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Title Page:

In-service training to improve phlebotomy technique

By

Lizelle Crous

A research report submitted for fulfillment of the partial requirements for a degree of Masters in Nursing at the Faculty of Health Sciences, School of Therapeutic Sciences at the University of the Witwatersrand.

Declaration:

I, Lizelle Crous, declare the following:

This research report being submitted for the partial requirements of the degree; Master of Science (MSc) Nursing, at the University of the Witwatersrand, Johannesburg is my own work and has not been submitted before for any degree at any other institution.



Signature: _____

Lizelle Crous

Signed at Randburg, on the 13th day of February 2015

Protocol number: M130466

Dedication:

This research report is dedicated to all the Nurses working in the laboratory.

"You can achieve an ordinary level of success by targeting objectives that are accessible to you. Or you can chase a more elusive target and shoot for the stars!"

Nigel H. Martin

Acknowledgements:

So many people have inspired me, contributed to and influenced me whilst conducting and writing up this research report. I came to the realization that no woman is alone in any venture.

Knowledge is power but doesn't come without pain and effort and many a day I thought of giving up, but then new inspiration reveals itself and you find reasons to continue.

I want to thank Dr Sue Armstrong, my supervisor, for keeping me on track and motivating me to continue, always reminding me of the finishing line that is around the corner.

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Abstract:

Competence of nursing staff working in the laboratory came under the spotlight with the introduction of the phlebotomist technician-learning programme. In modern medicine doctors rely on clinical laboratory services to assist them with managing patient care. They use information from the laboratory to diagnose and treat patients and it is therefore of the utmost importance to ensure quality specimens are produced enabling accurate test results.

Phlebotomy is considered a skill and not a discipline and needs workplace training programmes and policies to prevent errors. Sample collection takes place in the first phase of the testing process, pre-analytical, and is mainly performed by nursing staff, and when looking at error statistics, 60 – 70% of recorded errors are taking place in the pre-analytical phase, causing negative outcomes for the patient and involves risks that ranges from no harm detected to death.

Despite in-service training, problems were identified that is related to the phlebotomist's technique when performing a venepuncture. Therefore, establishing if nurses' phlebotomy technique can be improved through a training programme would provide valuable information in the attempt to improve quality results.

The purpose of this study was to identify technique variations of nursing staff and develop a training programme directed to correct phlebotomy technique variations and finally to test the effectiveness of such training programme.

The methodology used was a quantitative, experimental, pilot intervention study to provide guidance in answering the research questions based on a one group pre-test post-test design. Data was collected by means of peer video recordings of the nurses employed by the laboratory (n=20) in the workplace, based at outpatient departments of the laboratory, which was then evaluated by independent evaluators against a criterion based observational checklist.

Compliance to standards on the venepuncture procedure was identified during the pre-test with an average score of 61.9%. The training programme developed to address all deviations from the standards proved to be effective as the post-test mean score was 85%. The results suggests that knowledge and skills were acquired however further investigations are needed for guidance in standardisation of training programmes and the interval programmes should be presented.

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Chapter 1:

Overview of the Study

1.1 Introduction

This chapter encapsulates the research process and gives a brief overview of the study. With the introduction of the phlebotomist technician-learning programme, the competence of nurses performing this role came under the spotlight with regard to their level of skill when performing a venepuncture as they had never previously been specifically trained for or evaluated when performing this skill. Nurses were assumed to be able to perform this function but in reality their training on venepunctures is very limited when measured against the 18 month focused training of a phlebotomist technician.

Nurses have for many years been required to perform venepunctures in hospital wards and outpatient departments to assist doctors with their workload. It was therefore not a strange phenomenon for nurses to be employed as phlebotomists in the laboratory to assist pathologists with the demand of sample collection, as doctors began to rely more on diagnostic tests to make a diagnosis. The shortage of professional nurses and the increase in the number of patients making use of the private health care system resulted in a need and demand for more skilled phlebotomy staff. This led to the development of the phlebotomist learning programmes, and the consequent realization that nurses did not necessarily meet the requirements for correct venepuncture technique.

1.2 Background

In modern medicine, doctors rely on laboratory services to assist them with patient care management. They use the information obtained from the laboratory to diagnose, or exclude a diagnosis, and to treat patients. It is therefore important that the laboratory produces quality test results. Sample collection is done manually and human errors are therefore inevitable. To avoid mistakes, care should be taken to ensure that competent personnel follow the correct processes. (Wonglumsom, Manochiopinij, Sirisali, Vattanaviboon and Sirisali, 2011).

Phlebotomy is considered an acquired skill and not a discipline; therefore effective policies and workplace training are needed to facilitate the prevention of errors. Laboratory work is divided into 3 phases – pre-analytical, analytical and post-analytical. Nurses are mainly involved in the pre-analytical phase and, when looking at the statistics, 60 – 70% of errors occur in the pre-analytical phase. (Sharma, 2009). Pre-analytical procedures include tasks from the time of receiving the patient to the time the specimen is received in the laboratory.

An opportunity for errors is created when nurses lack knowledge about laboratory practices or do not have the appropriate skill to perform the necessary procedures. Lack of quality control might also be an issue. Phlebotomy is a neglected procedure in healthcare. Limited time is spent on training nurses and doctors on the procedures and yet it involves serious health risks, which could result from improper venepuncture technique impacting on the patient treatment outcomes. Two of the major complications that can occur due to improper technique are haemolysis and haemoconcentration. Prolonged tourniquet application will result in haemoconcentration, where blood plasma infiltrates the surrounding tissue causing an increased

concentration of protein-based analytes in the blood. A haemolysed sample is unacceptable for testing and will result in the patient being re-bled. The following technique errors will ultimately result in a haemolysed sample: Needle size smaller than 23-gauge; drawing from a bruised area or haematoma; applying the tourniquet too close to the puncture site; inserting the needle before the cleaning agent has air-dried and mixing the tubes vigorously. (Strasinger and Di Lorenzo, 2011).

Ernst (2006) stated that when patients come for a blood test, they demand "the knowledge and skills of a competent phlebotomist". The nurse (phlebotomist) is the responsible person to ensure specimen quality in the pre-analytical phase of laboratory tests. Errors in the pre-analytical phase, especially during the specimen-collection process, causes negative outcomes for the patient that ranges from no harm detected to death.

Research indicates that phlebotomy training, although it is in-service training, must be of good quality so that the phlebotomist understands the implications of wrong technique and errors in the pre-analytical phase's impact on test result outcomes. (Ernst, 2011).

Good venepuncture technique secures a satisfactory specimen and minimises patient discomfort. In this study the venepuncture procedure will be standardised to eliminate variations in technique together with implementing control measures to improve the quality of the collection method (venepuncture). Lack of control eventually results in improper technique or bad habits.

Previous studies (Hawkins, 2012; Green, 2008; Sharma, 2009; and Lippi, 2009) investigated the errors that can occur if the wrong technique has been followed, and indicate it is vital to improve the quality of service being rendered. Although all studies indicate that training is vital there is still no standardised training for nurses performing phlebotomy procedures. (Lippi, 2009;

Salvagno, Montagnana, Franchini and Guidi, 2006). There is an assumption that nurses are able to perform a venepuncture correctly as it is one of the skills demonstrated during the course of the programme to qualify as a nurse. Unfortunately nursing students have limited opportunities to practice and perfect this skill as most laboratories (public and private) have trained nursing staff in their employment to obtain samples for testing and do not accept student nurses for practical placements. Due to the limited opportunities nurses have to obtain phlebotomy skills, the focus of the nurse shifts from the venepuncture technique to accessing a vein for intravenous therapy. Even if the nurse has many years of experience in starting an IV, a different approach is involved to perform a successful venepuncture. (Ernst, 1998).

In the earlier years, nurses had many opportunities to become competent in different skills such as venepuncture and starting an IV, as they would work alongside the doctors who did not mind delegating certain tasks once demonstrated to nurses. Decentralizing laboratory services has meant that phlebotomy procedures previously performed by ward staff are now performed by nurses and technicians employed by the laboratory thus limiting opportunities for developing expertise in the skills while working in the hospital. Capacity issues in the hospital setting also led to nurses passing the role of collecting specimens to the laboratory staff, resulting in nurses losing the ability to perform this skill. Student nurses seldom get an opportunity to become competent in phlebotomy procedures during their years of study, and might only manage the skill once qualified as a professional nurse.

The literature does not answer the question on the effectiveness of training and whether training ensures competent and skilled staff. In a special report by Ho, Purdy, Adrian, Higa and Cembrowski (2002) they observed trained phlebotomists with years' experience on their performance of venepuncture, and found that out of 38 parameters that were monitored,

phlebotomists were noncompliant in 13 of them. Based on the results of this study, the effectiveness of the training programme and the methods of training are questionable.

Dennis Ernst (1998) describes the four indefensible phlebotomy errors, one of which is insufficient training. The medical communities assume that nurses have the skill and knowledge to perform venepunctures. A venepuncture procedure is very different to starting an intravenous infusion. Ernst (1998) wrote: "What may appear to be a simple, quick procedure involves a good deal of knowledge and technique to perform correctly". It is no use having a well-designed programme if the evaluation process is lacking. This will defeat the purpose. Ernst (2006) states that evaluation should take place on a regular basis for 3 - 6 months in the beginning and repeated biannually. This is to ensure competence is current, procedures updated and the margin for error minimised.

In the private sector nurses are employed as phlebotomists and are responsible for the collection of specimens. They receive in-service orientation on company procedural standards and have to complete a knowledge assessment. The nurses are only observed and assessed once they are in the workplace to see if they acquired the skills to perform a venepuncture. The question arises that if the training programme is effective and the operating procedures are in place, why was there an increase in documented pre-analytical errors at the private laboratory between July 2011 till July 2012? (Management Review Report: Ampath Laboratories 2012). The problems that were identified related to wrong technique were: patients complaining about having bruises or haematomas after a venepuncture procedure was performed and samples that have to be re-drawn due to haemolysis or under filled specimen containers. Micro clots in the blood sample also affect the results and render the sample unsuitable for testing. This is caused by either the wrong needle size that is used or when cleaning agent was not allowed to air dry or

even when the container was not inverted adequately after collection or a combination thereof. (Ampath Quality Report 2012).

The only way to improve the quality of the specimens and to reduce errors whilst performing the procedures is to observe staff while they perform a venepuncture and identify the mistakes they make. Even more importantly to test their understanding of the impact of that particular error has on the outcome of the test. (Ernst, 2011). Norcini and Burch (2007) suggest that providing feedback on performance after an observation in the workplace will add value to the learning process and improve the quality of care rendered.

1.3 Definitions and explanatory notes

- Adult: Person 18 years of age and older and able to sign consent for a procedure, and capable by law to do so.
- Ante Cubital fossa area: Acceptable location for blood collection because 3 prominent veins are located in this area – Median Cubital (1st choice), Cephalic (2nd choice) and Basilic (3rd choice).
- Laboratory: Refers to a private clinical pathology practice performing tests on specimens collected by nursing staff.
- Phlebotomy: Method used to access a vein or artery to obtain a blood sample.
- Phlebotomist: A qualified person, a registered nurse or a phlebotomy technician, working for the laboratory collecting samples for testing. The laboratory also employs enrolled nurses as phlebotomists, however they work under the direct or indirect supervision of a registered nurse.

- Pre-analytical errors: Occurs if the steps in the venepuncture procedure are not performed correctly. For the purpose of this study errors might include: (the possible affect is given in brackets).
    - Recontamination of collection site (possible source of infection)
    - Cleaning agent not allowed to air dry (haemolysis)
    - Tourniquet applied to close to collection site (haemoconcentration)
    - Tourniquet not loosened within 1 minute (haemolysis)
    - Vein selection – Median Cubital not first choice (not palpating for most appropriate vein) (may result in re-bleeding the patient)
    - Vein not stabilized correctly (bruising or haematoma)
    - Needle size too big or small for vein selected (haemolysis)
    - Needle insertion angle greater than 20˚ (haemolysis due to haematoma formation)
    - Specimen containers (tubes) not filled in the correct order (reflux of preservative – contaminated specimen – unsuitable for testing)
    - Blood not mixed properly by inverting the tube 3-4 times after filling with blood. (Haemolysis). (Green, 2008).
- STAT lab: This is a small branch of a laboratory based at hospitals with an emergency department and critical care units. A STAT lab only performs life-threatening tests and will provide results within an hour after collection. The turnaround time for test results

for specimens sent to a reference laboratory will range between 3 – 6 hours depending on the distance travelled.

- Technique: To what extent does the nurse avoid making conscious errors during the venepuncture procedure.

1.4 Problem statement

Despite in-service training the laboratory identified numerous problems related to phlebotomists' technique.

The orientation programme that new employees attend is aimed at getting nursing staff ready and competent to perform venepunctures as soon as possible and the duration of the programme is 7 days. Ernst (2006) states that evaluation of competence should take place on a regular basis however in reality once the nurse starts his/her phlebotomist' working career, no evaluation takes place.

Therefore, an attempt to establish if nurses' technique can improve through a standardized in-service training programme should be made.

1.5 Purpose of the study

To develop an in-service programme directed to correct phlebotomy technique errors.

To evaluate the effectiveness of the in service training programme, i.e. that quality is improved by eliminating procedural variations.

1.6 Research questions

- What is the current level of compliance to the standard operating procedures?
- What elements should be included in a training programme?
- Does the programme make a difference in the quality of the nurse's phlebotomy technique?

1.7 Research objectives

- To determine the level of compliance of the nursing staff to the standard operating procedures of the laboratory.
- To develop a training programme to correct specific technique problems.
- To test the effectiveness of such training programme.

1.8 Significance of the study

Diagnostic testing and "drawing blood" form part of the skills required of a person to practice as a professional nurse in South Africa. Unfortunately, there is no clear guidance concerning time spent and level of competence required to perform phlebotomy procedures. It is therefore understandable that the general assumption exists that nursing staff can draw blood because it is in their scope of practice.

(q) Preparation for and assistance with operative, diagnostic and therapeutic acts for the patient. Nursing Act 50 of 1978 – Scope of practice for a Registered Nurse.

The venepuncture procedure is one skill that a nurse is expected to perform, but teaching time spent on performing a venepuncture may vary from one institution to another. The phlebotomist qualification however is an eighteen-month certificate and on completion thereof, a person registers with the HPCSA (Health Professions Council of South Africa). This programme focuses primarily on the venepuncture procedure and clear guidance given with regard to the requirements of training and competence, which will lead to a person registering as a phlebotomist.

By conducting this study, the researcher aims to investigate the value of in-service training for nursing staff on the venepuncture procedure. The study can assist in updating training programmes, setting the standards required for evaluation of skill, and updating standard operating procedures.

