to competence in drawing blood. A list of competencies would be developed, approved by phlebotomists, and provided to each participant to bring to their training sessions, which would be checked off by their preceptor as competency is demonstrated in each area. This would ensure that each participant will receive uniform training related to phlebotomy technique. The pre-intervention specimen rejection data would be compared with the post-intervention data and sorted by types of errors and nursing units. This outcome would determine if the intervention produced a decrease on the number and types of errors. It would also determine whether or not learning gaps remained with respect to the cause and prevention of specific preanalytical errors.

The anonymous pre-tests and post-tests are identical and would be administered at least six weeks apart. The answers could be compared question by question to determine if significant learning has occurred. This analysis would also determine which questions were not answered correctly in both pre- and post-tests so additional gaps in learning could be identified.

Analysis and Synthesis

Specimen rejection data would be analyzed in Phase I for the purposes of determining the types of preanalytical error prevention(s) to identify the types of learning to evaluate as a result of the intervention in Phase II. It was formatted on a Microsoft Excel spreadsheet that is identical to the one to be used in Phase III and would be utilized

to determine the pre-intervention baseline data to compare with the post-intervention data. Both Phase I and Phase III data would be compared to determine if Phase II was successful or not. This can also be used to determine any possible modifications to the intervention phase that may be necessary.

A series of open-ended questions would be asked regarding the findings, such as (a) whether there could be another reason for a change in the number of specimens rejected; (b) whether there could be external factors, such as personal lack of focus, causing the numbers to increase or remain the same; or (c) whether further education and/or phlebotomy practice would change the outcome of the data. These answers could be determined by observation in the pilot nursing units as well as discussion with the various RNs and AP. Meetings with the resource personnel may be beneficial to determine the answers to these questions. These meetings may also be beneficial in producing other questions that may assist in increasing the effectiveness of future endeavors.

This type of design is much easier for one person to complete because data are collected and reported in two different phases (White & Dudley-Brown, 2012). Therefore, putting a nurse manager, educator, or administrator in charge of investigating these safety reports as well as analyzing the data would be a viable choice. The intervention was developed utilizing best practices from the current evidence. The information learned from the Phase I data analysis could be used to modify the content of the educational program, if necessary.

Summary

This project was designed to provide a perspective as well as a retrospective look at the data attributable to preanalytical blood specimen errors in a health care environment. An educational intervention accompanied by practical phlebotomy training would occur in between the two phases of data collection to determine if this can reduce the numbers of specimen rejections experienced. Only data would be analyzed in this project; therefore, no ethical issues must be considered other than ensuring no patient information is associated with the data. Participation in the pilot program could be offered to nurse managers and their staff who are responsible for obtaining patient blood samples. Ongoing program evaluation would occur to determine if any improvements may be necessary. Communication with the staff of both the nursing units and the laboratory regarding the status of the project would be ongoing as well.

Once the project was designed, a panel of experts conducted a formative review of the entire project, and the recommendations received were used to adjust the program prior to submission to the hospital where the project initiated. Upon submission, the project could be implemented by the hospital if they chose, and the DNP would be available, if necessary, to assist in data collection and/or implementation. Data analysis would be reported along with expected and unexpected outcomes. Lessons learned in the process may also be reported. The next section outlines the recommendations for change received by the panel of experts that are designed to make the project more effective.

Section 4: Findings and Recommendations

Introduction

The clinical problem that this doctoral project was designed to resolve is to decrease the number of rejected blood specimens drawn by RNs and AP in a community hospital setting. Although the lack of competence of RNs and AP in drawing blood specimens is likely the cause of this problem, there are relatively few nursing studies that address this problem. There are clinical laboratory professionals who have been writing about this problem for years, and many studies state that there are much fewer rejections when the specimens are drawn by a trained phlebotomist. The question this project attempts to address is, "Would an educational intervention reduce the number of preanalytical blood specimen errors collected by RNs and qualified AP in patient care areas of a health care facility?" The assumption is that increasing the knowledge and experience of the individuals required to obtain patient blood specimens will result in fewer rejections. The purpose of this project was to design a staff education project that increases the competency and confidence of RNs and AP so that they are able to obtain quality blood specimens from their patients, thereby decreasing the number of rejected specimens by laboratory personnel.

A panel of masters-degreed experts was formed to conduct a formative review of the project. They consisted of a director of Pediatric Surgical Services, a clinical nurse Specialist, and a certified registered nurse anesthetist, all of whom work at a large university health system. An anonymous questionnaire (see Appendix C) was designed and used to poll the experts regarding the appropriateness of the intervention, its ability to

address the identified gap in practice, validity of the material presented, clarity of the educational intervention, educational materials support of the goals and objectives, and the predicted increase in knowledge/skill as a result of the educational intervention. Additional comments were encouraged and received from the panel.

An application for study approval was submitted to the Walden University Institution Review Board. This was necessary to collect formative and summative evaluation data. Approval was granted and the study was identified as Study # 05-10-19-0261269 on May 10, 2019.

Findings and Implications

The anonymous questionnaire, attached as Appendix C, consisted of six statements and a comments section. The answers to all questionnaire items were based on a five-point Likert scale ranging from *strongly disagree* to *strongly agree*. The first statement on the questionnaire was, "The content included in this project is appropriate for an RN/AP staff educational intervention." All members of the expert panel strongly agreed with this statement. The second statement was as follows: "This educational intervention addresses the gap in phlebotomy knowledge/skill in RNs/AP in a hospital setting." The members of the panel all agreed, two of them choosing *strongly agree*. There were two *strongly agree* and one *undecided* response to the statement, "The material presented here will likely prepare RN/AP to obtain blood specimens that are suitable for laboratory processing." All members of the panel agreed, two strongly, to the statement, "This educational intervention provides a clear and concise approach to addressing the gap in knowledge/practice presented." When responding to the statement,

"The educational materials discussed support the goals and objectives outlined in the intervention," one member of the panel chose *undecided*, while the other two chose *strongly agree*. All chose *strongly agree* when responding to the statement, "This educational project appears to increase RN/AP knowledge/skill as supported by the evidence-based practices supplied."

All responses were positive, except two. The other two were neutral, but the comments provided explained the answers. Both of the *undecided* responses were on the same questionnaire. The comments after the *undecided* responses stated that more information/specific materials were necessary before a definitive choice could be made. This was an unanticipated limitation of the outcome.

Overall, the educational project appears to the panel to be appropriate to address the gap in practice previously identified. Should this project be successfully implemented in hospitals who depend on RNs and AP to obtain blood samples from patients, the possibility exists that there would be a decrease in the number of rejected specimens, an increase in the confidence of the RNs and AP, and a decrease in healthcare costs at the institution. Additional benefits that could be realized are an increase in patient satisfaction, a decrease in infection rates, and an increase in employee satisfaction/engagement. This project, if successfully implemented, could provide patients with faster treatment decisions based on more accurate and timely laboratory testing results.

Recommendations

This project should be implemented in hospitals that require RNs and AP to obtain blood specimens from medical/surgical and ICU patients for testing. It could be altered to provide training to the Emergency Department RNs and AP as well as those in other specialty departments. It could also become part of the RNs and AP orientation process so that all new employees who are expected to obtain blood specimens have the competency to do so. It is recommended that competency be tested every year by a trainer and that all RNs and AP be required to pass a test on the topic annually.

Strength and Limitations of the Project

The strengths of this educational intervention are that it provides education to RNs and AP who are required to perform tasks that they may lack the skills to do successfully. It fills a gap in practice that may decrease the number of rejected specimens by laboratory personnel, which will provide test results faster and more accurately so that treatment decisions can be made in a timely fashion. This project also has the potential to save hospitals millions in annual health care revenue.

The limitations of this project are that there are no data to determine whether the project could be successfully implemented. Even though the project has not been implemented, the expert panel does agree that this has a strong possibility of filling the gap in practice. The data are expected to be positive, but there is no current proof that it would be.

Section 5: Dissemination Plan

This work will be published in a peer-reviewed journal and will be made available to the institution experiencing the problem in practice via electronic submission. The audience for a project such as this would be nurse educators who are involved in staff development and orienting new RNs and AP. This product could be marketed via advertisements or publications in peer-reviewed journals targeted to these types of professionals.

