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Clinical Practice Guideline on Evaluating the Effectiveness of Venipuncture Arm Simulation

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2024

Abstract

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MS, Walden University, 2017

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Project Submitted in Partial Fulfillment

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Abstract

Venipuncture is an integral process in clinical care, and it has an indispensable role in diagnostics and determining therapeutic interventions. The process of phlebotomy has faced several challenges that have compromised patients' safety. The risk of incorrect venipuncture, or preanalytical errors, leading to severe patient complications of hematoma and thrombosis calls for training using current, evidence-based practices. The goal of this project was to develop a clinical practice guideline (CPG) to determine the efficacy of venipuncture simulation training using an arm task trainer to enhance the phlebotomy skills of nurses. Based on the outcome, present, state, test model and Nightingale's theory of nursing, in this project a CPG was developed that focused on enhancing venipuncture simulation and improving the practice in nursing to reduce analytical errors. A team of multidisciplinary experts reviewed the CPG using the Appraisal of Guidelines for Research and Evaluation Evaluative II tool. The findings, based on the tool's six domains, showed the phlebotomy content experts' evaluations of the CPG's scope and purpose, stakeholder involvement, rigor of development, and clarity. The results indicated that the CPG generally had room for improvement, with growth opportunities regarding information on the rigor of development, the clarity of presentation, applicability, and editorial independence. The quality domain scores ranged between 31% to 64% with a mean domain score of 52.1%. The CPG was rated as needing some refinement, with 100% of the expert panelists recommending use of the guideline with modification. Application of the evidence-based practice of using the CPG has the potential to improve patient outcomes, which is a positive social change.

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Dedication

This project is dedicated to God, my mother, my husband, and my supportive professor.

Acknowledgments

I wish to acknowledge the invaluable contributions of my professor and the faculty members who gave me proper guidance from the beginning to the end of this project. I also acknowledge the participants in the study for dedicating their time to enable me to achieve the intended objectives of the project. Finally, I am grateful to my husband who ensured that I had the time to facilitate the successful completion of the project.

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Section 1: Nature of the Project

Introduction

In modern-day health care, phlebotomy is a significant clinical activity used in diagnostic and therapeutic decision making. It is the most critical aspect of blood collection from a patient (Arslan et al., 2024); hence, the basis of knowing the patient's health and the clinical entity that follows in its place. Phlebotomy is a special skill requiring a detailed process when implementing that can be a challenge for nurses. If the nurse has less than satisfactory technique, it could lead to adverse events, such as hematoma and embolism, among other complications, and should be the basis for regular skill development (Kimori et al., 2018).

Different organizations continue to report challenges and numerous errors made during phlebotomy, especially due to lack of adequate and effective venipuncture simulation training (Sun et al., 2023). Addisu et al. (2023) reported common errors during phlebotomy that included (26.2%) prolonged tourniquet application, (22.9%) improper identification, (62.8%) inadequate cleaning of venipuncture site, and (6.6%) unsafe needle removal. In an observational study, Aggarwal et al. (2022) found many underfilled blood vials and contaminated blood vials. The high prevalence of errors highlights the inadequacies of existing interventions, including gaps in effective training using current venipuncture arm simulation, which necessitates proper simulation practice protocol.

Health care institutions are progressively using new training approaches. Task trainers, such as venipuncture arm simulation, are used to address the demand for enhancing nurses' phlebotomy competencies (Koukourikos et al., 2021). However, the

effectiveness of venipuncture task trainers has yet to be explored in its entirety by health care organizations (Hassanein et al., 2021; Kodikara et al., 2023).

In this project, I planned to create a clinical practice guideline (CPG), informed by the outcome, present, test (OPT) nursing model (see Pesut & Herman, 1998), to address the identified knowledge and practice-performance gap. The CPG was developed to bridge this gap by providing evidence-based practice recommendations for evaluating the effectiveness of venipuncture arm simulation training aimed at increasing nurses' knowledge and improving their competencies to reduce preanalytical errors. Using the Appraisal of Guidelines for Research and Evaluation Evaluative (AGREE II) framework, I identified a significant opportunity for practice development among nurses that could result in positive social change through reduced patient adversities related to phlebotomy and making an overall contribution to improving standard in clinical care.