This study will therefore be significant to:

- The nurses working in the laboratory
- The patients visiting the laboratory
- The laboratory (to improve their quality)
- The supporting doctors who will receive reliable results.

1.9 Overview of methodology

Only a brief overview of the research methods is given in this chapter. A more detailed description on the research methodology is provided in chapter 3.

The research design is one of a pilot intervention study using a Pre-test – post-test design. (Burns and Grove, 2009).



Pre-test: Nursing staff were video recorded whilst performing a venepuncture. Pre-analytical technique errors made by the nursing staff were identified by means of reviewing the video material against a criterion checklist.

Intervention: Training was presented addressing the errors identified during the pre-test. Training covered theory; addressing the error and the impact, that particular error has on the test outcome, as well as a practical component to enhance the skill of performing a venepuncture to improve the quality of the specimen. The duration and the group size of the training depended on the number of errors identified and the intensity of the errors.

Post-test: One month after completion of the intervention, a video recording of the venepuncture procedure performed by the nursing staff was done. This indicated to what extent the errors identified during the pre-test were eradicated. The aim was to achieve 100% compliance in the steps of a venepuncture procedure.

In the next chapter, the literature review, the importance of training and performing the venepuncture procedure accurately according to set standards will be discussed.

Chapter 2:

Literature Review

2.1 Introduction:

To have an understanding of the importance of this study, one has to look at what has been done previously, highlighting the important factors that can make a difference. It was therefore a revelation to realise that in the South African context no studies have been done on the topic of the venepuncture technique itself.

This chapter will give more information regarding the importance of laboratory testing in the medical fraternity. General mistakes being made in the pre-analytical phase shed some light on the importance of quality assurance and how training contributes to the success of patient management.

Giuseppe Lippi (2009) states: "Medical errors can traditionally be clustered into four categories, which include errors of diagnosis, errors of treatment, errors of prevention, and an 'other miscellaneous' category". Laboratory tests consist of complex processes involving ordering, reporting, interpreting and reacting to results, errors can be linked to all 4 categories and any mistake poses a serious health risk to patients. (Lippi, 2009).

The focus today is on good and affordable healthcare for all. If you want to improve the quality of laboratory testing you need to identify mistakes to minimize the effect through

training. Improving the quality of healthcare by reducing errors in the laboratory may have a favourable impact on patient safety and wellbeing. (Sharma, 2009).

Laboratory tests are divided into 3 phases: Pre-analytical, analytical and lastly post-analytical. Nursing staff are mostly responsible for the extra-analytical phases namely the pre-analytical and post-analytical phases, and errors occurring in the extra-analytical phases are a source of concern. Laboratory results' usefulness is more likely to be affected by mistakes made in either the pre- or post-analytical phase. (Sharma, 2009).

Sharma (2009) relate doctors' complaints about incorrect test results to errors occurring during the sampling or collection process of specimens; one of which is incorrect techniques.

It is therefore of the utmost importance, to ensure the quality of the test result, that the nursing staff be competent and confident when it comes to the venepuncture procedure. Wonglumsom et al. (2011) in their study Evidence-based learning as a tool of competency improvement for the phlebotomist, underlined the fact that specimen collection is dependent on correct processes to be followed by competent staff.

A study done by Agarwal, Chaturvedi, Chillar, Goyal, Pant and Tripathi (2012), which looked at quality indicators influencing patient safety in the total testing process in the laboratory. They concluded training is needed to improve laboratory staff members' skill by means of practical sessions, having knowledge of the procedure and tests did not show to have any impact on the sample quality, evident in having a reduced report of pre-analytical errors but no significant improvement in the number of sample rejections.

2.2 Nurses vs. Phlebotomists:

With increased patient numbers doctors realised they cannot keep up with delivering quality care to patients they allow nursing staff to take over responsibilities, such as drawing bloods for laboratory testing and commencing intravenous therapy. Nurses are with patients around the clock and it just seemed sensible for nurses to perform these tasks on doctor's orders.

The shortages of nurses in the hospital led to the development of the phlebotomist technician programme, launched in South Africa in 2004. The regulatory body and licensing authority is the Health Professions Council of South Africa (HPCSA). To register as a phlebotomist technician one has to complete an 18-month course. The course covers an overview of the basic anatomy and physiology of a human being, but most time is spent on the phlebotomy procedures. A further requirement is then to perform 100 simulated draws in a skills laboratory before they have to perform a further 100 supervised draws on real patients before they are deemed competent.

On the other hand nurses performing phlebotomy procedures in the laboratory setting receive in-service training or on the job training. New nursing staff was trained by the older, more experienced nurses working in the laboratory that led to the vast variations in technique. Another factor affecting the differences in technique is the lack of standardised training for nursing staff performing phlebotomy procedures. (Lima-Oliveira, Lippi, Salvagno, Montagnana, Picheth and Guidi, 2012). Unlike the phlebotomy technician programmes nursing staff do not need a certificate for phlebotomy, and therefore training programmes vary in requirements and set outcomes between different laboratories.

Another concern about the training nurses receives; they are not trained on tests, the requirements for these tests, and what may influence the outcome of tests. (Lima-Oliveira et al, 2012).

2.3 In-service training:

Private institutions like the laboratories in South Africa have come to the realization that to remain competitive they need to keep the workforce educated by means of in-service training. Salas et al. (2012) has found that organisations value the impact of a well-designed training programme has on staff development, establishing a culture of continuous learning and updating skills. Organisations use training and development activities to have the edge on their competitors as it allows them to improve their quality of service by adapting their workflow procedures in an innovative and safe way and still ensuring they reach their goals. (Salas et al, 2012). Due to high staff turnover and workload demands, it is imperative that companies must find a way to retain staff that is competent to ensure financial sustainability. The participants in a study on factors influencing professional development indicate that despite the efforts of companies to improve their skills, they prefer to rely on their own abilities and actions to improve their own competence. This might be due to non-standardization of programmes. Furthermore the participants identified experience and the environment as the most impactful on their development. (Khomeiran, Yekta, Kiger and Ahmadi, 2006).

In-service training has influenced how employees view the work environment and has created a higher work satisfaction level. Williams (2010) stated that the key to work base

learning that can change practice is teaching staff through critical reflection on own behaviour how to learn. The work place environment not only allows the staff access to develop skills with experienced people but also enables them to gain experience through practice. (Khomeiran et al, 2006) the work place also provides the context to develop self actualisation by creating an environment where critical reflection is promoted enabling staff to control their own learning in the workplace.

Factors to consider when designing an in-service training programme, which is effective in staff development, should be: the content to be included, the place where it would be taught and how much time the training would take and also what resources are available. Learning should not only consider what the employee should learn but also take into account the needs of the work place. Nevertheless, for in-service training to be effective the employee should be able, through critical thinking, to create and apply knowledge acquired. (Williams, 2010).

Due to high staff turnover and workload demands, it is imperative that companies must find a way to retain staff that is competent to ensure financial sustainability. In the laboratory, nursing staff, considered to be qualified, draw blood samples from patients. In-service training is therefore the best option to ensure competencies are upheld. Nursing staff do not need an additional qualification, however the skill needed for the venepuncture procedure is specialized and needs attention and therefore should be included in the training programme.

Human error will always occur but needs to be minimized as much as possible which must be born in mind when deciding on strategies to be implemented to prevent errors within

the laboratory. Agarwal et al. (2012) suggested that quality indicators to improve patient safety and care should provide information about real life scenarios and should comply with the following suggested objectives; all data including near misses must be looked at and the complete process must be evaluated from how the doctor ordered the test, the collection steps and the testing phase. Having this data will assist in identifying errors that can be addressed through training and implementing a quality assurance programme. (Agarwal et al, 2012).

In-service training is considered the best platform to uphold competencies with the least disruption in the workplace. According to Williams (2010), nurses have to take control of their learning and be empowered to make the needed changes to their practice and be supported when reflecting on their practice. Mentors play an important role in the education of employees in the workplace. It is imperative to structure and standardize the training to minimize the variations in technique. Skilled facilitation is also needed to assist nursing staff with critical thinking that will ultimately affect change, but a learning culture needs to be created first. (Williams, 2010).

On the job or in-service training also allows the employee to correct any mistakes without leaving the workplace to travel to a different venue that does not always simulate the real life situation. (Presley and Liotta, 2006), in-service training has proven to be a good alternative, to the traditional classroom based training, that has proved to make a difference in patient care. (Williams, 2010). Williams (2010) mentioned that learning in the work place is created from the work itself. Through reflection the employee then integrates knowledge with experience in the correct setting. Another skill the employees learn

through in-service training is the ability to question current practices and, through debate with their colleagues, decide on best practices.

Williams (2010) concluded her study on work-based learning in clinical practice; to improve patient care managers should consider implementing work-base learning, as it is motivational to staff that in turn brings about better patient outcomes.

For training to be successful assessment and feedback should also be considered. Norcini and Burch (2007) express a concern that observation of doctors in the workplace occurs seldom, if ever, and that can be said for qualified nurses in the workforce. Skill and competence are rarely observed or assessed in the workplace even though assessment tools and methods are readily available. Feedback on performance enhances not only the learning and teaching but it also assists with changing behaviour of employees (nurses). (Williams, 2010). Due to time constraints managers do not provide timeous formative assessments and feedback. Norcini and Burch (2007) suggest that strategies should be identified to improve the teaching, assessment and feedback provided within the workplace for it to become a routine process. After- training variations can also occur and regular evaluation through observation of nurses and feedback given will help with improving the quality of service by limiting the "bad habits" to occur. (Ho et al, 2002).

Video instruction offers a method of teaching nurses in the workplace as they can view and review the footage at their own time and pace, making notes in an environment in which they feel comfortable. Video instruction can be a great motivator and grab the viewer's attention immediately and lend itself as a teaching tool. (Chan, 2010). With the technology, i.e. smart phones, tablets or laptops; that is readily available today access to video clips of

skills can be viewed in any environment, at a low cost being incurred. (Yoo, Son, Kim and Park, 2009). Instruction through video can be taken a step further; using self-assessment as a teaching tool. Recording nurses while working will provide an opportunity for them to review their own practices and skills. Observing themselves will allow them to recognise their strengths and weaknesses and that will enhance the possibility for change in behaviour. (Yoo et al, 2009). Dearnley and Meddings (2007) supported the advantages of self-assessment in their pilot study, finding that self-assessment enhances learning and sense of achievement in the student whom develops the skills of critical awareness and reflectivity enabling them to become lifelong learners.

2.4 Venepuncture: procedural errors and associated complications:

According to the World Health Organisation, one needs to follow certain steps to ensure safe practices in phlebotomy, not only for the patient and the healthcare worker but also to ensure quality results to prevent repeat testing because of complications associated with errors in sample collections. (WHO, 2008). Incorrect phlebotomy techniques such as the venepuncture often results in complaints from doctors about wrong or unreliable test results. (Sharma, 2009).

The best practice guidelines suggest the following steps for a venepuncture procedure:

- Assembly of equipment (either needle and syringe or evacuated tube system)
- Performance of hand hygiene (social hand wash)
- Identification and preparation of the patient

- Selection of the site – Ante Cubital area or dorsum of hand.
- Application of the tourniquet.
- Donning of non-sterile gloves.
- Disinfection of site for 30 seconds and allow to air-dry.
- Anchoring the vein – pulling skin towards hand below puncture site and ask patient to clench fist.
- Entering the skin with needle at an angle below 30°.
- Loosening of tourniquet once blood flow has been established.
- Collection of samples in tubes – in the correct order and invert 5 times.
- Withdrawal of the needle and apply pressure to puncture site.
- Discarding needle safely.
- Labelling the specimen containers.
- Removal of gloves and decontamination of hands.

The objective and expected outcome when performing a venepuncture is to obtain an uncontaminated specimen, which does not allow erroneous results, ensuring accurate diagnostic interpretations to minimize and prevent patient anxiety, injury, risk for infection or misdiagnosis. (Lynn, 2011).

Green (2008) indicated that the pre-analytical phase affects the reliability of test results, not only compromises the possible diagnosis and treatment plans but also consumes valuable

healthcare resources; time to redo the testing, using consumables that has a cost implication for the laboratory and inconvenience to the patient going through the same experience to mention a few.

The most common complications due to procedural mistakes associated with wrong phlebotomy technique are haemolysis, haemoconcentration, haematoma and bruising, contamination, sample rejection and lastly infection. As discussed in the background, chapter 1.

The complications due to pre-analytical errors linked to technique variations could be prevented and managed. The laboratory is involved in decisions relating to medical diagnoses and treatments, (Agarwal et al, 2012) placing the laboratory in the midst finding solutions to improve patient safety through improving the total testing process. Error prevention would need control measures that would require compliance from all staff in the laboratory, controlled by an accreditation system. (Sharma, 2009).

2.5 Quality assurance: Current status in South Africa:

A quality assurance programme to overcome human errors, increase patient safety in the laboratory, and eliminate possible errors is needed. Hawkins (2011) stated in his review of managing the extra-analytical phase: "Accreditation agencies are increasingly requiring laboratories to go beyond analytical quality and take responsibility for the pre- and post-analytical (or extra-analytical) phases where most errors arise." Phlebotomy procedures are poorly investigated even though it is a major source for errors, it also lack quality control procedures. (Lima-Oliveira et al, 2012).

Hawkins (2011) states that lack of control measures will lead to errors that could be prevented if the correct processes, procedures and guidelines were in place.

Although the pathology sector has been in the forefront for quality improvement and implementing accreditation standards in South Africa, the focus remains on the analytical phase. The South African National Accreditation System (SANAS) is the body that visits and inspects the pathology laboratories in South African according to ISO standard 17025 (www.sanas.co.za). They measure each step in the laboratory against a pre-determined checklist and make recommendations accordingly. However, the only criterion on these checklists for the extra-analytical phases are measured against the laboratory's standard operating procedures, these procedures set by the nursing staff working in the laboratory as phlebotomists contain no reference to best practices.

Green (2008) concluded his study on specimen quality by saying that improvement could be achieved through education. The solution should include quality audits and the development of assessment criteria of specimen collection practices. It has to be an ongoing process, looking at identifying problem areas and finding workable solutions to minimize the recurrence of inefficient laboratory practices. The aim is to sustain specimen quality and improve safety measures.

So the question arises - do the current practices with regards to training for nurses in the laboratory improve their phlebotomy skill and are the standard operating procedures guiding them according to best practices being implemented?

In chapter 3, the research process followed is explained. How the process, enabled the researcher to gather evidence to answer the research questions.