Analysis of Self

Prior to becoming a nurse at the age of 46, I performed a variety of clerical functions and took classes in a clinical laboratory science program for four years. Just before my final year of the program, I sustained a closed head injury in an automobile accident and was forced to put my studies on hold. After recovering, I made many life changes and decided not to return to school at that time. Several years later, I decided to return to school and become an RN, then continue on to get my Master of Science in Nursing and DNP. Based on my past as well as current experiences, I feel that this project was a perfect one for me to design. I feel that I could provide helpful guidance toward the successful implementation of it as well.

Summary

Nurses and support personnel are sometimes required to perform tasks that they have varying levels of competence and/or confidence to perform. When this occurs around blood specimen collection, it causes an increased number of preanalytical errors that result in rejections of the specimens by laboratory personnel. This project was

designed to supply the necessary tools that RNs and AP need in order to perform blood draws with new knowledge, skills, confidence, and competence. A benefit that could be realized may be a reduction in the number of rejected specimens causing possible increases in patient safety, higher efficiency by staff, increased patient satisfaction, and significant savings in health care revenue. This project combined scholarly evidence from the nursing as well as clinical laboratory science professions utilizing the current best evidence. This current literature seems to trend toward implementing educational interventions designed to increase knowledge/skills related to obtaining blood specimens.

My role as the DNP student was to develop an educational/training intervention to address this knowledge/skill gap in practice. A successful intervention would decrease the number of preanalytical errors and, in turn, cause fewer rejections of the specimens by laboratory personnel. This could improve patient safety and satisfaction, reduce the risk of infection, and save hospitals thousands of dollars in wasted health care expenditures annually.

This project was designed to provide a look at the future as well as historical data ascribed to preanalytical blood specimen errors in a health care setting. This project offers practical training in phlebotomy combined with an educational intervention along with two phases of data collection that determine if the number of specimen rejections can be reduced by the implementation of the project. The project would be implemented on two pilot units which would provide ongoing program evaluation to determine if any alterations are necessary to increase the effectiveness of the project. Close and open communication between the laboratory personnel and the nursing units would be

encouraged throughout the entirety of the project. A panel of experts determined that the project was designed appropriately, has the ability to address the gap in practice, is clear and concise, has educational materials that support the goals and objectives, and will increase the knowledge/skill of the participants with regard to phlebotomy and proper blood specimen collection criteria. The comments provided were used to make changes to the project in an attempt to increase its effectiveness.

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Appendix A: Specimen Rejection Form

Specimen Rejection Form

When a specimen has to be rejected due to a preanalytical error, please record the reason below using tally marks. Please record the reason, if not listed, along with the numbers for that specific reason. At the end of each day, please tally the total for each category and email this sheet to _____ at _____.

Today's Date: _____

Reason for Rejection	**Number of Rejections**	**Totals**
Specimen Hemolyzed		
Insufficient amount of blood in tube		
Specimen clotted		
Improper labelling/no label		
Incorrect tube		
Incorrect patient		
Other (specify reason)		

_____

Printed Name of Reporter

_____ _____

Signature Date

Appendix B: Data Collection Worksheet

Data Collection Worksheet											
Month:											
Date	**Hemolysis**	**Underfill**	**Clotted**	**Wrong Label**	**Wrong Tube**	**Wrong Patient**	**Other (Specify)**	**Other (Specify)**	**Other (Specify)**	**Other (Specify)**	**Daily Total**
Day 1											0
Day 2											0
Day 3											0
Day 4											0
Day 5											0
Day 6											0
Day 7											0
Day 8											0
Day 9											0
Day 10											0
Day 11											0
Day 12											0
Day 13											0
Day 14											0
Day 15											0
Day 16											0
Day 17											0
Day 18											0
Day 19											0
Day 20											0
Day 21											0
Day 22											0
Day 23											0
Day 24											0
Day 25											0
Day 26											0
Day 27											0
Day 28											0
Day 29											0
Day 30											0
Day 31											0
Totals	0	0	0	0	0	0	0	0	0	0	0

Appendix C: Anonymous Questionnaire

Anonymous Questionnaire for Expert Panel

Please complete the form below by choosing the number describing your understanding of the DNP project entitled, Effectiveness of an Educational Intervention to Reduce the Number of Preanalytical Specimen, provided for your review. Please enter your expert opinion and comments below each question.

1. The content included in this project is appropriate for an RN/AP staff educational intervention.
   1. Strongly disagree
   2. Disagree
   3. Undecided
   4. Agree
   5. Strongly agree

Comments:_____

2. This educational intervention addresses the gap in phlebotomy knowledge/skill in RNs/AP in a hospital setting.
   1. Strongly disagree
   2. Disagree
   3. Undecided
   4. Agree
   5. Strongly agree

Comments:_____

3. The material presented here will likely prepare RN/AP to obtain blood specimens that are suitable for laboratory processing.
   1. Strongly disagree
   2. Disagree
   3. Undecided
   4. Agree
   5. Strongly agree

Comments:_____

4. This educational intervention provides a clear and concise approach to addressing the gap in knowledge/practice presented.
    1. Strongly disagree
    2. Disagree
    3. Undecided
    4. Agree
    5. Strongly agree

Comments:_____

5. The educational materials discussed support the goals and objectives outlined in the intervention.
    1. Strongly disagree
    2. Disagree
    3. Undecided
    4. Agree
    5. Strongly agree

Comments:_____

6. This educational project appears to increase RN/AP knowledge/skill as supported by the evidence-based practices supplied.
    1. Strongly disagree
    2. Disagree
    3. Undecided
    4. Agree
    5. Strongly agree

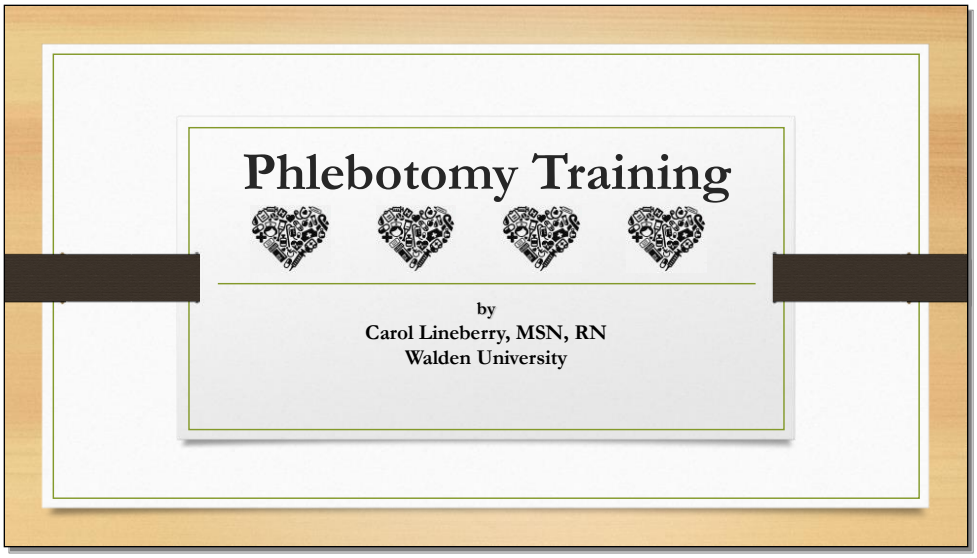
Comments:_____

Additional comments/suggestions:_____

Thank you for your time and feedback.