Problem Statement

Phlebotomy is among the most severe clinical care challenges impacting nursing practice. Because the procedure requires blood extraction, it implies the necessity of phlebotomists having both technical skills and adequate knowledge of human anatomy; therefore, a competent professional understands the significance of communication with a patient and the precautions to be taken to prevent the development of hematoma, infection, or nerve damage (Strasinger & Di Lorenzo, 2019). Although protocols exist that determine how the procedure should be performed, several discrepancies in phlebotomy practice can lead to numerous preanalytical errors. These discrepancies jeopardize clinical competency and patient safety, with Addisu et al. (2022) and

Aggarwal et al. (2023) recommending that this prevailing problem calls for educational procedural interventions.

The identified local nursing practice problem was rooted in current phlebotomy training and practice limitations. The issue's magnitude was supported by a vast body of evidence indicating the high impact rates on patient care and laboratory outcomes associated with phlebotomy-related errors (Dey et al., 2023; Unnithan et al., 2023). Some of the most common errors involve incorrect patient identification, handling of samples, and improper blood drawing (Alcantara, 2024; Leonard et al., 2020), all of which jeopardize patient safety and compromise diagnostic accuracy. According to Alavi et al. (2020), lab error rates, most of which are linked to the preanalytical phase, amount to 1%–3%, showing a need to improve the quality and efficiency of phlebotomy training methods. Common errors included missing patient identification, missing samples, and mislabeled containers. Moreover, Alavi et al. argued that although blood sampling and standardization standards exist, clinicians need better compliance, primarily where sampling occurs. Given this information, there is staunch support in the literature that the existing interventions might be ineffective in improving nurses' competence in phlebotomy. This conclusion was attributed to factors, including the lack of clear and adequate guidelines or standards, which was the focus of this CPG.

Evidence-based training is often provided to nurses to address proper techniques and procedures to reduce the rate of preanalytical errors as part of a quality improvement initiative at health care organizations (Abu-Baker et al., 2021). In many health care facilities, simulation training is intended to increase nurse competency in phlebotomy; however, research has revealed that health care organizations experience errors during the

venipuncture and phlebotomy processes (Addisu et al., 2022; Aggarwal et al., 2023; Alavi et al., 2020). If this trend continues, poor patient outcomes and harm due to errors can result in a loss of trust and reputation of the health facility and health care professionals.

The doctoral project holds a great significance for the field of nursing practice by virtue of fostering standardized, evidence-based training techniques, bolstering innovation and continuous improvement in simulation technology, and improving patient safety and skill proficiency among nurses. The projects implications are substantial, benefiting overall health care quality, clinical practice, and nursing education.

Purpose Statement

I conducted this project to establish an evidence-based and theory-supported CPG to enhance nurses' phlebotomy skills. The overall objective was to improve the quality of care delivered by improving venipuncture arm simulation effectiveness. The CPG was primarily developed to show staff how to use simulation to enhance competence and support quality of care by using standardized processes to promote safety and effectiveness. The foundation of this project rested in the following practice-oriented question: Does evidence and theory support the establishment of an evidence-based practice CPG for evaluating the efficacy of using a venipuncture arm simulation training for phlebotomy?

This effort was justified with a view of reported phlebotomy errors identified in recent studies and their implications on patient care (see Addisu et al., 2023; Aggarwal et al., 2022). In the project, I provide an overview of the appropriateness of simulation-based training, focusing on venipuncture arm simulation, with the objective of providing

practical findings that can help set the foundation for a considerable improvement in nurse training and a guideline for implementation of a phlebotomy skills training among nurses. In the CPG, I outlined standardized processes and protocols designed to evaluate the training aimed at boosting the efficiency of nurse-performed phlebotomy to reduce or eliminate preanalytical errors, significantly improving patient safety and quality of care.

Therefore, I intended the CPG to reduce inconsistencies in clinical settings to improve the quality of clinical training and lead to better patient care. By promoting a better understanding and usage of effective venipuncture techniques, the intervention reduced phlebotomy-related complications, enhanced patient outcomes, and ensured a higher quality of diagnostics in every health care setting. As a result, the expected deliverable was the creation of a more comprehensive and evidence-based framework for phlebotomy training, allowing nursing professionals to achieve high levels of clinical competency and operational enhancements.