Chapter 3:

Research Methodology

3.1 Introduction:

Research methodology is the systematic approach taken by the researcher to find solutions for a particular research question. It encompasses the various steps and logical reasoning taken by the researcher to study the problem.

The research methodology guides the researcher when deciding what are the most appropriate methods and techniques to use for data collection, population selection as well as data analysis. In this chapter the research process is outlined and each step of the process is explained from the research setting, population and sampling, data collection and how the data was analysed.

3.2 Research methodology:

A quantitative, experimental, pilot intervention study was used for the purpose of this study. This methodology was thought to provide the most suitable guidance for the research questions. It determined the methods of data collection as well as what techniques and principles to apply when analysing the data.

Quantitative research: "is a formal, objective, systematic process in which numerical data are used to obtain information about the world. This research method is used to

describe variables, examine relationships among variables, and determine cause-and-effect interactions between variables." (Burns and Grove, 2009).

Experimental research: The idea of experimental research is to compare two things with one another. There are three main categories of experimental designs identified namely: pre-experimental, quasi-experimental and true experimental. Differences between the experimental designs are the degree of control of the variables and if a comparison group was used or not. Experimental research provides a platform to conduct intervention studies as it allows the researcher to determine what is known about the study, subjects or intervention and to determine if there is any difference between before and after. (de Vos et al, 2013).

Pilot study: A pilot study can be seen as a small-scale version of the complete project, before a researcher attempts to conduct the research mainly to establish and rectify any discrepancies and also to determine the feasibility of the study. (de Vos et al, 2013). The reasons the researcher used a pilot study to conduct this research are as follows:

- Determining the feasibility in terms of cost involvement and practicality of the implementation of the intervention.
- Cost implications in developing the intervention, in-service training programme, for professional nurses working in the laboratory.

- Design a protocol for implementation of the intervention to assure quality within the laboratory setup.
- Finally, because of the small number of available participants, a pilot study is done to gather information to answer the research questions. (Burns and Grove, 2009).

A pilot study only provides limited information, however it still allows for identification of deficiencies that can be addressed. (Burns and Grove, 2009).

Intervention research: Interventions are treatments or programmes that are implemented that will result in change of behaviour to improve quality of care. Intervention research aims to provide a platform for the generation of knowledge, nurses' use as evidence for best practices. Burns and Grove (2009).

3.3 Research design:

The research design chosen for this study is a pre-experimental design namely a one-group pre-test/post-test design. De Vos et al (2013) states: "These designs have been developed to determine the presence of cause-and-effect relationships between different variables. In technical terms, it means that we want to measure whether a specific intervention (independent variable) has any effect on the unit of analysis (dependent variable)." The one-group pre-test – post-test design was chosen for this study as it enabled the researcher to test if in-service training, the intervention, has an effect on the current phlebotomy practices of registered nurses (the participants), even

if it creates awareness that training is needed to update their skills, a positive outcome is reached.

3.4 Overview of research plan:

The study was conducted in three phases. The first was to validate the criterion based checklist (Annexure A.1) used during the pre-test and post-test. It was accomplished by running a trial run of the pre- and post-test using phlebotomy technicians (excluded from the study) as participants allowing the assessors to familiarise themselves with the tool. The validation process is explained later in this chapter 3.7.1.

Data collection took place during the second phase and in the last phase additional information and statistics were obtained from the various laboratories to compare the outcome of the intervention with what is happening in practice; for example the researcher obtained information from the laboratory concerning sample rejection numbers and compare the information with the results of the study. Due to the number of participants, the researcher was able to obtain valuable data from the participants as feedback on the intervention and their experience on the process, which was looked at in the last phase.

A summary of the methodology can be seen in figure 3.1 below.

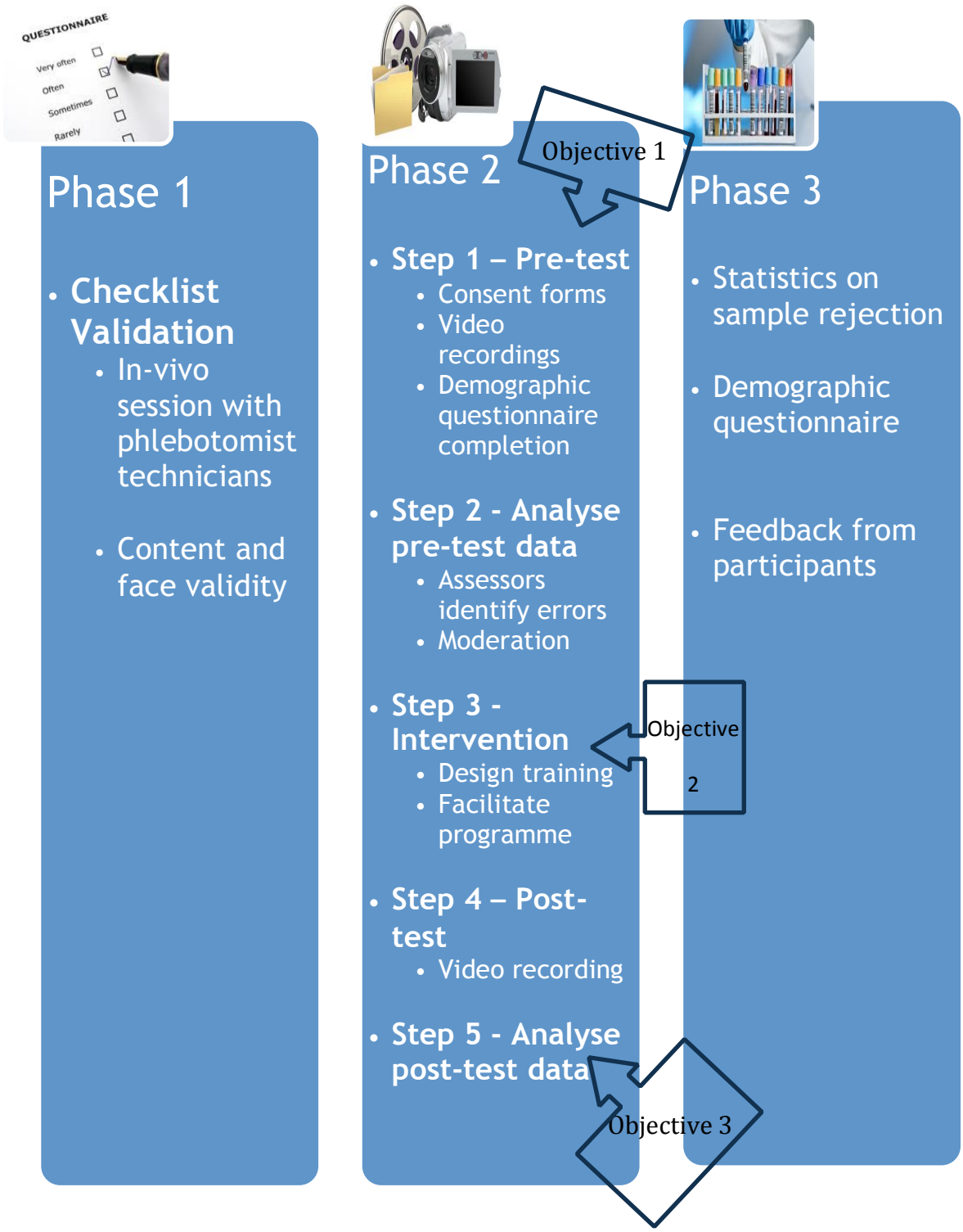


Figure 3.1 Summary of Research Plan

3.5 Research setting:

The study was conducted in a natural setting. The reason for conducting the study in a natural setting was to observe nurses' behaviour in their work environment. It is very difficult to replicate the workplace in a simulated situation as stressors that occur on a daily basis cannot be predicted and replicated. The workplace environment is also familiar to the nurses and they should be comfortable in the environment, reducing the added stressors of being assessed that would have occurred if it had been done in a training room. Data was collected at outpatient departments (depots) of a private laboratory, which are based at private hospitals in the Gauteng South Region. The laboratory has a STAT lab on site and is the preferred service provider at these hospitals, with a high demand for pathology testing, requiring more phlebotomy staff.

3.6 Population and sample:

The population was made up of nurses working for a private laboratory in the Gauteng South region. The nurses were based at laboratories at five private hospitals. The original population amounts to 53(N). Due to policy changes that were made after commencement of this study that, upon resignation of nurses from their posts, phlebotomy technicians would be employed in their positions, two hospitals became unsuitable for the purpose of this study as they experienced a high turnover of staff between the period of proposal submission and data collection. The final population size was N=35.

Census sampling was used for the purpose of this study. Due to the limited numbers of registered nurses working at the laboratory, the whole population had to be included. The final sample size was 20 (n). The sample is 57% of the population that participated in the study. The nurses who were not included in the final sample were either unavailable or refused participation and therefore did not sign consent.

Patient selection: The presence of the STAT laboratories at these hospitals makes it convenient for doctors to refer their patients for blood tests on an outpatient basis to the laboratory. The outpatient numbers are large and enabled random selection of patients on whom the nursing staff can perform the venepuncture procedure for this study. Every third adult patient who visited the Depot of the STAT laboratory and who agreed to participate was included. The reason for random selection of patients was to exclude biases and favouritism from the nursing staff, as well as it prevented the nursing staff member pre-empting which patient they were about to bleed.

Exclusion criteria: Phlebotomy technicians were not participating in the study as they completed an 18-month phlebotomy-training programme and are registered as phlebotomist technicians with the HPCSA.

Inclusion criteria: All nursing staff, which is permanently employed by the private laboratory, based at the three private hospitals in the Gauteng South Region.

3.7 Research method:

This study consisted of a pilot study, conducted to establish the feasibility of the study and of the intervention. The aim was to describe the phlebotomy process and to gather

evidence of procedural variations that may affect the outcome of the test; develop a training programme to prevent procedural variations and test the effectiveness thereof.

3.7.1 Phase 1: Validating instrument:

The first step in this study was to check the feasibility of using the existing procedure evaluation instrument (Annexure A.2) as a research tool. This instrument is currently used by the laboratory as an assessment tool for competence of the phlebotomist technician-learning programme. Instrument validity ensures that the instrument measures the concept (steps in the venepuncture procedure) and that it is measured accurately. (de Vos et al, 2013).

Content validity ensures that all the components to test a variable are represented in the tool. (Brink, van der Walt and van Rensburg, 2012). The first step taken by the researcher to ensure content validity was to look at WHO's procedural recommendations on the procedural steps for a venepuncture and doing a literature review on factors that influenced the various steps of the procedure. The checklist used to observe the pre and post-tests is derived from a checklist currently used in the phlebotomy technician's programme (Annexure A.2). As this study only focused on the venepuncture technique of the nursing staff member, non-applicable criteria such as patient identification, test confirmation and hand decontamination were omitted.

Face validity is concerned with the representativeness of the content of an instrument and if it measures all aspects of the concept. (de Vos et al, 2013). This was done by running an *in-vivo* session with phlebotomy technicians, whom have been excluded from the study as the participants, the assessors used the tool to identify any problems with

the content, steps in the procedure, and they could familiarize themselves with the tool. (Annexure A.3). The assessors, experts in the phlebotomy field, comprised of a nursing service manager in phlebotomy and a training sister at the laboratory, made judgements on the inclusions and exclusions of the criteria used in the checklist. The following changes were made to the checklist, because of their feedback, and then used as a criterion checklist for the video recordings:

- Each criterion was broken down into smaller steps.
- Comments from the assessor added as field notes.

Changes to the checklist is shown in table 3.1

Table 3.1 Changes to Checklist

Step in Procedure	Criteria
Positioning Patient	**1.** Fully extends the patient's arm
Applying the tourniquet	**2.** Apply 10 – 15 cm above puncture site
	3. Ensure tourniquet is not too tight
	4. Loosen the tourniquet within 60 sec
Selecting a suitable vein	**5.** Palpate the vein to determine direction and patency
	6. Ask patient to hold fist – no pumping of hand
Disinfecting the site	**7.** Clean the site
	8. Allow the adequate time for alcohol to air dry
Anchoring the vein	**9.** Do not re-palpate the site
	10. Anchors the vein by pulling the skin downwards towards the hand

Needle insertion:	**11.** Angle of needle insertion is less than 20°
	12. Did not bend the needle
Filling of collection tubes:	**13.** Loosen tourniquet once blood flow is established
	14. Wait for vacuum to be exhausted before removing the tube
	15. Mix the tube by inverting it
	16. Fill tubes in the correct order
Removal of the needle:	**17.** Release the tourniquet
	18. Remove needle and apply pressure to site

Reliability of an instrument as defined by de Vos et al, (2013): when an instrument provides the same result on repeated measurements. Steps to improve reliability include standardizing instructions, elimination of unclear instructions and maintaining consistent scoring procedures. During the *in-vivo* sessions, the instrument was tested for reliability. It provided an opportunity to standardize the instructions and to see if the instrument was consistent. As per the feedback from the assessors the tool proved to be easy to use and scoring was consistent not only from one observation to the next but also the scores of the evaluators were similar which assured inter-rater reliability.

3.7.2 Phase 2: Data collection:

The research design of a pre-test – post-test allowed the researcher to collect valuable information regarding the venepuncture technique applied by nursing staff members. Observations were done by means of video recordings of the procedure, which were

then evaluated, using a criterion based evaluation sheet. Video recordings of human behaviour have certain benefits over in-person observation, which directed the decision to use recordings for the purpose of this study. Recordings are less threatening to the participants as it feels less like an assessment and would minimize change of daily routine and behaviour. The generation of additional information that an in-person observer might have missed is an added benefit, it allows the reviewer the opportunity to stop and replay and make notes without interrupting the process enabling improved judgements. (Paterson, Bottorff and Hewat, 2003).

3.7.2.1 Pre-test:

The pre-test was done by means of video recordings, of the nursing staff in the depot whilst performing a venepuncture on patients. Two independent evaluators evaluated the recording against the criterion based evaluation sheet. The aim of the pre-test was to identify procedural errors made by the nursing staff that can have an influence on the test outcome, which was included in the intervention. Once all the procedural errors were identified, the intervention was designed and implemented. The number of procedural errors or the frequency of occurrence, even though documented, was not a factor in deciding on inclusion in the intervention. All procedural errors identified were included in the intervention.

3.7.2.2 Intervention:

The intervention was in the form of a training programme, given in the workplace, addressing all procedural errors identified during the pre-test. Salas et al (2012) stated that training is not just a classroom activity that enables learning; it actually is needed to improve performance in the workplace. As explained in the background of chapter 1, nursing staff were exposed to an induction programme where simulators, limbs, were used to demonstrate the procedure and an opportunity to practice the skill was given. Due to time constraints, staff shortages and access to these simulators another approach was necessary to allow staff to perfect their skill in the workplace.