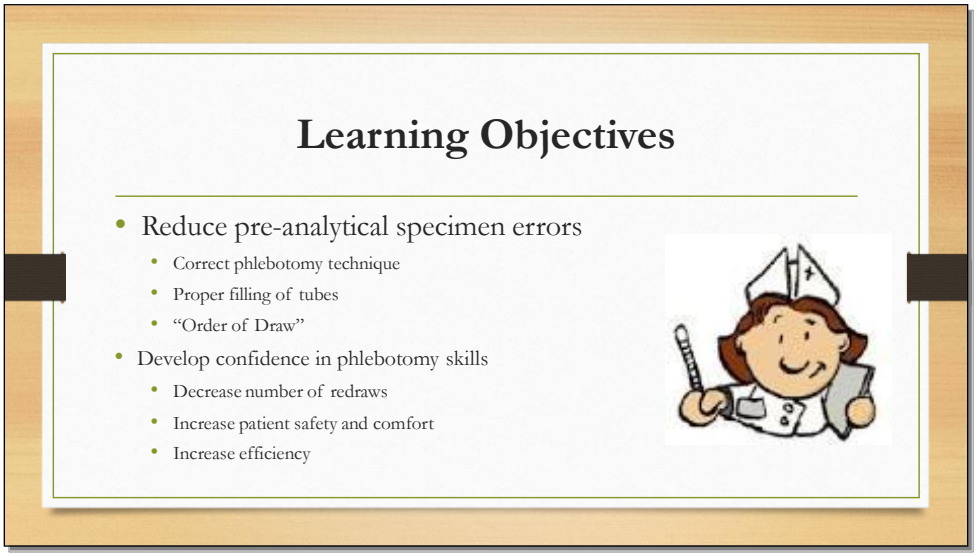
Appendix D: Inservice Presentation

Slide 1



Introduce self and discuss:
Bathroom locations
Cell phones off/silent
Estimated time of training
Any other items of importance

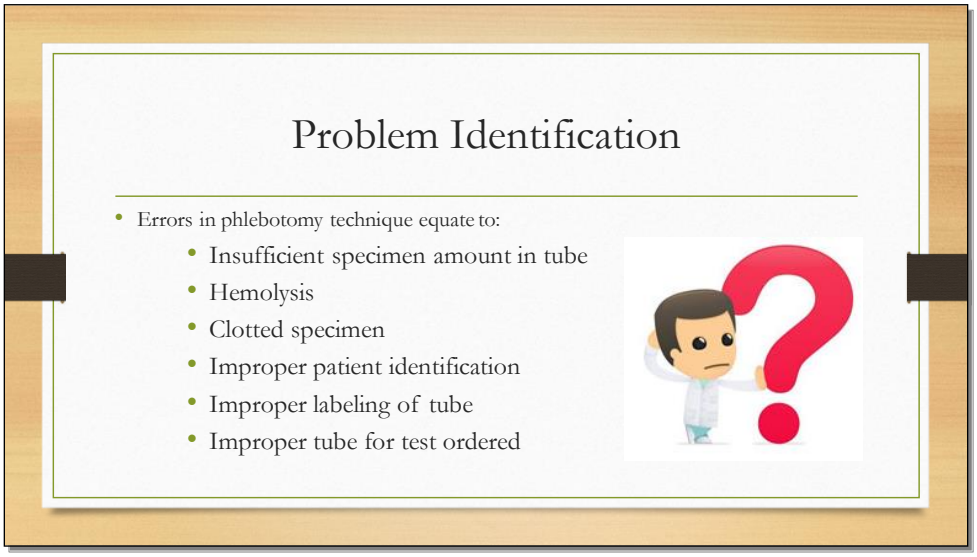
Slide 2



Pre-analytical specimen errors happen mostly when phlebotomy procedures are performed improperly. This may occur because a person is not using correct technique, doesn't fill the tubes properly, or fills the tubes in the wrong order. This usually occurs when a person is expected to perform tasks that they may not be properly trained for. Once you receive the proper knowledge and skills, confidence follows.

Confidence, combined with knowledge and skill in phlebotomy, can help reduce the number of times you have to redraw specimens which increases the patient's safety and comfort, and increases your efficiency because you are not repeating tasks.

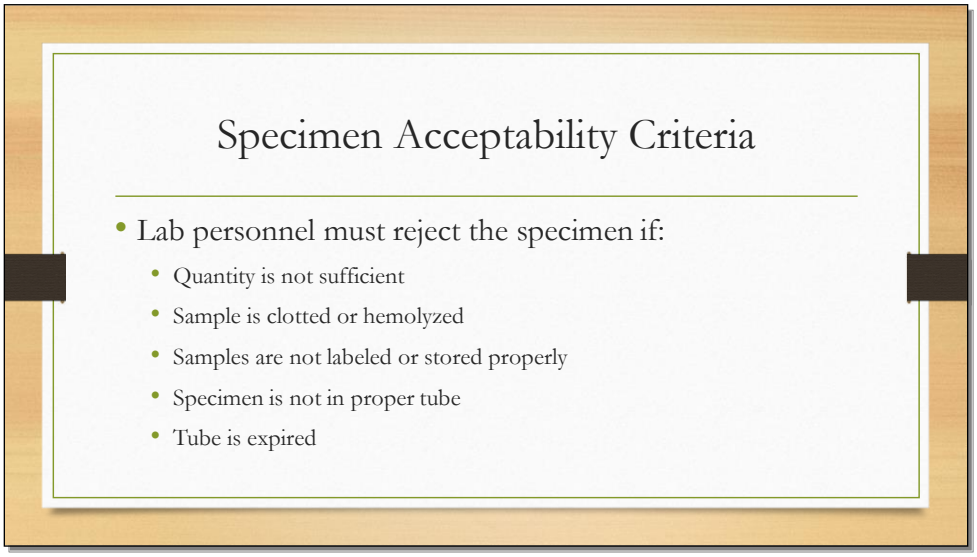
Slide 3



Rejection of blood specimens has been a problem for decades. There is not much in the nursing literature regarding this subject, but the clinical laboratory journals provide plenty of information as to the prevalence of it, what it affects, and what types of errors are occurring.

- Insufficient specimen amount
- Hemolysis
- Clotted specimen
- Improper patient identification
- Improper labeling of tube
- Improper tube for test ordered

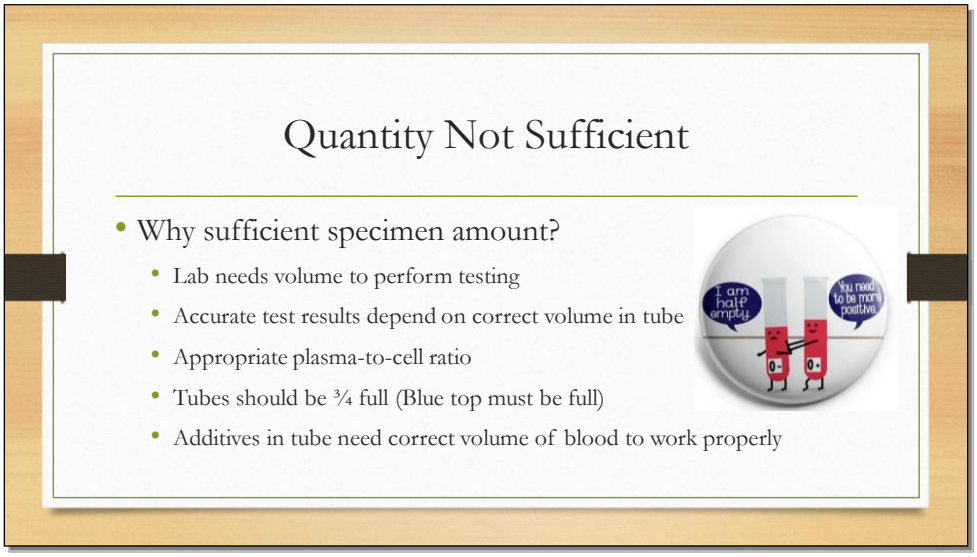
Slide 4



Tests will not be performed on specimens that do not meet these criteria because it is laboratory policy. Please do not take this personally, just know that everyone must work together to keep patients safe, comfortable, and receiving appropriate treatment.