Nature of the Doctoral Project

This evidence-based project entailed creating a CPG to facilitate enhanced phlebotomy. To achieve this, I conducted a thorough review of the existing information sources to better understand the most current knowledge and information on the project's topic. Studies were retrieved and selected from various databases accessible through the Walden University Library, such as PubMed and CINAHL, based on strict criteria; in particular, the studies had to be published less than 10 years ago. Additionally, only the following themes of previous studies were explored: venipuncture arm simulation efficacy, phlebotomy by nurses' performance, and preanalytical error prevalence. As such, the organization and analysis of the gathered evidence encompassed thematic

synthesis, where I classified findings from the identified literature according to themes relevant to the project topic and the practice-oriented question. The analysis was guided by tools, including the AGREE II tool, per Bargeri et al. (2021) who showed that the tool enabled the assessment of CPGs developed from evidence. An expert panel that included experienced clinical professionals in phlebotomy reviewed the CPG in the current project based on the AGREE II instrument to ensure the identified CPG met high standards of clarity, applicability, and relevance to clinical nursing.

I conducted this project with the expectation that I would formulate, evaluate, and refine a CPG that addressed the practice gap by focusing on using venipuncture arm simulation to improve phlebotomy training. The analysis of the current evidence generated practical recommendations that served as intervention measures to significantly improve nurses' proficiency and confidence in phlebotomy procedures. The findings from this evidence-based analysis contributed high-quality knowledge to the nursing education and practice field by allowing me to present validated guidelines that reduced nurses' preanalytical errors, improved patient outcomes, and enhanced the quality of services across health care settings.

Significance

The implications of this quality improvement project extended far beyond the current clinical setting. A wide variety of stakeholders are affected by improvements in phlebotomy practice. Direct patients are the most impacted by enhanced safety and a reduction in the frequency of complications associated with venipuncture, reduced hematomas, and infections, which Aykal et al. (2020) and Flockenhaus (2021) identified as two of the significant risks and challenges of venipuncture. Nursing professionals are

another stakeholder group, and their abilities and confidence in performing these procedures are critical facets of patient quality of care and safety because they are the frontline venipuncture staff.

The project contributed to enhancing nursing practice by introducing a structured methodology for evaluating existing training methods and their opportunities for improvement in the case of venipuncture. This led to standardized and evidence-based guidelines for educational interventions to improve nurse competence in phlebotomy. A CPG grounded in a comprehensive review approach utilizing the AGREE II framework allowed the summarizing of available knowledge and formulation of specific recommendations on how phlebotomy training could be improved. This change was essential to bridge the gap identified between the current training approach and the level of competency most needed in nursing practice.

The project underscored the American Association of Colleges of Nursing's *Essentials of Doctoral Education for Advanced Nursing Practice*, specifically Essentials I, II, III, and VI. Essential I focuses on the scientific underpinnings of practice, which prepares the nurse with a doctor of nursing practice (DNP) to utilize multidisciplinary theories and concepts to create and assess new nursing practices (Giddens et al., 2022). Essential II addresses organizational and system leadership for quality improvement, thus preparing the DNP student to lead organizational initiatives that improve patient safety and quality of care (Giddens et al., 2022). Essential III prepares DNP students to analyze current literature critically, leading to the development, implementation, and evaluation of quality improvement initiatives, while Essential VI prepares DNP students for the role of leading interprofessional teams during scholarly activities (Giddens et al., 2022).

Furthermore, this project contributes to positive social change by improving phlebotomy and other health goals by increasing patient satisfaction, lowering the cost of health care, and improving overall trust in the health care system.

Summary

Venipuncture arm simulation is among the common interventions to improve nurses' competence in phlebotomy (Hassanein & Deif, 2020). Studies have demonstrated that quality of care and patient safety are compromised due to errors and mistakes during phlebotomy (Rana et al., 2024); therefore, standardizing this education process can reduce and prevent errors, resulting in improved patient outcomes. In Section 1, I addressed the existing issues and gaps within phlebotomy practices, particularly the inadequate efficacy of venipuncture arm simulation during nursing training. This part of the project provided the background for further exploration of opportunities to implement evidence-based practice solutions to fill the existing gap. Section 1 was also focused on the project's significance to patients and health care professionals as well as its possible implications for nursing practice. In Section 2, I will discuss how the problem under study was identified and framed with a focus on the specific methodology and analytical techniques used in the project.