The training programme focused on the following aspects:

- The correct steps in the venepuncture procedure.
- Implications of variations in the procedure.
- Complications of variations in the procedure.
- Influence on test outcome quality of variations in the procedure.

The training methodology was a group (peer) learning approach. The nursing staff watched a video explaining the steps of a venepuncture procedure. They had to evaluate the procedure and then give feedback on the implications. A group discussion was held to derive best practices based on the evidence. Colleagues captured the video recordings of the pre-test so they had the opportunity to view their peers in action and it was also covered in the discussion session. The participants had the opportunity to perform the procedure and be evaluated by peers in the workplace. The advantage of

this was that of immediate feedback on performance from their colleagues. Feedback from the participants on their experience gave valuable insight on the way forward for on the job training.

3.7.2.3 Post-test:

The same format was followed with the post-test as with the pre-test. Video recordings of the nursing staff were done in the depots, whilst performing a venepuncture procedure. Again, the recordings were evaluated by two independent evaluators, against the same criterion based evaluation sheet, used during the pre-test. Procedural mistakes were identified and the frequency noted.

3.7.3 Phase 3: Additional information:

Each participant (nursing staff member) was asked to complete a demographic questionnaire. (Annexure B) This enabled the researcher to have a better understanding of the characteristics of the sample of nursing staff in the laboratory. Questions asked in the questionnaire covered areas of age, training and years of experience in the field. The reason for these questions was to relate procedural errors to these demographics that might have, to a lesser extent, impact on the intervention. Statistical information was obtained from the laboratory about the sample rejections during the pre-test and post-test, to see if there was an improvement in the number of sample rejections. Currently the laboratory's quality assurance system does not link sample rejection directly to the venepuncture technique of the nursing staff.

3.8 Data analysis:

Data analysis for quantitative studies, such as this study, falls into four main categories: descriptive, association, causation and inference. (de Vos et al, 2013). Descriptive data analysis was used because of the small sample. In de Vos et al (2013) descriptive statistics are described as: "methods used to report the distributions of a sample or population across a wide range of variables. The aim of these methods is to produce a scope of the characteristics of such distributions through frequencies, measures of central tendency and measures of dispersion." Because only a small group participated, descriptive statistics were used to describe the basic features of the study. It provided meaningful data relevant to an education programme, and helped with understanding the mean and standard deviation.

Two independent evaluators used a criterion based observational evaluation form for both pre- and post-tests, to evaluate the video recordings. The total scores indicated the compliance level to the procedure standards. Additional control assured by obtaining feedback from the performing laboratory on the sample quality of all specimens collected in the study. Statistics from the laboratory enabled the researcher to determine if there was a decline in the number of rejected samples. The researcher fulfilled the role of moderator, and reviewed the data collected to ensure all problems were identified and addressed in the training programme and that the post-test results gave a true reflection of the effectiveness of such a training programme.

3.9 Validity and reliability of study:

Internal and external validity of experimental designs have a number of threats that have to be minimized by the researcher for the study to be successful. Although this is a pilot study efforts were made to limit threats to the validity and reliability of the study. The threats that had the potential to influence the outcome of this study, identified by the researcher, were the demand factor (occurs when participants are aware of what the research is all about and change their behaviour to what they conceive is expected of them) and what is called the Hawthorne effect (participants react differently to real life because of their participation in a study) (de Vos et al, 2013). To prevent the occurrence of the demand factor and the Hawthorne effect the researcher asked the nursing staff to video record one another (peer recording) to minimize changes in behaviour that may occur when an outsider observes the proceedings (limit the demand factor) and it would feel less like an assessment that would also result in changed behaviour (limit the Hawthorne effect).

Standards for performing a venepuncture are universal and set up according to the WHO guidelines for phlebotomy and the unit standard published on the SAQA website. The criterion-based tool used for this study is based on these standards.

Inter –rater reliability was established by having two independent evaluators observe and evaluate the video-recordings of the nurses performing the phlebotomy procedure in both the pre-and post-training conditions, using the same criterion based evaluation tool.

Evaluators, two nursing managers working in departments in another area and not in the Gauteng South region not included in the study were used to review the recordings to exclude supervisor / supervisee complications and biases, as they do not know the nursing staff participating in the study and don't oversee the departments included in the study.

3.10 Ethical considerations:

- **Anonymity:** No patient or nursing staff member was identifiable on the recordings as the video recordings only displayed the Ante Cubital fossa area of the patient and the hands of the nurse. No identifiable content was captured as the study excluded the patient identification and labelling of the samples procedures so there was no risk of compromising anonymity.

- **Confidentiality:** The video recordings cannot be traced back to a specific individual or laboratory site. Nursing staff work shifts so recordings of all nursing staff could not be recorded in one day. The sites were visited on more than one occasion. The researcher had a list of all staff names in alphabetical order not by location and ticked off once they had been recorded. The recordings therefore cannot be linked to a specific individual. The researcher aimed to identify procedural errors and not who made the errors, therefore no recording could be linked to a specific individual. The video recorder gave a code for each new recording to separate between the participants. The pre-test and post-test recordings were captured on separate memory cards.

- **Consent:** was obtained from all nursing staff participating in the study and the patients from whom they drew blood. Participation was voluntary and no staff member or patient was forced to take part. They could also withdraw at any stage without any prejudice. (Annexure C.1). Patients who agreed to have their blood drawn also received an information letter and consent was obtained from them. (Annexure C.2)

- **Data collected:** The video recordings were done to identify mistakes made not who made the mistakes and to evaluate the effectiveness of training. Information gathered cannot be traced back to a specific person. The raw data was only accessible to the researcher and supervisor.

- **Evaluation:** Independent evaluators were used. No participant reported to these evaluators in the laboratory. The outcomes therefore could not influence their work relations within the laboratory.

- **Permission:** to conduct the study was obtained from the management of the private laboratory (Annexure D.1) and the University of the Witwatersrand Ethics committee. (Annexure D.2).

- **Researcher:** No participant or evaluator reported to the researcher or *vice versa*. The researcher has no influence on the career pathway of any participant or evaluator. On commencement of research the researcher was in the employment of the private laboratory but had resigned once data collection commenced.

- **Possible harm to patients:** In the event the evaluator observed procedures that might be harmful to the patients it was reported to the nursing managers of all the participating departments, to address the issue. The laboratory has quality measures in place preventing employees to try more than once to obtain a blood sample. On the recordings was only one nurse that had the tourniquet on so tight that it left a red mark on the patient's arm, though it is not life threatening it was still reported to all the managers.

The research process has been described in this chapter, looking at the design of the research and method of data collection that enabled the researcher to obtain information to answer the research questions. In chapter 4, the findings of the study are explained.

Chapter 4:

Findings

4.1 Introduction:

In this chapter the findings from the descriptive analysis will be explained as well as the results obtained from the questionnaires given to the participants in the study.

4.2 Pre-test results:

The pre-test consisted of video recordings that were measured against a criterion based checklist. The checklist had 18 criteria, which the nursing staff had to perform during a venepuncture procedure. (Annexure A.1).

The performance of the participants during the pre-test averaged at 61.9%, calculated as follows:

$$\frac{\text{Number of correct steps in the procedure performed by participants}}{\text{Total number of steps (18 steps/procedure x 20 participants)}}$$

$$20 \times 223 \div 360 = 61.9$$

In order to interpret the findings of the pre-test, findings have been divided into three groups namely steps that more than 15 participants performed, steps of the procedure that

were performed by 10 – 15 participants and lastly steps of the procedure that were performed by less than 10 of the participants.

Steps that more than 15 participants performed:

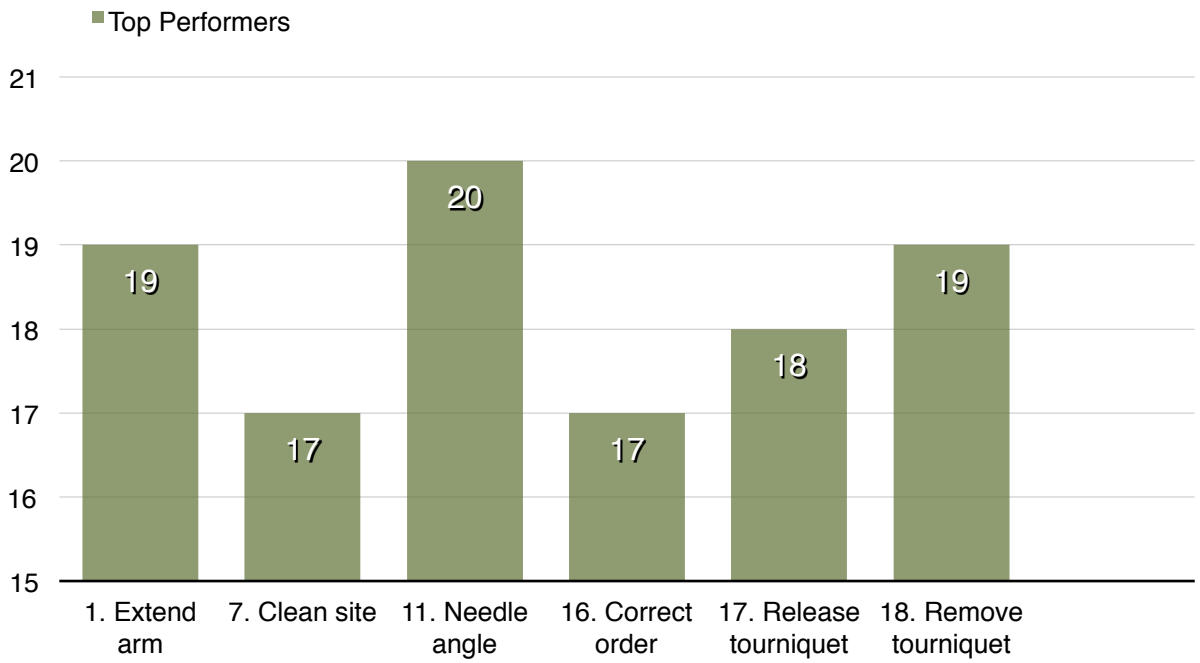


Figure 4.1 Top Performers

Figure 4.1 illustrates steps of the venepuncture procedure 15 - 20 of the participants performed correctly.

- *Step 1:* Fully extend the patient's arm; nineteen participants positioned the patient correctly.

- *Step 7:* Clean the site; seventeen participants disinfected the puncture area.
- *Step 11:* Angle of needle insertion less than 20°, all participants entered the skin with the needle at an angle less than 20°.
- *Step 16:* Filled the containers (tubes) in the correct order; seventeen participants comply with this step.
- *Step 17:* Loosen the tourniquet once blood flow has been established was performed by eighteen participants
- *Step 18:* Apply direct pressure on the puncture site after the removal of the needle; nineteen participants applied direct pressure to site after the needle was removed.

10 – 15 of participants performed the following steps of the procedure correctly:

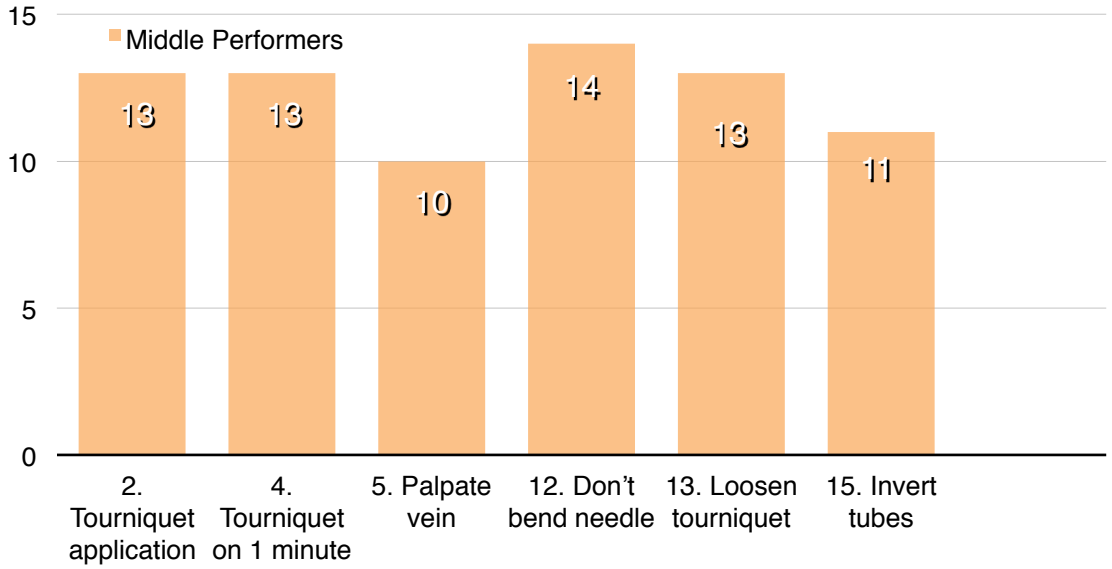


Figure 4.2 Middle Performers

The following steps, as illustrated in figure 4.2, was performed correctly by the 10 – 15 participants:

- *Step 2:* Apply tourniquet 10 – 15 cm above puncture site: Thirteen participants applied the tourniquet correctly.
- *Step 4:* Loosen the tourniquet within one minute. Thirteen participants loosened the tourniquet within 60 seconds.
- *Step 5:* Palpate vein for direction and patency. Ten participants palpated the vein to feel for direction and patency.
- *Step 12:* Do not bend the needle: Fourteen participants did not bend the needle before needle entry into the skin.
- *Step 13:* Loosen the tourniquet once blood flow was established: Thirteen participants loosen the tourniquet once blood flow was established.
- *Step 15:* Inverted the tubes after filled with blood: Eleven participants inverted the tubes to mix blood with additives.

Less than 10 participants performed the following steps of the procedure correctly as displayed in figure 4.3 below.