Introduce Hospital Policies

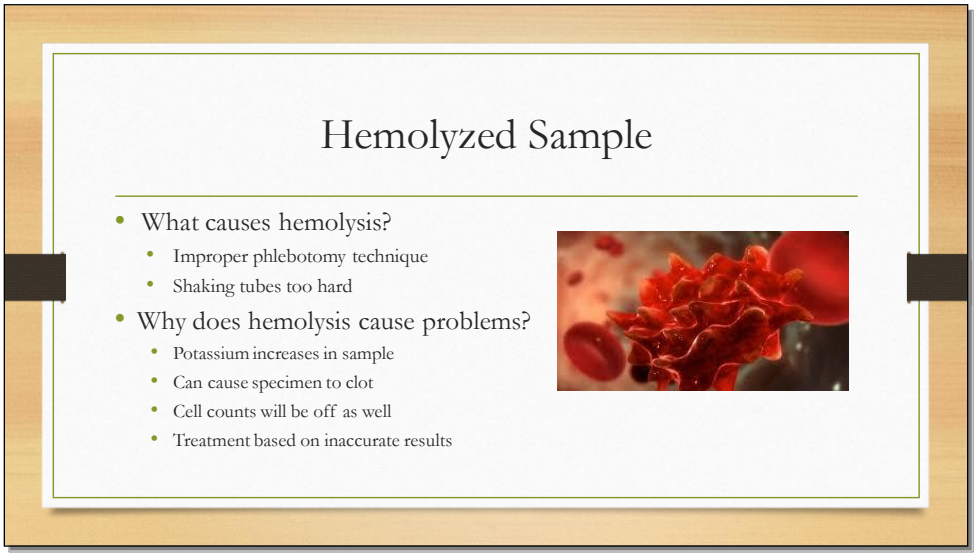
Slide 5



Insufficient specimen amount—under filling of tubes can cause problems

- Lab needs volume to perform testing—if they don't have enough blood, you will have to redraw
- Accurate test results depend on correct volume in tube—if there is not enough cell-to-plasma ratio, results could be inaccurate.
- Could cause harm to patient
- Tube should be ¾ full (Blue top must be full) because additives in tube need an appropriate amount of blood to work properly and Blue top requires the whole tube of blood for test to be run.
- There are marks on the tubes that show minimum fill lines.

Slide 6



Hemolysis—cells burst during or after phlebotomy procedure

If tube fills slowly, it is likely that hemolysis is occurring.
This can also occur if tubes of blood are shaken, not mixed gently

Try to increase the angle of draw by lifting up on the back of the needle. You can also gently adjust the needle forward or backward slightly to see if flow increases.

Potassium higher inside cells than outside
Potassium must be replaced if low to prevent harm to patient—can cause heart problems

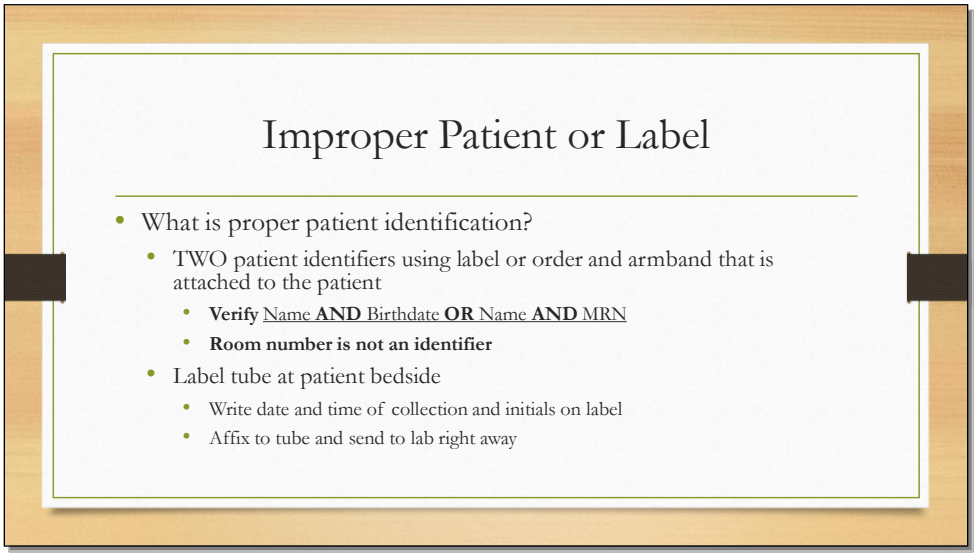
Slide 7

Clots in specimens do not allow most tests to be run, so you will have to redraw these.

When the tube fills very slowly, it is almost certain to clot, so either do what is necessary to increase speed of filling or discontinue the draw.

This is why we need to have good technique, mix the specimens properly and send them to the lab quickly

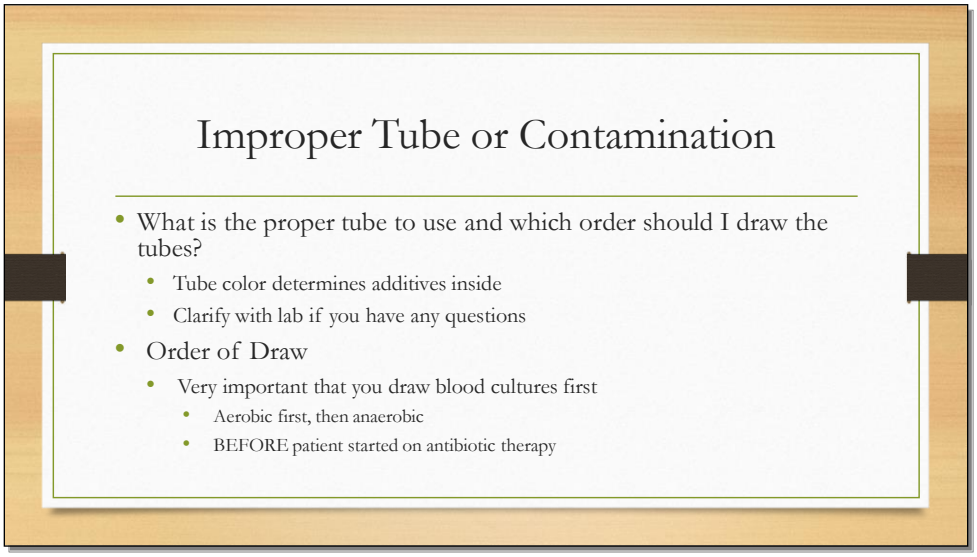
Slide 8



Improper patient identification can lead to results reported on wrong patient which can lead to improper treatment and harm to patient
Need to ID patient appropriately using 2 patient identifiers

- Match label OR order to patient armband
- Verify NAME AND DOB OR NAME AND MRN, NOT room number
- Label patient tube at bedside—add date, time, and initials to label and put on tube
- Send to lab right away—some samples are time sensitive.
- Good practices prevent potential problem

Slide 9



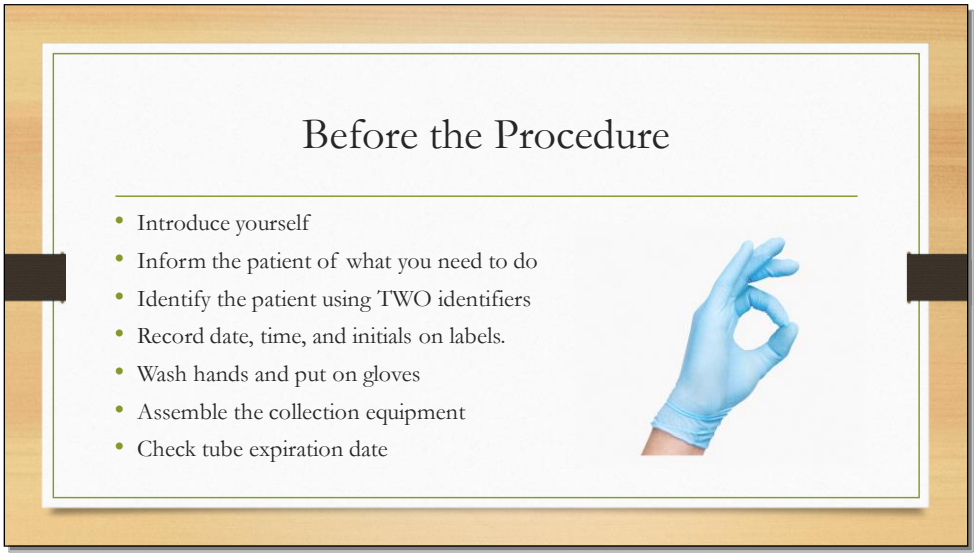
Improper tube for test ordered

The color of the tops of the tubes tells you what additive, if any, are in the tubes. Certain tests require certain types of additives, so it is imperative that you have the right tube. If you send the wrong tube, you will have to redraw the right one, so it is best to take time to get clarification from the lab if you have any questions. There will also be some reference material on the unit for you to refer to as well.