Section 2: Background and Context

Introduction

Proficiency in phlebotomy is a fundamental clinical skill necessary for diagnostic purposes and therapeutic interventions that remains a challenge in the operating standards of contemporary health care settings, as indicated by the specific errors performed and the differences in the competencies of nursing professionals (Kimori et al., 2018; Serra et al., 2018). Increased phlebotomy errors are both a state and national burden in the United States (De la Salle, 2019). This concern, combined with the significance of phlebotomy to patient care, called for the evidence-based training and practice approach taken in the current project. The focus of the local nursing practice problem under study was the current inadequacies of phlebotomy training, with a particular emphasis on using venipuncture arm simulations to improve nurses' phlebotomy competency levels. I conducted this DNP project to develop a CPG to assess the effectiveness of venipuncture arm simulation in enhancing nurses' phlebotomy competence to improve quality during phlebotomy practices (see Aggarwal et al., 2022).

In this section, I provide a detailed overview of the identified problem, including the present state of phlebotomy practices; the theoretical frameworks and scientific foundation of the project; and the project's significance to nursing practice. The section also includes discussions of the factors of the identified problem's local nature as well as my respective role and responsibilities as the DNP student and the roles and responsibilities of the project team. In this section, I provide an extensive description of the context in which this DNP project was placed to ensure that the reader develops a well-rounded knowledge of the practice problem and its significance. This background

informed the subsequent discussions regarding the methodological approaches, evidence synthesis, and CPG development to enhance the efficacy of venipuncture arm simulations in nursing education and the practice setting.

Concepts, Models, and Theories

Grounded within proven nursing theories and contemporary educational models, I intended this DNP project to address the complexities of phlebotomy training. Overall, the interdisciplinary approach taken in this project was rooted in traditional, basic nursing philosophies and supported by innovative pedagogical tools to examine the challenges holistically.

Conceptual Framework

This DNP project's conceptual framework was based on both the environmental theory proposed by Florence Nightingale and the OTP model. Nightingale's groundbreaking theory focused on the central function of the environment in rehabilitating patients and their wellness (de Souza et al., 2022). In the theory, Nightingale emphasized that nurses must use their brains, hearts, and hands to create healing environments to care for the patient's body, mind, and spirit (Riegel et al., 2021). The theory implies that the patient's well-being needs to be prioritized in nursing practice. When referring to phlebotomy, which is a prerequisite for a healthy and prosperous blood draw, phlebotomists must be in a reasonably appropriate, structured, and secure setting to minimize the possibility of preanalytical errors and improve patient outcomes (Peres et al., 2021).

Concurrently, for clinical reasoning and decision-making processes, the OPT model provides a structural guideline for analysis and intervention to bridge gaps

between the current and ideal nursing practice (Seo & Eom, 2021). In the case of the current project, the model underpinned the structured exploration of venipuncture arm simulations as an effective intervention, supported the assessment of current competencies, targeted meaningful categories and scope for improvements, and allowed for testing of the effects of education.

Integration of Concepts, Models, and Theories

I integrated the OPT model with Nightingale's environmental theory to form a solid theoretical foundation to close the identified gaps in phlebotomy training. In this project, the environmental factors that affect phlebotomy outcomes were combined with a targeted, evidence-based educational intervention to develop a guideline to enhance the effectiveness of venipuncture arm simulations among nursing students. The theoretical convergence enabled me to take a comprehensive approach where the advancements in training methodologies are efficient in improving the technical capacity of nurses and consistent with the broader principles of patient safety and care. The theoretical framework placed me at the junction between historical nursing wisdom and the contemporary pragmatic cycles, which made it possible to develop evidence-informed strategies and, at the same time, honor the basis of nursing.

Operational Definitions

Within this DNP project, I operationalized the following terms for better reader clarity (see Table 1 for definitions of several types of preanalytical errors):

Phlebotomy competence: All needed skills, knowledge, and attitudes to successfully but safely complete a venipuncture procedure. The procedure "success" is

measured by specific, accurate error rates in several attempts and simulation performance (William et al., 2016).