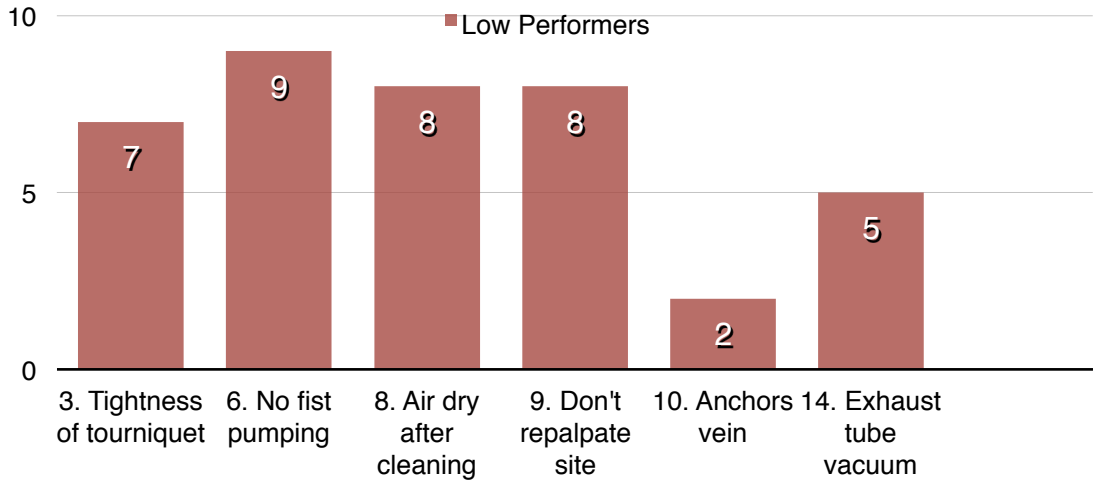


Figure 4.3 Low Performers

The steps shown in figure 4.3 were performed correctly by less than 10 of the participants.

- *Step 3:* Tourniquet applied not too tight, only seven of the participants ensured that the tourniquet was not too tight.

- *Step 6:* Patients asked to hold fist not to "pump" their fists. Nine participants complied with this step.

- *Step 8:* Allowed enough time for the disinfectant to air-dry. Eight of the participants waited for the disinfectant to air-dry before continuing with the procedure.

- *Step 9:* Do not re-palpate the puncture site after cleaning the area. Eight of the participants did not re-palpate the puncture site after cleaning the area.

- *Step 10:* Anchored the vein by pulling the skin of the patient downwards towards the hand. Only two participants anchored the vein before needle entry.

- *Step 14:* Inverted the tubes after filling to mix the blood with the preservative; five participants inverted the tubes to mix blood with preservatives.

In the following figures participant performance during the pre-test will be displayed.

Participant performance during the pre-test:

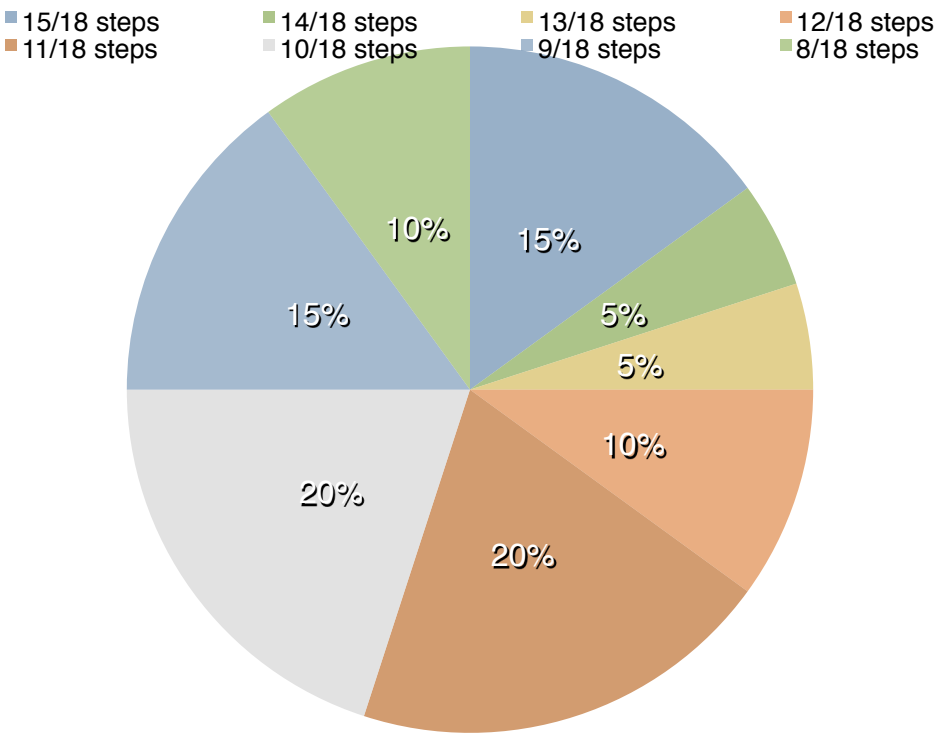


Figure 4.4 Participant Pre-Test Performances.

Participant performance as illustrated in Figure 4.4: 10% of the participants performed 8 steps; 15% of the participants performed 9 steps. 20% of the participants performed 10 and 11 steps irrespectively. 10% of the participants performed 12 steps, 5% of the participants performed 13 steps and 14 steps. 15% of the participants performed 15 steps.

4.3 Post-test results:

The post-test was performed 2 months after the pre-test and within a month after the intervention was conducted. (The same criteria were used in pre – and post-test).

The posttest performance of the participants averaged at 85%.

Calculated as follows:

$$\frac{\text{Number of correct steps in the procedure performed by participants}}{\text{Total number of steps (18 steps/procedure x 20 participants)}}$$

$$(306) \div 360 = 85\%$$

Participant performance after training (post-test):

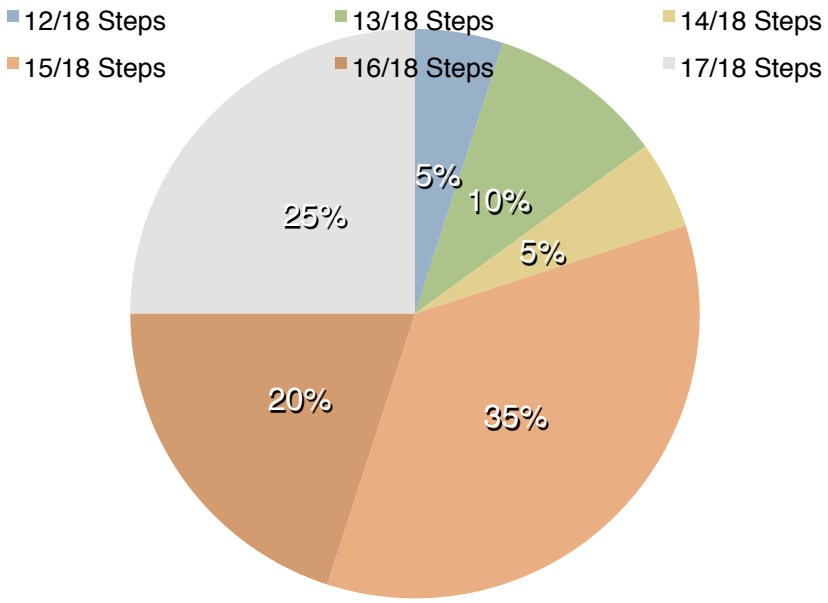


Figure 4.5 Participant Post-Test performances

5% of participants performed 12 steps, 10% of participants performed 13 steps and 5% of participants performed 14 steps. 35% of participants performed 15 steps, 20% of participants performed 16 steps and 25% of participants performed 17 out of the 18 steps, as shown in figure 4.5.

Difference between pre-test and post-test in participant performance of steps:

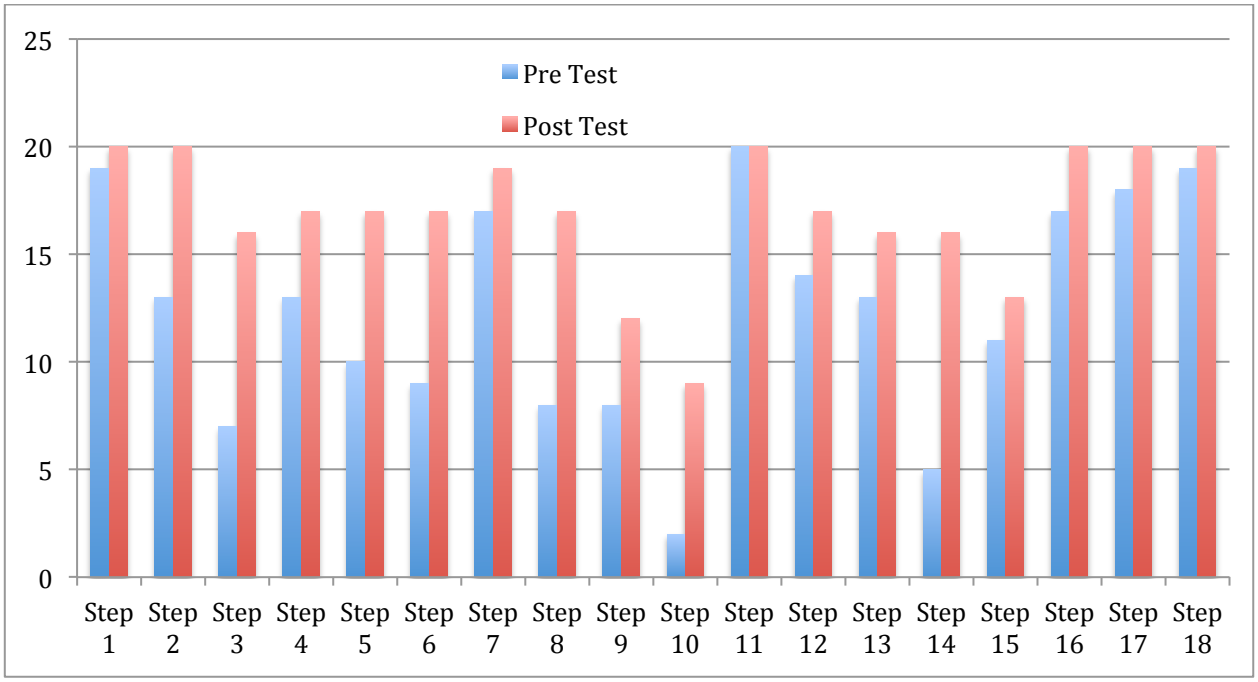


Figure 4.6 Pre-Test / Post-Test Comparison: Steps 1 - 18

The participants' performance improved in all the steps from the pretest to the posttest, as shown in figure 4.6. The most significant improvement in performance was noted in steps linked to ensuring the tourniquet is not too tight; palpation of the vein to determine direction and patency; allow time for the cleaning agent to air dry. However re-palpating the site and anchoring the vein still needs attention.

4.4 Additional information from laboratory:

Information was obtained from the laboratory on the number of samples that were rejected and deemed unsuitable for testing and is shown in figure 4.7.

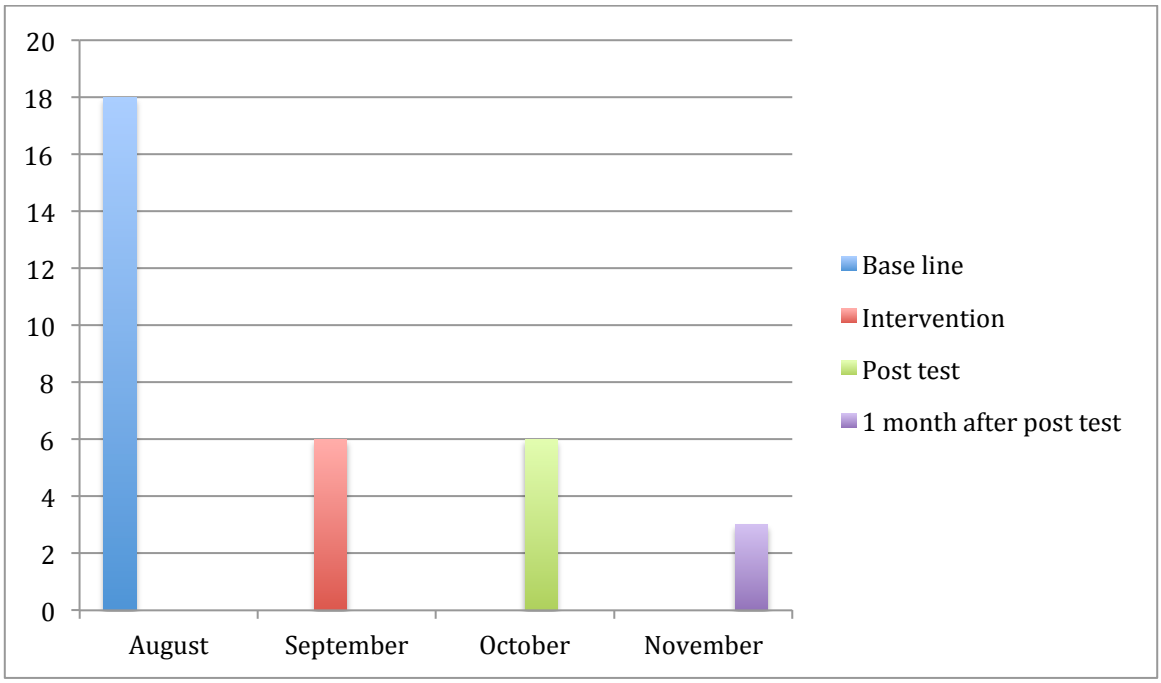


Figure 4.7 Sample Rejection Numbers

Figure 4.7 illustrates that there was a decline in sample rejection numbers from the pre-test, August a total number of 18 samples were rejected. During September the intervention (in-service training) only 6 samples were rejected. The post-test, conducted in October, a total of 6 samples were rejected. Finally in November a month after the study only 3 samples were rejected. Unfortunately the total number of samples collected during this period is not available. However this is still indicative that the training programme had a positive effect on the efficiency of the laboratory testing process. The testing process relies on a quality sample and reasons for rejection is directly linked to sample quality as explained in the background.

4.5 Demographic data:

Participants completed a questionnaire about their training and years of experience their responses are shown below in figures.

Question 1: How many years have you been collecting blood?

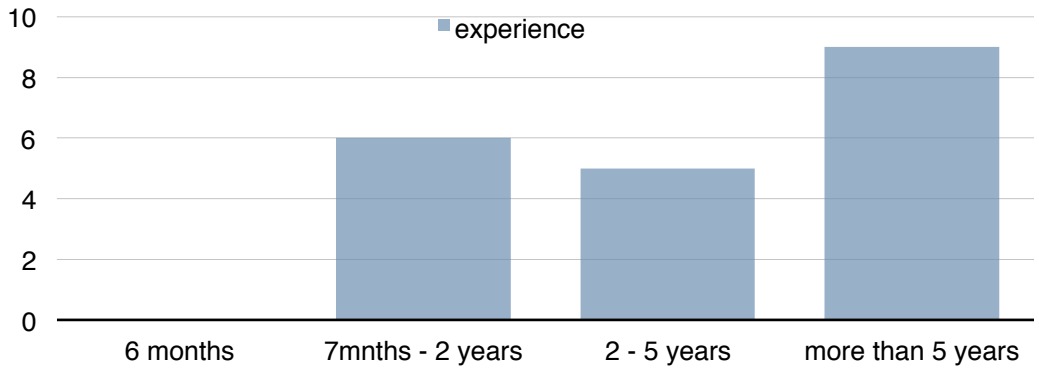


Figure 4.8 Demographic Questionnaire: Question 1

Six of the participants have been stationed at the laboratory between 6 months and 2 years. Five participants have been with the laboratory between 2 and 5 years and the majority (nine participants) have been employed as phlebotomists for longer than 5 years, as indicated in figure 4.8.