Antibiotics kill bacteria. Blood cultures are looking for bacteria in the blood, so taking a blood culture after antibiotics have begun does not yield accurate results. Ask RN or ordering physician if they still want the test after the antibiotics have started.

More on Order of Draw later in this presentation…
CUE UP VIDEO https://www.youtube.com/watch?v=_8ZsqXFqvQM

Slide 10



It is very important that you let the patient know what you are going to do

Use proper means of identifying the patient—If the arm band is not attached to the patient, follow protocol for fixing this

Record date and time on the same number of labels as you have tubes to draw

DO NOT PUT LABELS ON TUBES UNTIL YOU ARE DONE DRAWING THEM.

We all know the importance of washing our hands and wearing gloves for everyone's protection

Put all of your collection equipment together and check expiration dates on tubes

Now you are ready to choose a site

Bring up BD pamphlet @ https://www.bd.com/a/35713

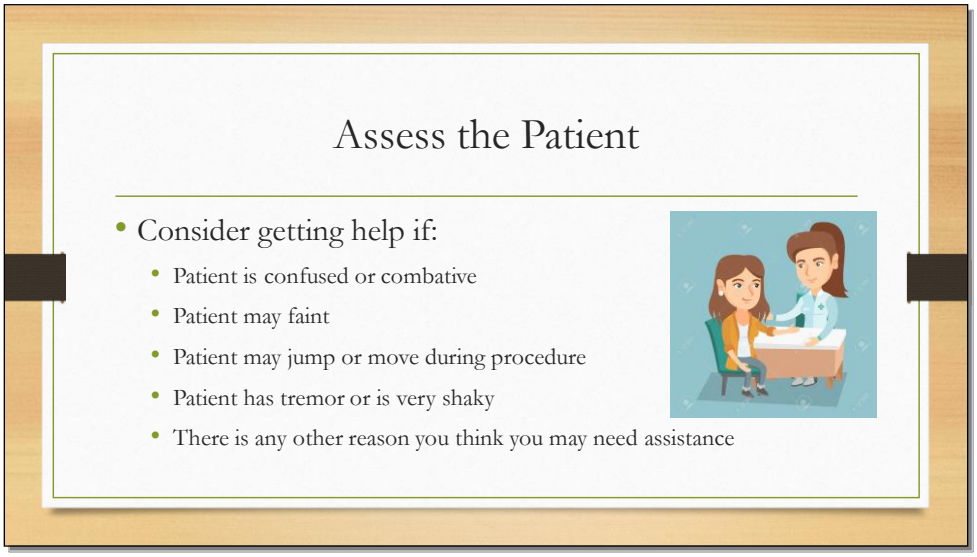
Slide 11

Gathering your supplies and putting everything together the same way every time will prevent many mistakes.

This is a suggested method of doing things. You may choose to do things in a different order, but make sure you include all of the steps.

Once the supplies are at the bedside, the patient has been identified properly, the tubes are not expired, and the labels are ready to go on the tubes, it is time to begin the procedure.

Slide 12

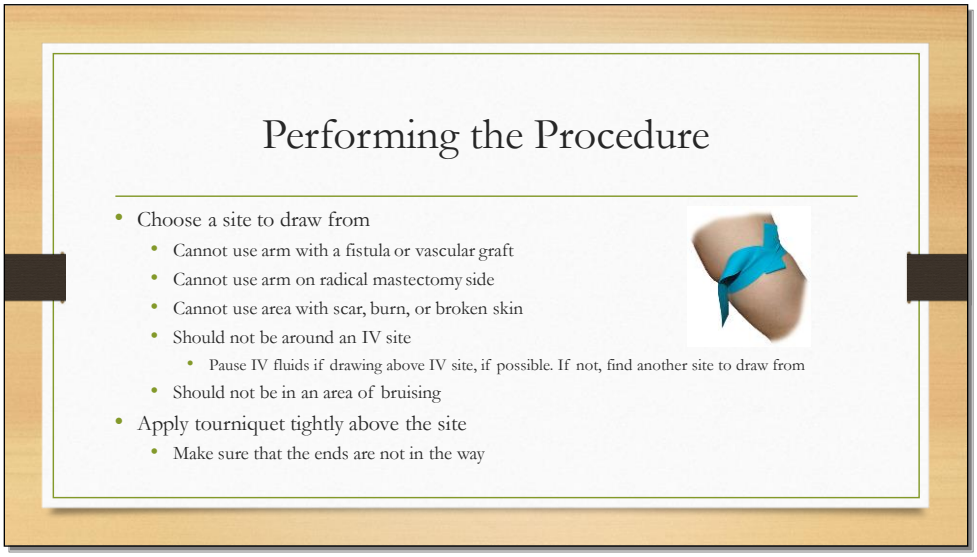


If there is any reason you think you may need help, ask someone to help you.

Your safety as well as that of the patient is very important.

If the patient moves with the needle in their arm, they can cause damage to themselves such as a hematoma or damage to a nerve, muscle or tendon.

Slide 13



Check to make sure that patient does not have a fistula or vascular graft, has not had a radical mastectomy, and does not have scars, burns, or broken skin on or near the site you choose.

It is important to stay away from IV sites when performing venipuncture because the IV fluids can dilute the specimen. Some IV fluids such as Heparin should be stopped prior to drawing certain tests. This information should be obtained from the laboratory, if there is a question, and then brought to the attention of the nurse.

It is also very important to apply the tourniquet properly so that the veins below fill with as much blood as possible making them easier to find and less likely to collapse when drawing the specimen. The tourniquet should be removed in less than a minute after application, so make sure that you have everything ready before you apply it.

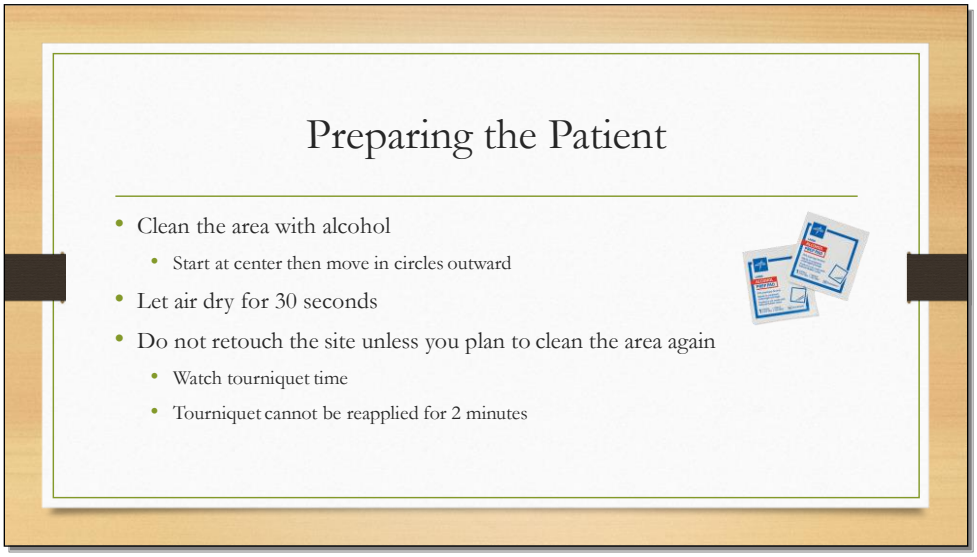
Slide 14

First look for good veins on the surface.

If you can't see them, apply a tourniquet and try to feel them.