Preanalytical errors: Medical errors defined as occurring before the actual analysis phase in laboratory testing (Sepetiene et al., 2021). They include a lack of or an inappropriately attached patient band, poor sampling, or improper labeling (Nordin et al., 2024).

Venipuncture arm simulation: Artificial arm models are created with a human-like design and possible arm veins are put in them to replicate human anatomy (He at al., 2022). These models are then used to train health care professionals on correctly performing a venipuncture procedure.

Table 1

Definition of Preanalytical Errors

Preanalytical errors	Definitions
Insufficient sample	A serum was obtained, but it was insufficient for the requested tests.
Sample not on ice	Samples for arterial blood gas analysis were not transported on ice.
Delay in sample transportation	Samples were not sent to the lab on time.
Hemolyzed sample	Presence of pink to red tinge in serum plasma.
Incorrect sample identification	There is a mismatch between the name of the sample and the request form.
Expired reagents	Unfit reagents for use.

Relevance to Nursing Practice

The need for high-quality phlebotomy training in nursing practice is an imperative that cannot be underestimated. Intrinsic to the curricula, due to the centrality of blood analysis to patient care and diagnosis, adequate phlebotomy must be precise, skillful, and

safe to protect patients from potential infections, hematomas, or diagnostic errors (Kimori et al., 2018). The history and modern experience of blood analysis medicine suggests proper training and quality enhancement initiatives because the need for error reductions is high in the context (Serra et al., 2018). A recent study reinforced the importance of simulation-based training as a feasible approach to improving phlebotomy skills in nurses (de Souza-Junior et al., 2020). This method seemed effective and safe since it provides the necessary environment for skill acquisition and improvements for nurses who are novices or veteran nurses. Unfortunately, there still can be a problem in developing a strong and unified approach regarding training contents and the measurement of outcomes due to the lack of utilizing such an intervention in many educational or patient safety processes (Hassanein et al., 2021).

I designed the current DNP project to close this gap and support the need to assess the impact of venipuncture arm simulations. I drew upon the established body of nursing theory and modern pedagogical frameworks, specifically by combining Nightingale's environmental theory (for its emphasis on the need for a supporting educational and practice environment) with the OPT model (for its aim to improve the approach to clinical reasoning and nursing education; Riegel et al., 2021; Seo & Eom, 2021).

The significance of this project to nursing practice is broader than mere skills acquisition because it covers a range of perspectives, such as a patient's surrounding environment, practitioner knowledge, and systemic assessment. This project addressed the gap between traditional training approaches and current clinical expectations by linking educational activities to evidence-based strategies and theoretical frameworks. I

conducted this project to enhance nursing practice based on the need for patient safety, effectiveness, and high-quality patient care.

Local Background and Context

The local context of this project was situated explicitly for a health care facility with diverse patient demographics and varied health care needs, particularly in phlebotomy. This setting has increased demands for maintaining high standards of phlebotomy practice through patient capacity measure issues and facility protocols that influence these issues. The primary concern and nationwide priority of avoiding preanalytical errors are essential, given their potential threat to patient safety and diagnostic relevance (Hjelmgren et al., 2023).

The local evidence that supported the need for this project was a recent audit that identified a recurring pattern of preanalytical errors across the facility, such as insufficient sample volumes, compliance with quality metrics, wrong needle withdrawal, and sample and venipuncture site contaminations. This is consistent with the existing literature that indicated that preanalytical phases were the most error-prone steps in the laboratory testing process and constituted an institutional problem symptomatic of a broader systems error that called for targeted interventions to improve phlebotomy practices and, thus, patient care (De la Salle, 2019).

Each health care organization usually has guidelines defining the activities and responsibilities of clinical staff nurses and laboratory technologists. Phlebotomy is a delicate and crucial part of care delivery that requires effective performance. The project site facility's governance structure, mission, and strategic vision reflect its safety and quality care commitment. It has supported and fostered a culture of compliance and

continuous quality improvement regarding clinical procedures and best practices. However, despite the existing policies and training measures, there was a discrepancy between the knowledge students acquire through theory and clinical practice (i.e., nursing students seemed unprepared to perform phlebotomies safely and effectively).