Question 2: How were you trained in the phlebotomy procedure?

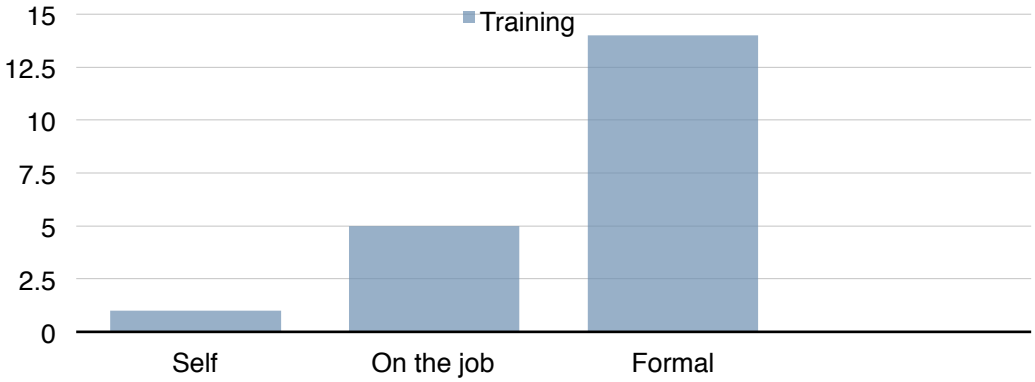


Figure 4.9 Demographic Questionnaire: Question 2

Figure 4.9 indicates that one participant stated she/he had been self-taught in phlebotomy procedures; five indicated that they've been taught "on the job" whilst working whereas the majority of participants, fourteen, had formal phlebotomy training.

Question 3: How long was your training?

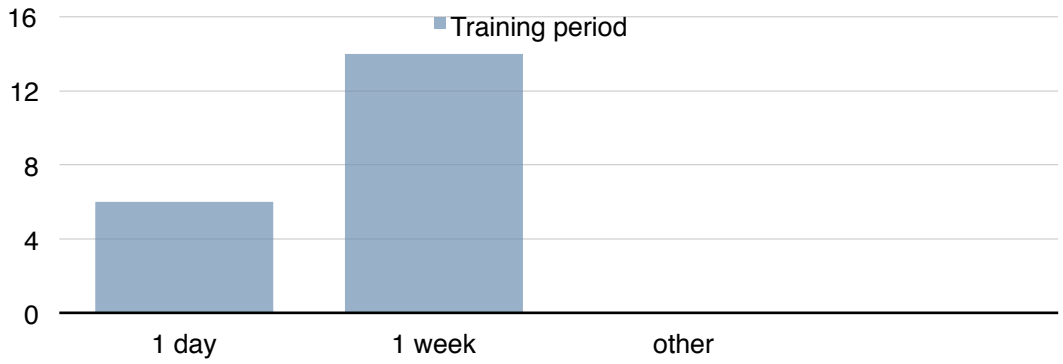


Figure 4.10 Demographic Questionnaire: Question 3

Figure 4.10 illustrates the duration of the phlebotomy-training participants received. Six participants indicated on the questionnaire that their phlebotomy training was only 1 day and fourteen participants indicated that they had training for a week.

Question 4: Are you using the same technique as you were taught?

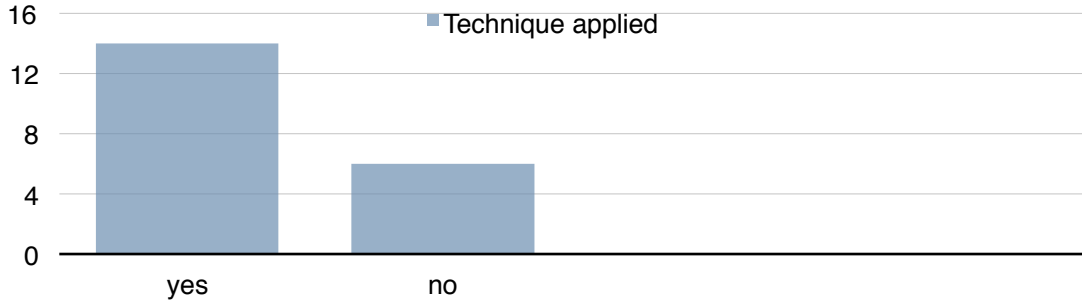


Figure 4.11 Demographic Questionnaire: Question 4

In figure 4.11 fourteen participants indicated that they are still using the same phlebotomy technique they were taught in training.

Question 5: Have you come up with your own technique?

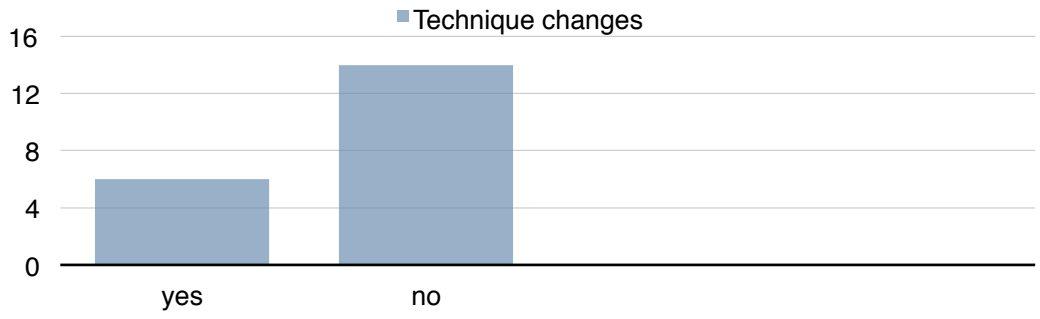


Figure 4.12 Demographic Questionnaire: Question 5

Figure 4.12 shows that most of the participants did not change their technique from what they have been taught. Only six participants came up with their own technique different from what they were taught.

4.6 Discussion of results:

From the demographic data collected in this study a link can be made between years working at the laboratory and the training nurses received. Nurses working for longer than 5 years at the laboratory had mostly received on the job training, merely an introduction on how to draw blood; on the other hand nurses with less than 5 years working experience had attended more formal phlebotomy-training programme that extended over a seven-day period. Again, nurses whom received a more formal training programme indicated that

they are still using the same venepuncture technique they were taught during their phlebotomy training. Nurses who had a less formal introduction to phlebotomy indicated that they have adapted their technique over the years and no longer perform the procedure as they were taught. Due to anonymity, the video recordings could not be linked to a specific questionnaire to correlate the pre-test results with the years' experience of the participants.

However the perceptions of nurses on their own performance and what they perceived to be the correct technique was contradicted with the results obtained from the pre-test. If nurses are still using the same technique as taught the pre-test score would have reflected a much higher compliance score than that of 61.9%.

It was evident from their responses that nurses with less than five years working experience had attended a more structured training programme than those nurses working for more than five years. Underlining this statement is the nurses whom attended a more structured training programme did not change their technique from what they have been taught. The pre-test, with a low mean score of 61.9%, however indicated that in-service training is required at regular intervals. D.J. Ernst (1998) reinforced this notion in his article "Four Indefensible Phlebotomy Errors and How to Prevent Them." He contends that training your phlebotomy personnel is key to preventing mistakes and lawsuits, because ineffective training and evaluation of those performing venepunctures are indefensible in a court of law. Ernst (1998) stated: "In addition to completing a well-organized and implemented orientation program, those who perform phlebotomy should be evaluated regularly for technique." He continues to define 'regularly' as within six months after completing a training programme and annually thereafter.

"Work-based learning has the potential to change practice. For effective work-based learning nurses need to take control of their own learning, receive support to critically reflect on their practice and be empowered to make changes to that practice." (Williams, 2010). The training programme used as the intervention for this study aimed to change practice in the workplace. This was achieved by means of showing a video on the correct venepuncture procedure. A hand out was given to each participant, with implications incorrect technique will have on the test result. (Annexure E). The nurses then had an opportunity to discuss and reflect on their own practices. The practical component consisted of each participant had to draw blood being observed by their peers. Afterwards feedback were given on performance. The post-test results indicate that the programme achieved what it was intended for. With participants performing at least 15 out of the 18-venepuncture procedural steps, they showed that learning took place whilst performing the task in the workplace.

One of the objectives of this study was to determine the level of compliance of nurses working at the laboratory to the standard operating procedure of performing a venepuncture. The pre-test score of 61.9% indicates a deviation from the standard operating procedure on venepuncture and a third of the steps were performed poorly with anchoring the vein before needle insertion as the step least performed, only two participants stabilized the vein before needle insertion.

The post-test results show a different picture. With an average of 85% it is clear that the intervention had a positive influence on the nurses' performance. Although all steps of the procedure show an increase in frequency, there are still areas of concern. Some nurses are

still re-palpating the puncture site after cleaning the area, which might indicate a lack of confidence on the nurses part and the veins are still not anchored before needle entry.

The participants were asked to provide feedback on their learning experience and to comment on what they've learned. All participants but one, said that this experience has changed the way they perform venepunctures. One participant responded: " I did procedure the same way as when I started; nothing changed from the pre-test to the post-test."

The following themes on what the participants gained from the intervention and how they changed their technique from the pre-test to the post-test are summarised in table 4.1.

Table 4.1 Participant feedback

Number of participants with same comment	**Comments**
6	Move tourniquet further away from puncture area
9	More frequent training sessions – it is important to reinforce skills
6	All steps in the venepuncture procedure are important and why it is important
12	To release the tourniquet, within a minute, once blood flow has been established to prevent haemolysis
7	Importance of the correct order of draw and inverting the tubes
5	Do skills practically – not just theory
10	To allow enough time for cleaning agent to air dry
6	Ensure the correct needle size – not too small or too big for vein
5	To stabilize the vein
6	Don't bend the needle
6	Ensure the tourniquet is not too tight and too close
6	Volume of blood in tube – not to under fill the tubes

5	Gained confidence through training
7	More frequent training sessions
8	Do not ask patient to pump their hand but to hold a fist
5	Recording one another and review the video's very helpful
5	Discussing with colleagues the right and wrong technique and how to improve was very useful.

Comparing the outcome of the post-test with the feedback from the participants, it is clear that they identified areas for improvement with regards to their own technique. The participants also expressed the need for more frequent training sessions and the importance of being kept up to date with the latest techniques.

The reason companies invest in staff development in the form of training is to have a return on investment, not only to improve the skill and knowledge of staff, the ultimate goal changing behaviour of staff to increase organisational effectiveness. Change in performance in the workplace indicates that transfer of training has occurred. (Foxon, 1993). Foxon (1993) has identified a few factors that impact on motivation of staff to transfer training into practice, namely the environment, available resources and support from supervisors. Motivation is affected negatively if staff perceives supervisor support as unfavourable and if the training is contradicting the organisational values and goals. Motivation goes beyond the training programme and the effect is determined by the relevance and purpose of training. (Foxon,1993). Govranos and Newton (2014) support this view in their findings that nurses yearned for opportunities to participate in activities that facilitate lifelong learning, and the development of a work culture that support learning with the support of the managers and the organisation that will assist them to fulfil the demand of healthcare systems to deliver safe and effective patient care. Peer-assessment or evaluation can assist

with motivation, it allows the person to reflect on own practices and compare it against that of their colleagues, not only do they learn more about the task or skill but they learn about themselves that can lead to self-actualisation. (Bothma, Brysiewicz, Chipps, Mthembu and Phillips, 2014).

Video recordings provide an element of flexibility when it comes to time constraints and resource availability and for this reason were used as a means of peer and self-evaluation in this study. The recording process and the watching of video material have shown to be an effective tool to demonstrate best practices and stimulate group discussions. (Barrat, 2010). During the pre-test and post-test participants recorded one another and provided an opportunity for them to observe colleagues perform the same task and compare their own performance. The feedback from the participants indicated that some valued this as a learning opportunity to improve their own performance as they observe the interaction with the patients as a complete entity. This is valuable as it shows reflection has taken place and assisted with acquiring practical knowledge and experiential reasoning (Barratt, 2010) internalise information and improve critical thinking.

In-service training aims to develop staff and ensure quality care based on best practices, however effective in-service training is challenging due to the workplace demands staff faces in the workplace. (McCluskey and Lovarini, 2005). The researcher had to consider workplace demands and available resources when developing the in-service training programme for this study. Due to staff shortages that impacts on the time availability to attend training, it was decided to present the department with the material and each participant could go through the material in their own time. As they were recording one another during the pre-test and post-test, they had the opportunity to reflect on their own

performance and compare with their colleagues' performance. A video was shown on the correct procedure and notes were given on the implication on test outcomes if technique variations occur each participant could read in their own time. A group discussion was held post recordings to discuss the best practices that are in line with organisational policies and procedures. (Barratt, 2010). Workshops or classroom based training improve theoretical knowledge but there is no guarantee that transfer will take place and result in behaviour change, (McCluskey and Lovarini, 2005), that is why peer review of performance and video were used as instruction methods during the intervention for this study. Further investigations are needed to determine the frequency and duration of in-service training programmes to establish behaviour that can change practice.

In this study an improvement was seen in the decline of samples rejected from the pre-test to the post-test. However there is currently no reporting system for the reason why samples are rejected within the laboratory quality assurance system that is directly linked to the collection process. When samples are rejected and found to be unsuitable for testing it delays the turnaround time that negatively impacts on patient care. For errors to be reported a culture of disclosure of errors should be established in the workplace to identify and rectify any system or process problems. (Jacobsz, Zemlin, Roos and Erasmus, 2011).

Chapter 5:

Conclusions, Limitations and Recommendations

5.1 Introduction:

This chapter is the concluding chapter of the research report. In this chapter a summary will be presented of the study highlighting the main findings deduced from the results. Limitations of the research will be discussed and finally include recommendations for nursing education, practice and research.

5.2 Summary:

The purpose of this study was to develop an in-service training programme aimed at correcting phlebotomy technique errors, and secondly to evaluate the effectiveness of the training programme. The objectives were to firstly identify the level of compliance of the nursing staff to the standard operating procedure related to the venepuncture. Secondly the objective was to design a training programme focusing on all errors identified and thirdly to test the effectiveness of the programme.