If this fails, get the Vein Finder device

Slide 15

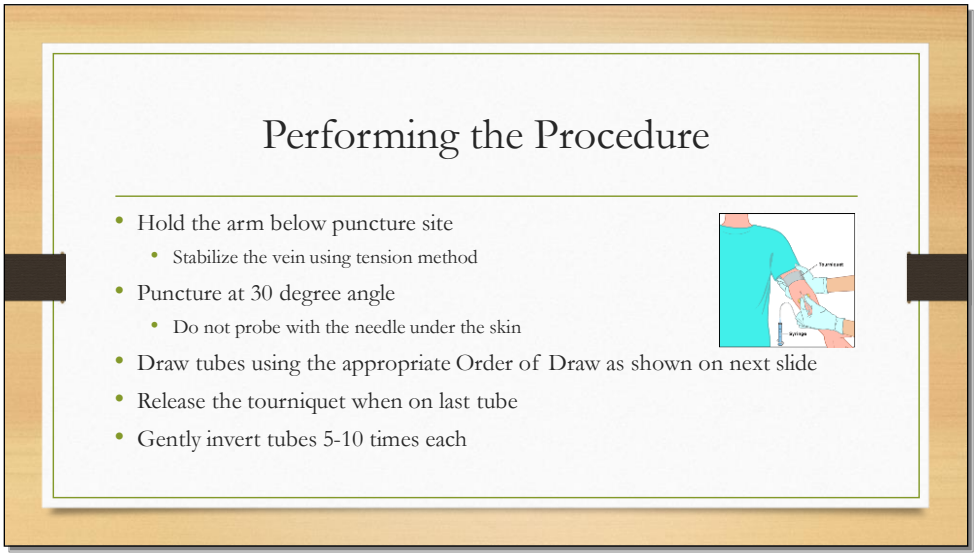


Make sure the site is dry before you insert needle because the alcohol kills bacteria while drying and the alcohol can also cause hemolysis

Do not retouch the site if this can be avoided because you will have to clean it again and that could cause you to have to take the tourniquet off.

You cannot reapply tourniquet for two minutes

Slide 16



Pull skin back to stabilize the vein and tighten the skin at the insertion site

Insert needle at a 30 degree angle and DO NOT probe side-to-side once the needle is under the skin. You can move up and down in the needle path

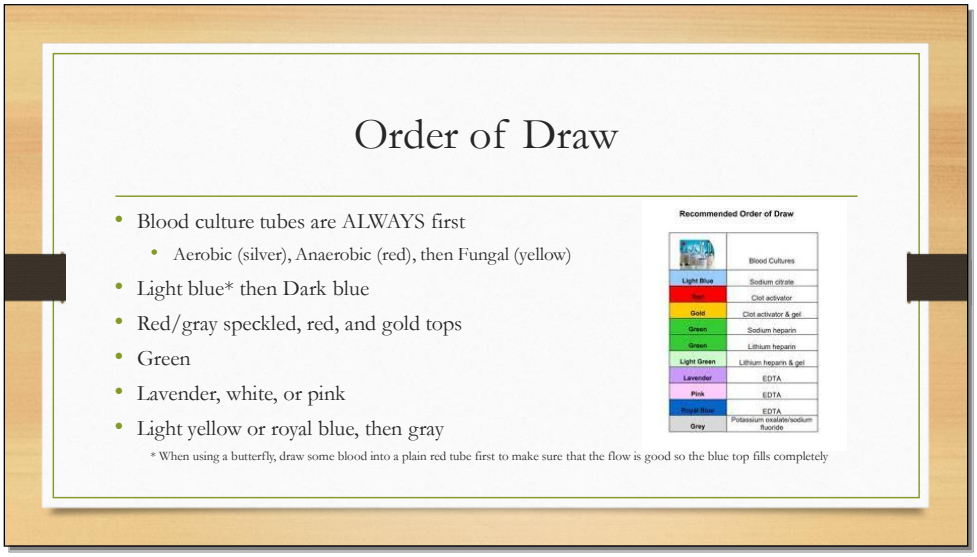
Side-to-side probing can cause damage to the vein, muscle, tendon, or nerve.

Make sure you are familiar with the order of draw to prevent contamination of tubes

When you put the last tube into the holder, you can release the tourniquet and get your gauze pad ready to apply to the insertion site.

Invert the tubes 5-10 times GENTLY if there are additives in them as soon as you can after they are drawn, but DO NOT SHAKE THEM.

Slide 17

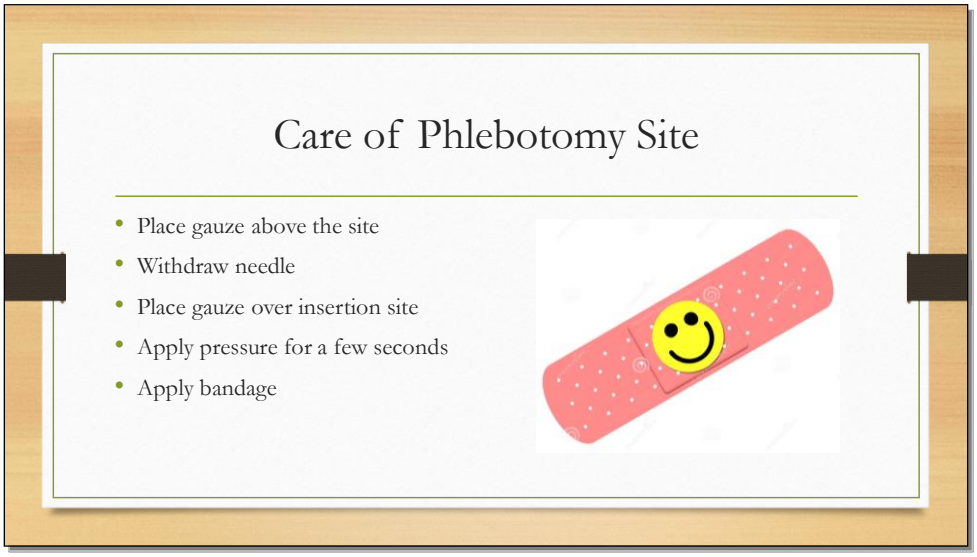


Discuss tubes and set ups—vacuum, air, additives, needles, etc.

Tubes must be drawn in a specific order to prevent contamination of the specimen.

- Light blue tubes must be full, so they are drawn first.
    - If using a butterfly needle, you have to start to draw an empty tube without any chemicals in it as a waste.
        - This assures that all of space in the tube is filled with blood.

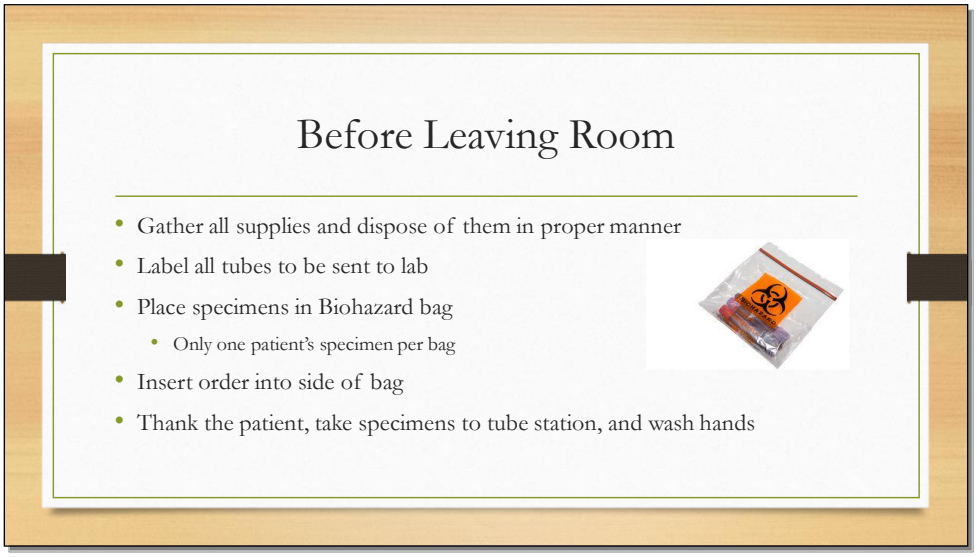
Slide 18



Do not apply pressure on skin when needle is still in there. This can cause injury to the patient and it hurts.

Once needle is removed, pressure can stop the bleeding. Apply pressure to minimize bleeding under the skin, then apply a bandage over the site.