This project aligned with state and federal guidelines to promote patient safety and health care quality. For instance, the project site facility's compliance with the state's Health and Hospital Association guidelines and requirements of patient safety and quality improvement standards under the Patient Safety and Quality Improvement Act of 2005 indicated the facility's alignment with national quality and safety standards (Agency for Healthcare Research and Quality, n.d.; Office for Civil Rights, 2022). Compliance with these regulations showed the facility's commitment to regulatory specifications and provided evidence that the facility was actively integrating a strategic, evidence-based practice.

Role of the DNP Student

I have witnessed the impact of preanalytical errors on patient care quality, driving my renewed commitment to the subject as part of my academic pursuit. With my nursing professional foundation and academic reform background, my perspective contributed to the clinical rationale and understanding of how this project can benefit nursing practice. Moreover, my focus on enhancing nurses' clinical strengths has helped position my relationship with this subject and led to a strong desire to advance nursing skills. I was the project leader tasked with overseeing the project's ongoing activities while synthesizing gathered evidence and developing the CPG using the AGREE II framework.

I took a collaborative perspective, working with empirical evidence and drawing from a database of the AGREE II framework to structure evidence-based initiatives.

I was motivated by my aspiration to close the gap between academic theory and clinical practice as well as raise the phlebotomy profile among nurses and its impact on patient outcomes. One factor supporting my motivation for the project was the potential to limit the number of preanalytical errors. Additionally, I was excited about the project's future implications for education and practice in nursing.

However, it was essential to recognize the potential sources that may have compromised the project's integrity. My professional knowledge and experience may have created bias in this project. Therefore, I took steps to address this issue, including collaborating with a diverse team, using systematic methods, and asking for the opinions of phlebotomy and education experts.

As the project leader, I oversaw the development of the CPG and established a good working relationship with content experts (i.e., the selected participants). Building solid relationships with stakeholders in this process was critical to the project's success because it allowed for learning about the difficulties and complexities of actual phlebotomy processes. As the project leader, I ensured adequate time was allocated for the project's development and that team members collaborated to achieve success. I was motivated by the notion that extensive research and evidence-based interventions could minimize phlebotomy errors, thereby improving patient safety and the standard of health care delivery.

Summary

In Section 2, I identified the local context that was the impetus for this project: a primary care setting, marked by preanalytical challenges that were a local manifestation of broader systemic problems. This information laid the foundation for a discussion of the relevance and transferability of the project because the resultant CPG was evidence-based and well-tailored to the practical realities of genuine clinical settings. In Section 3, I provide a review and thematic synthesis of previous studies on the topic.

Section 3: Collection and Analysis of Evidence

Introduction

Increased phlebotomy errors are a significant global health care concern, calling for an effective intervention to improve nurses' phlebotomy competency. I conducted this DNP project to develop a CPG to enhance the competence of nurses in phlebotomy practices and provide recommendations for the evaluation of the efficacy of venipuncture arm simulation training. In the CPG, I offered the groundwork for health care professionals to infer that they should use the most current, evidence-based practice to ensure safe patient care. The CPG is comprehensive and straightforward to reference for daily clinical practices and is uncomplicated to incorporate into practice.

In Section 3, I provide an inclusive methodological framework for the project. I preview the processes used to create new evidence in this DNP project to support or further discern the identification and development of a novel CPG designed to improve the practice of venipuncture arm simulation training. This involved describing the proposed methods for developing policies, engaging stakeholders, and the expected frameworks for implementation and evaluation.

Practice-Focused Question

The issue under study in this DNP project was the inconsistency and deficiency surrounding the current phlebotomy training approaches and, more precisely, venipuncture arm simulation, at the project site. The practice-focused question for this project was: Does evidence and theory support the establishment of an evidence-based practice CPG for evaluating the efficacy of using a venipuncture arm simulation training for phlebotomy?

Sources of Evidence

I drew the sources of evidence for this project from peer-reviewed research articles, systematic reviews, meta-analyses, qualitative studies, and CPGs that addressed the following:

1. The efficacy and impact of venipuncture arm simulations in nursing education and training.
2. The incidence, types, and underlying causes of preanalytical errors in phlebotomy.
3. Theoretical and practical frameworks supporting the integration of simulation-based learning in clinical training.
4. The development, implementation, and evaluation of CPGs in phlebotomy.
5. Appraisal tools and instruments used to appraise the quality and applicability of the CPG, specifically the AGREE II instrument.
6. The OPT model of evidence-based implementation.