The research methodology chosen for this study proved to be appropriate as the objectives were met by the outcomes.

The first objective was met during the pre-test as non-compliance was established with an average score of 61.9% for the pre-test. The training programme was developed to address all

deviations from the standards and the programme's effectiveness was evaluated during the post-test, which shown to be effective as the post-test mean score was 85%.

5.3 Main findings:

Comparing the findings of this study to that of Ho et al (2002) it can be seen that in their study "Measurement of Variation in Videotaped Outpatient Phlebotomies" there are some similarities. Out of 38 parameters they measured they found non-compliance to 13 of the parameters. The most common areas of noncompliance were improper disinfection, improper drying of site, and re-contamination of puncture site, incorrect needle angle and not inverting specimen containers. In this study even after the intervention noncompliance is found in re-palpation of the site and stabilizing the vein. Lima-Oliveira et al (2012) noted non-compliance in their study with tourniquet application time that is too long and fist clenching.
In all these studies (Ho et al, 2002; Lima-Oliveira et al, 2012) and this study the variations in technique resulting in errors is different, this might be the result of no golden standard that exists currently on training guidelines or the lack of quality control measures on the pre-analytical phase of the testing process.

Feedback from the participants on the process indicated an awareness of the importance of continuous in-service training and evaluation was created, as 9 participants mentioned that training is important to reinforce skill; another 6 said that through the training they understand the steps of the procedure, the importance of each step better.

Reflection on own behaviour and the behaviour of their colleagues were also found to be valuable, according to at least 5 participants.

5.4 Limitations:

This was a pilot study to test the feasibility and usefulness of the intervention. The following limitations were identified:

- Finding literature on nurses performing venepunctures proved difficult to find; research is done on the extra analytical phases of the laboratory process but not much is written on the collection process itself. Furthermore in the South African context no studies are done on the nurses' role in the laboratory.

- Due to policy changes in the laboratory during the study the number of nurses available to participate was limited.

- Difficulty was experienced in gaining cooperation from middle management, i.e. the nursing managers, as they saw participation in the study as a threat to their own competence and leadership; at the beginning of the study managers were reluctant to permit access to the departments.

- The study was conducted at departments of one private laboratory group and is therefore contextual and limits generalisation of results.

- The sample rejection reasons are not included in the quality report of the laboratory and that together with the unavailability of total sample numbers might render findings unreliable.

5.5 Recommendations for nursing education:

Phlebotomy is a skill that is taught to student nurses during their pre-registration programmes. Competency is not always established in all skills demonstrated therefore out of this study it shows that on the job training might be beneficial and can be adapted for other clinical skills programmes. The establishment of a training programme to improve the clinical skills of nurses and also to create an awareness of the importance of lifelong learning will ultimately result in quality nursing care that will be beneficial for the practice, the nurse and the patient.

The findings indicate that workplace learning is beneficial for competence in clinical skills. Peer review for evaluation of competence should also be considered as it enhances the learning experience of participants. Training proved to make a difference but it should not be a once off but should take place on a continuous basis as well as evaluation. Learning should therefore be designed to not only meet the needs of the nurse but also of the work place and patient. (Williams, 2010). If recordings are being considered for teaching and evaluation the purchase of a recording device must be considered as a cost implication.

The results also suggest that knowledge and skill is acquired whilst performing a dedicated task. This can be considered as a possible approach when teaching a nursing process or skill.

5.6 Recommendations for nursing research:

A follow up study might be insightful to determine to what extend the nursing staff that participated in this study retained knowledge and skill.

To perform a longitudinal study to observe new nursing employees and phlebotomy technicians over a period of time to determine to what extend technique variations occur, to determine at

what time interval in-service training should be attended to prevent variation of technique that can impact on quality.

Investigations to determine to what extend the variations in technique impact on the quality of the specimen and ultimately the test results might be insightful to establish the compliance level to procedural instructions. Should it be 100% compliance to all steps or can there be a difference in the weight each step carry when it comes to the influence they have on the test outcome?

5.7 Recommendations for nursing practice:

A survey to be conducted to establish to what extend policies and procedures for nurses in the laboratory can be standardised, will assist in developing a training programme that can be implemented in any laboratory environment.

Peer video recordings of any skill especially patient communication could be valuable in practice as it will develop critical thinking, increase skill and develop a sense of self-actualisation. This can be valuable in pre and post registration scenarios.

Procedures for laboratories should be standardized nationally as the practice of each department writing their own policies has impacted negatively on training and practice.

Though the steps of the procedure are outlined by the WHO guidelines; internal policies that complicated the training programme need to be identified and remedied.

Development of a grading system, that forms part of the quality assurance programme, is needed together with an effective evaluation programme to identify problems with processes and the implementation of steps to rectify these problems.

5.8 Conclusion:

This study was conducted to establish if in-service training could improve the skill of nurses when performing a venepuncture. The reason for improving skill of nurses collecting blood samples is to improve the quality of the sample to ensure accurate results that will assist clinicians to make a diagnosis and propose an appropriate treatment plan.

In conclusion, the results from the pre-test compared to the post-test have improved however 100% compliance to the procedure was not reached. The short training programme given proved to have an effect as seen in the post-test results (85%). The steps in the procedure still not performed might indicate that the participants still lack confidence in their own capabilities to access the vein with the first try. Confidence comes with experience and competence comes with practice. Having a system of regular observation of skill even peer observation can provide the platform to boost confidence, as help is readily available when doing the procedure and competence as valuable feedback are provided at the end of the performance.

Because phlebotomy is becoming a specialized skill it is important to ensure that nurses have the competence and the confidence to perform a venepuncture without hesitation.

The training programme should therefore enhance skill and portray professionalism. This will motivate nurses working in the laboratory to become experts and specialists in their field, committing to life-long learning, caring for their patients by ensuring the best specimen is produced for testing.

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Annexure A.1: Checklist used in Pre- and Post-test

Checklist for assessing Video Recording of the Venepuncture procedure:

Criterion	Yes	No
Positioning patient: **1. Fully extends the patient's arm**		
Applying Tourniquet: **2. 10 – 15 cm above puncture site** **3. ensure tourniquet is not too tight** **4. loosen tourniquet before releasing, length of time tourniquet left on less than 60 sec**		
Selecting suitable vein: **5. Palpate the vein to determine direction and patency** **6. Ask the patient to hold fist (no pumping of hand)**		
Disinfecting the site: **7. Clean site** **8. Allow time for alcohol to air dry**		
Anchoring the vein: **9. Do not re-palpate the puncture site** **10. Anchors firmly by pulling skin downwards towards hand**		
Needle insertion: **11. Angle of insertion less than 20°** **12. Did not bend the needle**		
Filling Collection tubes: **13. loosen tourniquet once blood flow has been established** **14. Wait for vacuum to be exhausted before removing tube** **15. Mixing tube by inverting 4 to 5 times** **16. Fill tubes in correct order**		
Removing of needle: **17. Release tourniquet** **18. Remove needle before applying pressure with cotton swab, Apply direct pressure on venepuncture site.**		

Annexure A.2: [redacted] Laboratory Checklist

PERFORMANCE CHECKLIST: Adult Venous Blood Collection (Conscious Hospital Patient)						
Intern Name:					**Unit standard ID:**	252400
ID No:					**Unit standard Title:**	Collect blood for medical pathology or blood transfusion.
HPCSA No:						
Employee No:						
1st	**Patient:**	**In**	**Out**	Surname & Initials	**Requisition No:**	
2nd	**Patient:**	**In**	**Out**	Surname & Initials	**Requisition No:**	
3rd	**Patient:**	**In**	**Out**	Surname & Initials	**Requisition No:**	
4th	**Patient:**	**In**	**Out**	Surname & Initials	**Requisition No:**	

CRITERIA FOR MASTERY

- Square brackets [ ] indicate compulsory criteria.
- Curly ( ) brackets may have a tick and a cross.
- Where there is a tick and a cross, it may be that the item is irrelevant.
- All square brackets [ ] must be ticked for you to receive credit for this standard.
- Where there is a tick and no comment in the box it means that the item is good and no comment is needed.
- Comments may be given on ticked box to clarify a point or ask you to consider something more.
- This is intended to extend your learning and will not require any further action from you.

Did the Intern?	**Judgement**		
Assessment:	**Assess**	**1st Re**	**2nd Re**
1. Greet the ward staff in a friendly manner.	[O1C1]	[O1C1]	[O1C1]
2. Confirm the request: Patient, room number, test/s.	[ ]	[ ]	[ ]
3. Greet the pt/client in a friendly manner.	[O1C1]	[O1C1]	[O1C1]
4. Introduce her / himself whilst maintaining good eye contact.	[O1C1]	[O1C1]	[O1C1]
5. Introduce the company.	[O1C1]	[O1C1]	[O1C1]
6. Announce the reason for his/her presence.	[O1C1]	[O1C1]	[O1C1]
7. Request the patient to state his/her Surname and initials.	[O1C2]	[O1C2]	[O1C2]
8. Verify details like ID, address, medical aid and phone number/s.	[O1C2]	[O1C2]	[O1C2]
9. Validate comparison of wristband with bed card/file.	[O1C2]	[O1C2]	[O1C2]
10. Address the patient as Mr or Mrs X (Not just sir or Mam)	[O1C1]	[O1C1]	[O1C1]
11. Provide privacy.	[O1C1]	[O1C1]	[O1C1]
12. Enquire if patient/client has adhered to applicable pre-collection constraints.	(O1C5)	(O1C5)	(O1C5)
13. Complete the patient demographics the request form from admission form.	[O1C4]	[O1C4]	[O1C4]

PERFORMANCE CHECKLIST: Adult Venous Blood Collection (Conscious Hospital Patient)			
Did the Intern?	**Judgement**		
Assessment:	**Assess**	**1st Re**	**2nd Re**
Assessment Date:			
14.Determine whether the patient/client ever had blood collected before.	[O1C1]	[O1C1]	[O1C1]
15. Explain the procedure to the patient: - Procedural steps: In detail if required. - Signature purpose: Info correct. Consent. Responsible for payment. - Confidentiality: Just lab staff access. Confidentiality agreement. - Resulting: Only to referring doctor & when available.	[O2C4] [O2C4] [O2C4] [O2C4]	[O2C4] [O2C4] [O2C4] [O2C4]	[O2C4] [O2C4] [O2C4] [O2C4]
16.Obtain the consent signature from the patient.	[O1C3]	[O1C3]	[O1C3]
17.Record applicable clinical information.	[O1C4]	[O1C4]	[O1C4]
18.Wash her/his hands with a suitable antiseptic.	[O3C1]	[O3C1]	[O3C1]
19.Position the patient. / Seek assistance if required.	[O2C4]	[O2C4]	[O2C4]
20.Put gloves on or ask the permission from the patient to select the site without gloves if prefer to palpate without gloves.	[O2C4]	[O2C4]	[O2C4]
21. Select a site: a. Apply tourniquet about 10 cm above the intended site. b. Palpate the vein for: depth, direction & pulse. c. Consider all allowed veins in order of preference. d. Ensure the patient's hand is closed. Request the patient to forms a fist. e. Release the tourniquet within one minute.	[O2C1] [O2C1] [O2C1] [O2C1] [O2C1]	[O2C1] [O2C1] [O2C1] [O2C1] [O2C1]	[O2C1] [O2C1] [O2C1] [O2C1] [O2C1]
22. Select a collection method: - **Syringe & needle**: Specific amount of bloods to be collected or fragile and thin veins. - **Evacuated system**: Available veins easy accessible, healthy and normal tubes required. - **Winged infusion set**: Fragile veins, but more than 20ml blood required. Motivate personal preference. (Oral)	[O2C2]	[O2C2]	[O2C2]
19. Prepare the collection site: (With gloves) Cleanse the site with a circular motion from the centre to the periphery with workplace prescribed cleaning solution and allow to air dry.	[O3C1]	[O3C1]	[O3C1]
23. Place the selected equipment and collection case within easy reach.	[O2C3]	[O2C3]	[O2C3]
24. a. Sharps container b. Biohazard container (must have red plastic bag in it). c. Tourniquet. d. Tubes required for tests requested. e. Receiving bowl / kidney dish. f. Vacutainer holder and needle/ syringe and needle/ butterfly with Lauer. g. Clean dry swabs.	[O2C3]	[O2C3]	[O2C3]

h. Plaster.			