Slide 19



This is one of the most important parts of the process…

If the tubes are not labeled, they will not be tested and you will be redrawing the specimens
DEMONSTRATE PROPER TECHNIQUE INCLUDING INVERTING THE TUBES
Apply the labels you previously dated, timed, and initialed (if applicable) onto the tubes being careful not to cover any barcodes on the tubes or labels.

Put tubes into bag and seal the bag

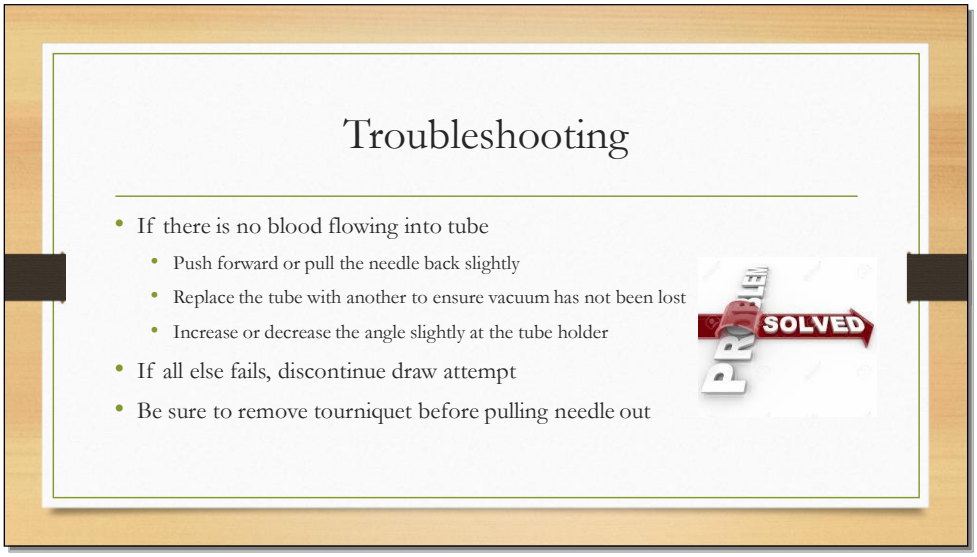
DO NOT PUT ANY OTHER SPECIMENS IN BAG

Put order into side of bag if applicable

Thank the patient and tube specimens to lab right away because some specimens must be tested right away.

You must wash hands with soap after contact with body fluids.

Slide 20



Sometimes the needle does not penetrate or goes through the lumen of the vein. This can be fixed by either pulling back or pushing forward on the needle SLIGHTLY

Sometimes the vacuum is gone from the tube, so another tube is needed

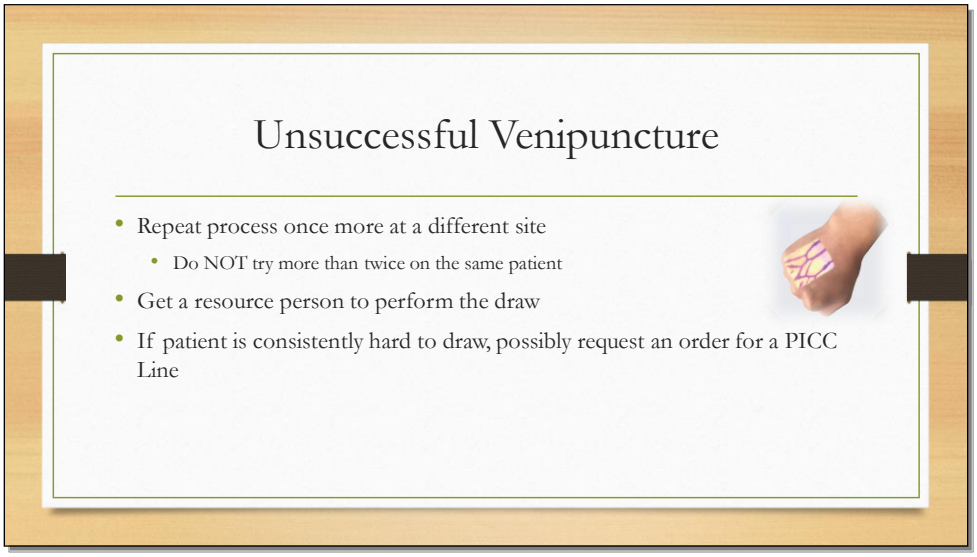
The needle may be in the vein, but up against a wall or valve, so increasing or decreasing the angle at the tube holder may remedy this problem

If nothing works, you have to discontinue, but make sure to remove the tourniquet first.

You will finish up by caring for the phlebotomy site just as you would after a successful draw.

NEVER pull needle out and reuse on the patient and never reuse tubes.

Slide 21



You will start from the beginning by gathering supplies, putting together your equipment, etc.

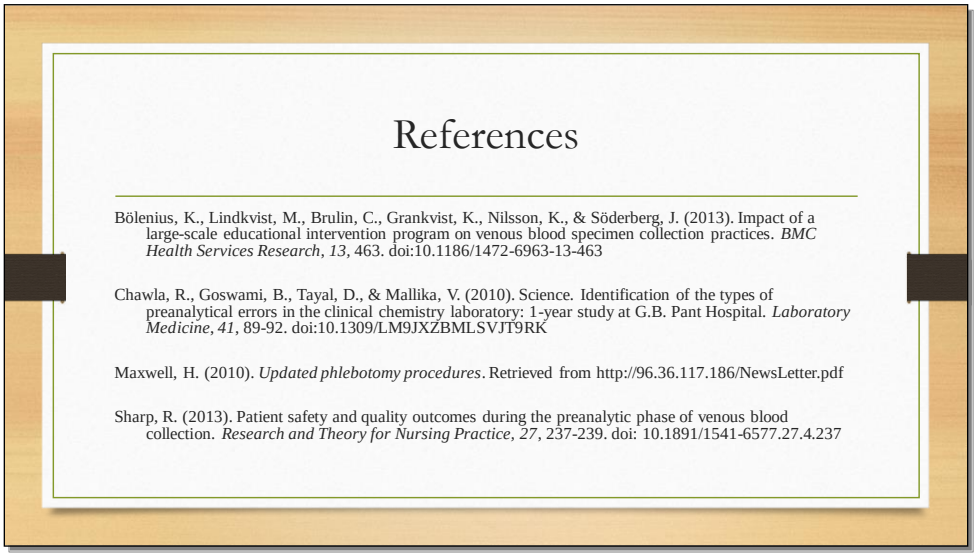
You CANNOT reuse needles or anything that has been punctured by a needle.

If you are unsuccessful the second time, get a resource person to perform the draw.

Answer any questions

Go through Scenarios

Slide 22



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Chawla, R., Goswami, B., Tayal, D., & Mallika, V. (2010). Science. Identification of the types of preanalytical errors in the clinical chemistry laboratory: 1-year study at G.B. Pant Hospital. *Laboratory Medicine*, *41*, 89-92. doi:10.1309/LM9JXZBMLSVJT9RK

Maxwell, H. (2010). *Updated phlebotomy procedures*. Retrieved from http://96.36.117.186/NewsLetter.pdf

Sharp, R. (2013). Patient safety and quality outcomes during the preanalytic phase of venous blood collection. *Research and Theory for Nursing Practice, 27*, 237-239. doi: 10.1891/1541-6577.27.4.237

Appendix E: Discussion Scenarios

Discussion Scenarios

- You have a patient who is being treated with potassium supplements and you draw the lab specimen on the same arm as the potassium is running in.
    - What could happen to the potassium level?
    - If we accept these results, what happens to the patient?
    - What should you do about this?
    - Low potassium levels and high potassium levels in the blood are very dangerous.
- You begin to draw the patient's blood specimen and notice the tube filling very slowly.
    - What should you do about this?
    - Should you keep the first tube or discard it? Why or why not?
    - If you are unable to fix the situation, what should you do?
- You have a patient who is on Heparin therapy and you draw the lab specimen while the Heparin is running in.
    - What could happen to the coagulation studies?
    - What should you do about this?
- You have a patient who has a PICC line or a Power Port, should you select a peripheral site to draw?
    - What should you do with this patient?
- Can anyone think of other scenarios that would require a different approach?