PERFORMANCE CHECKLIST: Adult Venous Blood Collection (Conscious Hospital Patient)			
Did the Intern?	**Judgement**		
Assessment:	**Assess**	**1st Re**	**2nd Re**
25. Collect the specimen/s:			O3C2
a. Show the sealed/ sterile- packed needle to patient.	[O3C2]	[O3C2]	[O3C2]
b. Break the seal and attach the needle firmly to the syringe/ vacutainer holder and inspect with a quick glimpse for quality.	[O3C2]	[O3C2]	[O3C2]
c. Re-apply the tourniquet / Baumanometer pressure if required.	[O3C2]	[O3C2]	[O3C2]
d. Remove the sheath of the needle and discreet check the needle for quality.	[O3C2]	[O3C2]	[O3C2]
e. "Fix" the superficial vein.	(O3C2)	(O3C2)	(O3C2)
f. Request that the patient take a deep breath.	[O3C2]	[O3C2]	[O3C2]
g. Give a warning, like: "I'm going in", 'There we go", "OK then", etc. on entering.	[O3C2]	[O3C2]	[O3C2]
h. Puncture the skin with a clean, smooth motion.	[O3C2]	[O3C2]	[O3C2]
i. Puncture the skin with the needle bevel up.	[O3C2]	[O3C2]	[O3C2]
j. Puncture the skin at the required angel to prevent vein damage.	[O3C2]	[O3C2]	[O3C2]
k. Keep the syringe/ butterfly/ vacutainer holder steady.	[O3C2]	[O3C2]	[O3C2]
l. Carefully use equipment to prevent any injury.	[O3C2]	[O3C2]	[O3C2]
m. Slowly pull back on the plunger with syringe collection.	(O3C2)	(O3C2)	(O3C2)
n. Attach the required equipment to the butterfly to allow for collection.	(O3C2)	(O3C2)	(O3C2)
o. Insert the blood collection tube into the holder with vacutainer collection.	(O3C2)	(O3C2)	(O3C2)
p. Loosen the tourniquet when blood begins to flow.	[O3C2]	[O3C2]	[O3C2]
q. Advise the patient to open their fist or maintain a fist.	[O3C2]	[O3C2]	[O3C2]
r. Observe the flow of bloods & the puncture site at all times.	[O3C2]	[O3C2]	[O3C2]
s. Inform the patient of the progress and ensure them everything is going well.	[O3C2]	[O3C2]	[O3C2]
t. Observe pt/client throughout procedure to ensure they are okay.	[O3C5]	[O3C5]	[O3C5]
u. Fill the containers with the required volume of blood.	[O3C3]	[O3C3]	[O3C3]
v. Fill the tubes in required order of draw.	[O3C3]	[O3C3]	[O3C3]
w. Remove the needle carefully and place a clean dry swab on the site.	[O3C2]	[O3C2]	[O3C2]
x. Discard the needle directly into the sharps container.	[O4C1]	[O4C1]	[O4C1]
y. Gently mix the tubes (Tilting a few times) as they are filled.	[O3C3]	[O3C3]	[O3C3]
z. Release the tourniquet at least every one-minute.	[O3C2]	[O3C2]	[O3C2]

aa. Transfer the bloods to the tubes in the rack or side of suitcase with syringe collection	(O3C2)	(O3C2)	(O3C2)
ab. Take corrective action if blood flow is inadequate or fail to flow.	(O3C2)	(O3C2)	(O3C2)
26.Remove the tourniquet completely.	[O3C2]	[O3C2]	[O3C2]
27. Apply firm pressure to the site with clean swab until bleeding has stopped.	[O3C4]	[O3C4]	[O3C4]
28. Determine allergy before applying an adhesive plaster to the venepuncture.	[O3C2]	[O3C2]	[O3C2]
29.Advise the patient to apply pressure and leave the plaster on for at least 15min.	[O3C2]	[O3C2]	[O3C2]
30.Advise the patient that the procedure is completed, and they only need to verify their details on the tubes.	[O3C2]	[O3C2]	[O3C2]
31.Request the pt/client to complete the Service Evaluation form.	[ ]	[ ]	[ ]
32.Discard gloves into biohazard waste container.	[O4C1]	[O4C1]	[O4C1]
33.Write the Surname & Initials on all the specimen containers.	[O3C7]	[O3C7]	[O3C7]
34.Add any other required details on the containers as per workplace protocol.	(O3C7)	(O3C7)	(O3C7)
35.Allow the client/ patient to verify the above information.	[O3C7]	[O3C7]	[O3C7]
36. Seal containers in specimen bag and place requisition number in outside pouch before putting it in the collection suitcase.	[ ]	[ ]	[ ]
37. Remind the patient of the resulting protocol.	[O1C1]	[O1C1]	[O1C1]
38.Make the patient comfortable and tidy the bed.	[O3C1]	[O3C1]	[O3C1]
39.Thank the patient for their co-operation.	[O1C1]	[O1C1]	[O1C1]
40.Greet the patient with an appropriate greeting.	[O1C1]	[O1C1]	[O1C1]
41.Greet the ward staff friendly on his/her way out.	( )	( )	( )
42.Fill in all the requisition form information that must be completed by the nursing sister or phlebotomist.	[O4C2]	[O4C2]	[O4C2]
43.Prepare the specimen/s for transit to processing facilities or storage according to the prescribed protocol.	[O4C3]	[O4C3]	[O4C3]
44.Complete documentation according to the Workplace protocol.	[O4C2]	[O4C2]	[O4C2]
45.Communicate confident, professionally and effectively with the patient.	[O1C1]	[O1C1]	[O1C1]
46.Provide the service confidently and promptly to demonstrate competence.	[ ]	[ ]	[ ]

Comment 1st Assessment:			
Competent:		**Not yet competent:**	
Assessment date:		**Assessed by:**	
Moderation date:		**Moderated by:**	
Comment 1st Re- Assessment:			
Competent:		**Not yet competent:**	
Assessment date:		**Assessed by:**	
Moderation date:		**Moderated by:**	

Annexure **A.3: Checklist used in trial run**

Checklist for assessing Video Recording of the Venepuncture procedure:

Criterion	Yes performed	No (Not performed)
1. Positioning patient • **Fully extends the patient's arm** • **Look at both arms for suitable site**		

2. Applying Tourniquet
• **Applies tourniquet correctly**
  ○ **10 – 15 cm above puncture site**
  ○ **ensure tourniquet is not too tight**
  ○ **loosen tourniquet before releasing**
  ○ **length of time tourniquet left on less than 60 sec**		

3. Selecting suitable vein:
• **Tells patient to make a fist**
• **Palpate the vein to determine direction and patency**
• **Choice of vein:**
  ○ **One that they can feel**
  ○ **Median Cubital or**
  ○ **Cephalic or**
  ○ **Basilic**		

4. Disinfecting the site: • **Cleaning site with webcol in a circular motion** • **Allow time for alcohol to air dry** • **Do not dry area with cotton swab / gauze**		
5. Anchoring the vein: • **Anchors firmly by pulling skin downwards towards hand** • **No pumping of the hand (patient)**		
6. Needle insertion: • **Warns patient before entering skin** • **Angle of insertion less than 20˚** • **Bevel of needle facing upwards** • **Quick thrust**		
7. Filling Collection tubes: • **loosen tourniquet once blood flow has been established** • **Ask patient to relax hand** • **Wait for vacuum to be exhausted before removing tube** • **Support needle when changing tubes** • **Mixing tube by inverting 4 to 5 times** • **Fill tubes in correct order**		
8. Removing of needle: • **Release tourniquet** • **Remove needle before applying pressure with cotton swab** • **Apply direct pressure on venepuncture site.**		

Annexure B: Demographic Questionnaire

Nursing Demographic Questionnaire:

Question	Answer
1. How many years have you been collecting blood by means of a venepuncture?	≤ 6 months ☐ 7 months – 2 years ☐ 2 years – 5 years ☐ ≥ 5 years ☐
2. Where were you trained in phlebotomy procedures?	Self ☐ On the job training ☐ Formal training ☐
3. How long was your training for a venepuncture procedure?	1 day ☐ 1 week ☐ Other State: _____ _____
4. Are you using the exact same technique your first trainer taught you	Yes ☐ No ☐
5. Have you come up with your own technique?	Yes ☐ No ☐

Annexure C.1: Nurse Participant information letter and consent form

Letter to Nursing staff:

Dear Colleague

My name is Lizelle Crous and I am an MSc student at the University of the Witwatersrand. You are invited to take part in a research study that I will be conducting at your workplace. This is a consent form for research participation and contains important information about the study and what to expect if you decide to participate. Please read the information carefully and you are most welcome to ask questions at any time.

The purpose of the study is to identify pre analytical errors during the venepuncture procedure; this information will be used to improve the current phlebotomy training programme in use. The risks are minimal as the procedure is part of your daily duties.

The study will be conducted by means of video recordings of the procedure and these recordings will be assessed by external evaluators to identify the pre analytical errors. A training programme will be designed to address these specific errors and the implication of them on the outcome of test results. Once you have attended the in service training, video recordings of the procedure will be done again (post-test) to see if the training programme is effective in eliminating procedural errors. You will also be asked to complete a questionnaire to establish your phlebotomy training history.

There will be no direct benefit to you for your participation in this study, and the study will not influence your current employment status, however I hope the information obtained from the study will be useful to streamline the training programme for phlebotomy and improve the quality of samples.

You can be assured that you won't be identifiable on the recordings as it will only capture the Ante Cubital fossa area of the patient. All information will be kept confidential as it is not possible to link the recording to a specific person.

It is your choice to participate in the study or not. If you do take part in the study, you will be asked to sign the consent form and a copy will be given to you. You are under no obligation to stay in the study once you signed, you may withdraw at any time without giving any reason.

Thank you.



Lizelle Crous

082 319 5462

Consent:

	Initial
I have read this information and am aware that I am being asked to participate in a research study.	
I confirm that I had the opportunity to ask questions and they were answered to my satisfaction.	
I understand that my participation is voluntary and that I may withdraw at any time, without giving any reason.	
I agree to take part in this study.	
I understand I will be asked questions about my phlebotomy training and competence.	

Signature: _____ Date: _____

Consent to be recorded on video:

I agree to being videotaped for the purpose of evaluating my phlebotomy technique. I understand that I will not be identifiable on the recordings and that being recorded will not have any effect on my employment status. I am aware that I may withdraw this consent at any time without penalty, at which point, the videotape will be erased.

Signature: _____

Date: _____

Name of person obtaining consent: _____

Signature: _____

Date: _____

Annexure C.2: Patient information letter and consent form

Letter to Subjects: Patients

Dear Sir/Madam

My name is Lizelle Crous and I am an MSc student at the University of the Witwatersrand. You are invited to take part in a research study that I will be conducting in the laboratory.

The purpose if this study is to identify areas where the phlebotomy technique can be improved to ensure better quality samples. The study will be conducted by means of video recordings of the procedure.

There will be no direct benefit to you for your participation as the sample will be processed as usual with no additional cost. The researcher is not liable to cover any costs that you as the patient incur for having the tests done.

You can be assured that you won't be identifiable on any recording as it will only reflect the site where the procedure will be performed. Information obtained from the study will be kept confidential.

If you decide to take part in the study, please sign the consent form. By signing this form, you do not give up any legal rights. Once signed you are under no obligation to proceed participate in the study and may withdraw at any time without reason.

Kind Regards

Lizelle Crous

0823195642

Consent:

By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask questions. I understand my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without additional cost. I am aware that I am still responsible for settling the laboratory account for performing the requested tests. I am aware that the outcome of the study will not influence my test results in any way. I voluntarily agree to take part in this study.

Signature: _____

Date: _____

Consent to be videotaped:

As a subject in this study, I agree to being videotaped for the purpose of enabling the researcher to record the phlebotomist's technique. I am aware that I may withdraw this consent at any time without penalty, at which point, the videotape will be erased.

Signature: _____

Date: _____

Person obtaining consent:

Name: _____

Signature: _____

Date: _____

Annexure D.1: Permission letter to CEO of private laboratory and the response from CEO

Letter to Management:

To Whom It May Concern:

My name is Lizelle Crous and I am an MSc student at the University of the Witwatersrand. I want to conduct a research study at some departments of the laboratory in the Gauteng South West region.

The identified departments are: Nursing staff working at the following Netcare facilities: Sunninghill, Olivedale, Krugersdorp, Milpark and Garden City.

The purpose of the study is to identify the pre analytical errors that occur during the venepuncture procedure; design training programme that address' these errors to improve the quality of technique and ultimately ensure quality of the sample.

The data will be collected by means of video recordings of the venepuncture procedure and will be analysed by phlebotomy experts to identify the errors that is most prevalent. The recordings will be made during working hours and it will not affect the daily routine of the department.

The study will be beneficial to the company as it will improve the test result outcome if we are able to correct the errors made during the venepuncture procedure.

Confidentiality and anonymity: The nursing staff or the patients won't be identifiable on the recordings as it will only reflect the Ante Cubital fossa area of the patient. Information obtained from the study will be kept confidential.

Voluntary Participation: Participation will be voluntary. Patients and staff members can withdraw at any time and are under no obligation to participate. There will also be no costs involved for the participants or the laboratory.

Once permission has been granted a proposal will be submitted to the University of the Witwatersrand ethics committee for approval.

I would appreciate your permission to go ahead with the study.

Thank you.

Yours Sincerely

Lizelle Crous

082 319 5642

lizellecrous@tiscali.co.za

Lizelle Crous

From: Ruhan Robbertze
Sent: 13 November 2012 02:54 PM
To: Lizelle Crous
Cc: Thea Cronje; Dr. Jana van Niekerk
Subject: research proposal

Dear Lizelle,

Good news – your research proposal has been approved by Dr Van Rooyen.

Kind Regards

[redacted]
robbertze@ampath.co.za
www.ampath.co.za

Annexure D.2: HREC ethical clearance certificate

R14/49 Ms Lizelle Crous

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130466

NAME: (Principal Investigator)	Ms Lizelle Crous
DEPARTMENT:	Department of Nursing Education CM Johannesburg Academic Hospital
PROJECT TITLE:	In-Service Training to improve Phlebotomy Technique
DATE CONSIDERED:	26/04/2013
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Kay Stewart
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 05/06/2013

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.**

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Annexure E: Training programme

- **Venepuncture**
- **Critical points that affects results**
- **Tourniquet application**
- **Has to be place at least 10 – 15 cm above the puncture site and has to be released with in 1 minute – if not it will cause:**
    - **Haemoconcentration (accumulating of red blood cells in one area that will lead to higher analyte results)**
    - **Stasis – that will result in Haemolysis (braking of red blood cells) that will result in a re-bleed.**
    - **Point to remember:**
    - **too tight too long: Haemolysis**
    - **too close too long: Haemoconcentration**
- **Cleaning site**
- **Puncture site must be cleansed with alcohol to prevent bacteria to enter the blood stream that can cause bloodstream infections.**
- **The alcohol must be allowed to air dry – no cleaning effect when wet.**
- **Alcohol can enter the blood stream if not allowed to air dry that will result in erroneous results and ultimately a re-bleed.**
- **Point to remember:**
    - **Clean and wait to air dry.**
- **Choice of equipment:**
- **Needle size – very important as it can cause haemolysis and pain for the patient during the draw.**
- **Always use the biggest needle suitable for patient**
    - **Only sizes allowed for venepuncture: 23G – 21G (Blue, black and green0**
- **Points to remember:**
    - **Too small needle (haemolysis)**
    - **Can also cause haematoma as blood can seep out of vein between vein and needle**

- **Angle of needle entry**
- **Angle of needle entry very important as it may result in haematoma formation.**
- **Appropriate angle of entry for venepuncture is between 15º and 20º**
- **If too steep (≥ 20º) will result in going through the vein resulting in a haematoma forming at the back of the arm**
- **If too shallow (≤ 15º) will result in a slow draw and will result in haemolysis**
- **Stabilizing the vein**
- **Failure to stabilize the vein will result in missing the vein and can cause pain and haematoma formation**
- **How to stabilize:**
    - **Ask patient to make a fist (no pumping as that influence electrolyte results)**
    - **Pull the skin down towards the hand**
- **Order of draw**
- **Due to reflux (blood going back through the needle into the vein) and presence of preservatives (in the tubes) a specific order should be followed.**
    - **Blood culture preservatives don't affect the one below**
    - **Citrate**
    - **Serum tubes Preservative affect the one above**
    - **Heparin**
    - **EDTA**
    - **Fluoride**
- **Tubes**
- **Points to remember:**
    - **Tubes must be filled with required amount of blood – under filling will result in wrong test results**
    - **Mixed – invert 4 – 6 times at least to mix preservative with blood to ensure blood to preservative ratio is not affected.**