Appendix F: Pre- and Post-test With Key

NAME:_____ DATE:_____

Phlebotomy Test

1. You have an order for a coagulation study. You are planning to use a butterfly needle. Which tube(s) should you gather for this patient?

    a. Red top
    b. Light blue top
    c. Green top
    d. Both a and b

2. You are told by your unit clerk that you have a stat order to draw some blood on Room 426. She hands you the labels for Mr. Smith. You gather your supplies, walk into the room, and see your patient that you have had for 3 days in a row. He agrees to the procedure and you draw the specimen, put the labels on the tubes, and send them to the lab. The missing steps are:

    a. There are no missing steps.
    b. You must look at the order, use two identifiers for the patient, and match the labels with the patient's order.
    c. You must stop his IV fluids prior to drawing his blood.
    d. You must get written consent to draw his blood.

3. You are in a hurry to go home and have to get a blood sample for your patient before you go. You gather your supplies, verify the tests, patient, and labels. You have to draw 5 different tubes. The patient asks if you have to fill each tube. Your answer is:

    a. I need to just put a little in each tube.
    b. I have to fill each tube to the top
    c. I have to fill each tube ¼ full.
    d. I have to fill each tube ¾ full, except that blue one. That one has to full.

4. You are on your way into a patient's room when the lab calls and tells you the specimen you sent for Mr. Smith had clotted and could not be tested, so it has to be redrawn. You thank them and think the real reason you have to redraw the specimen is:

    a. The lab person is unhappy and wants to give everyone a hard time.
    b. The blood was not mixed with the additive after being drawn.
    c. The lab didn't test it right away and the blood clotted.
    d. The entire world is conspiring against you today.

5. You are trying to draw a blood specimen from one of your patients who has the reputation of being a difficult draw. You have had two failed attempts at getting a specimen. You should:

    a. Get someone else on your unit to try to get the specimen.
    b. Get a vein finder and try again.
    c. Call the doctor and say you can't get the specimen; he or she has to order a PICC line.
    d. Ignore the order and let the next shift handle it.

6. Mrs. Jones has dementia and needs to have blood drawn. She has been known to be combative but seems to like you. As you attempt to put the needle in her arm, she pulls away and slaps you in the hand causing a needle stick injury. What could have been done to prevent this injury?

    a. You could have asked for help to stabilize her arm.
    b. You could have let someone else draw her blood.
    c. You could have ignored the order for the lab test.
    d. There is nothing you could have done, it was bound to happen.

7. You are trying to draw blood from Mr. Brown and the tube is filling really slowly. You are happy to have found a vein in his good arm, since he has an IV in the other hand and is known to be a difficult draw. What can you do to try to increase the flow rate?

    a. Put another tube on to see if the vacuum in the tube is bad.
    b. Push the needle in or pull it out slightly in the needle path.
    c. You can try both a and b.
    d. There is nothing you can do, slow and steady wins the race.

8. You get a call that the specimen you just sent for Ms. Black is hemolyzed and they are unable to test it. You ask the lab tech what you could have done to keep that from happening. Choose all that apply:

    a. You may not have used proper phlebotomy technique.
    b. You may not have been inside the vein lumen.
    c. You may have used a needle that was too small.
    d. You may not be cut out for this job.

9. You see an order for antibiotics for Mr. Schultz. He also has an order for blood cultures. What should you do first?

    a. Start the antibiotics and then draw the blood cultures because the antibiotics were ordered first.
    b. Draw the blood cultures first, then start the antibiotics.
    c. It really doesn't matter what order you do them in.
    d. Delegate this task to your patient care tech.

10. You put the tourniquet on the patient and realize that one of the tubes you grabbed from the supply room is expired. What do you do now?

    a. Draw the blood in the tube anyway and hope the lab doesn't catch it.
    b. Leave the tourniquet on while you run to the supply room and grab another tube.
    c. Release the tourniquet and go get another tube from the supply room.
    d. Leave it for the next shift to worry about.

Phlebotomy Pre-test or Post-test KEY

1. D
2. B
3. D
4. B
5. A
6. A
7. C
8. A, B, C
9. B
10. C

Appendix G: Competency Form

Phlebotomy Skills Verification

Each venipuncture must be observed by a phlebotomist and evaluated according to the criteria listed below. A minimum of 3 successful venipunctures is required for competency to be determined.

Skills/Theory	#1	#2	#3
1. Accurately collects blood specimen following hospital policy			
a. Verifies order, gathers all venipuncture supplies prior to entering room.			
b. Washes hands properly, greets patient, and introduces self			
c. Verifies patient identity using **two** of the following identifiers: Patient name, date of birth, MRN, last four digits of SS#, Driver's License.			
d. Verifies that the lab requisition and label information matches and asks the patient what they are here for, in his/her own words.			
e. Assesses the patient for an acceptable venipuncture site.			
f. Explains intended procedure to patient and parent/guardian (if applicable).			
g. Verbalizes sites that should be avoided, such as those with scar tissue, hematomas, edematous areas, extremities with dialysis shunts, PICC lines, and/or IVs.			
h. Positions patient, extending upper extremity comfortably			
i. Verifies tubes to be collected correspond to tests ordered and checks expiration dates on tubes to be used.			
j. Applies tourniquet 3-4" above the selected puncture site and removes within 2 minutes.			
k. Asks the patient to make a fist, but not pump hand			
l. Cleanses the puncture site with alcohol swab starting at the site and working in a circular motion outward.			
m. Allows puncture site to dry while donning gloves, connecting vacutainer to needle, removes cap, and inspects needle.			
n. Draws skin taut to anchor vein in place and inserts needle (bevel up) into the vein at a 15-30º angle, avoiding trauma and excessive probing.			
o. Holds needle completely still while inserting tubes onto vacutainer. Fills tubes properly and in proper order.			
p. Removes the tourniquet as the last tube is filling and asks the patient to open his/her fist.			
q. Removes the vacutainer tube and the needle from the patients arm, engages the safety mechanism and applies adequate pressure to the puncture site with gauze/cotton ball while keeping arm straight. Asks the patient to hold pressure on the site while tubes are prepared for processing.			
r. Places needle in the sharps container.			
s. Gently inverts the tubes 5-10 times and correctly records all applicable information on labels, affixes them to tubes.			
t. Records applicable date, time, and phlebotomist's information on requisition form or in computer.			
u. Places properly labeled specimens into biohazard bag and seals bag. Places requisition in the pouch on the back of the bag and places bag in proper place for processing			
v. Assures puncture site has stopped bleeding and applies tape or bandage.			
w. Removes gloves, discards properly, and washes hands.			
x. Assists patient out of the unit and sends specimens for processing.			
2. Verbalizes that they can only attempt a venipuncture on the same patient twice before getting assistance.			
3. Verbalizes ways to avoid hemolysis, such as mixing tubes gently, making sure site is dry prior to puncture, and avoiding excessive probing or traumatic venipuncture.			
4. Verbalizes and demonstrates proper procedure for drawing blood cultures, such as peripheral sites are preferred, different sites used if more than one set of cultures are ordered, skin is cleansed and allowed to dry prior to puncture, Chlora-prep is uses to clean site in a concentric motion, verbalizes appropriate sample volumes, and labels bottles with source site, date, and time. Also verbalizes procedure when antibiotics have already been started.			

RN/AP Signature: _____ Date: _____

Preceptor Signature: _____ Date: _____

Appendix H: Curriculum Plan

Professional Development Curriculum Plan

Implementation Activities	**Responsible Parties**	**Time Required for Activity**	**Timelines**
Pre-Test for participants	Nurse Educator/Instructor	10 minutes	
Phlebotomy presentation	Nurse Educator/Instructor	20 minutes	
Q&A/Discussion Scenarios	Nurse Educator/Instructor	20 minutes	
Post-Test for participants	Nurse Educator/Instructor	10 minutes	Can combine everything in one shift or split class and phlebotomy training up over two separate dates
Phlebotomy skills competency	Outpatient laboratory preceptor/phlebotomist	2-6 hours depending on skill level and patient population in lab	1 month total per inpatient unit/ED personnel