The identification and examination of published outcomes and research were fundamental in outlining the available evidence on the effectiveness of venipuncture arm simulations in improving phlebotomy skills. I searched the PubMed, CINAHL, Web of Science, and Cochrane Library databases with the following keywords and phrases: *venipuncture simulation, phlebotomy training effectiveness, simulation-based nursing education,* and *preanalytical errors in phlebotomy*. My search strategy encompassed Boolean operators to ensure the searches were refined and expanded whenever necessary. The literature reviewed were publications less than 10 years old for a balance of current practices with some historical context. This publication range enabled the obtaining of

sources that captured the advancement in simulation technology and its use in the pedagogical setting. The search was exhaustive and was followed by a manual search of the reference lists of potential articles for additional studies. The criteria for inclusion and exclusion in the project were rigorous to guarantee that the selected studies were relevant, of high quality, and applicable to the practice-focused question. The final output was a synthesized body of evidence that illustrated what is already known and ways where literature was incoherent or where gaps existed to guide practice implications (see Appendix A for a table of evidence).

Evidence Generated for the Doctoral Project

I generated new evidence in this project to answer the practice-focused question adequately. This evidence was produced to evaluate the CPG about the effectiveness of measuring venipuncture arm simulations as one of the crucial tools of phlebotomy learning. This type of evidence is necessary for supporting empirical claims that are crucial for facilitating the use of this guideline in practice to improve nurses' competency and reduce errors.

Participants

The sample of participants in the current project included nursing professionals currently working in a health care setting who engaged in phlebotomy in the context of their routine responsibilities. Sampling was purposive to identify and invite two participants who had experience and exposure to phlebotomy, mirroring the diverse real-world contexts where these skills are applied. Their relevance to the practice-focused question was based on their involvement and expertise in phlebotomy and in education on phlebotomy. The project participants consisted of a group of content experts who were

invited to participate in the initial evaluation of the CPG. The CPG content experts included a manager.

Procedures

The AGREE II is an established reliable and valid tool (Brouwers et al., 2010) that guided the development and evaluation of the CPG based on the tool's six domains. The tool is considered the most used guideline appraisal tool, consisting of 23 items organized within six domains (Bargeri et al., 2021). I considered key elements of the six domains in the development of CPG.

The scope and purpose domain was used in this CPG to explain the purpose of enhancing the effectiveness of venipuncture arm simulation training for nurses. The health questions asked were specified, and the target population was set to improve phlebotomy skills through structured simulations. I developed this initiative with the aim of reducing preanalytical errors so that patient care could be improved in various settings (see Bargeri et al., 2021).

I applied the involvement of stakeholders domain to ensure that diverse professional contributions, such as nursing educators and phlebotomy specialists, are needed for applicability and relevance. Fostering such a comprehensive perspective made CPGs respond better to the various nuances associated with phlebotomy training, hence becoming adaptable to real-world scenarios (De Leo et al., 2023).

I implemented the rigor in development domain to adhere to the AGREE II framework for developing evidence-based guidelines, which covers evidence appraisal, criteria setting, and recommendation development. This detailed approach ensured the

recommendations were based on solid evidence to build an evidence-based guideline (see Bargeri et al., 2021).

The clarity and presentation domain make the guidelines easily accessible to users. I used visual aids, such as flow charts, to help users understand and apply guidelines easily in clinical scenarios.

In the evaluation and applicability domain, participants used the AGREE II tool to assess the quality of the guideline and its relevance for use. Barriers have been identified when implementing it so that solutions can be proposed to eliminate them. This proactive evaluation was aimed at guaranteeing the practicality of the CPG in clinical settings and its efficacy in phlebotomy training contexts.

I strictly implemented the editorial independence domain throughout the project process to avoid bias or external influence so that the guideline is best suited for both health care providers and patients (see Bargeri et al., 2021). An independent panel also evaluated the quality and applicability of the CPG in the evaluation of the CPG stage of the project. I then used their collective feedback for revisions to further enhance the highest evidence-based practice standards for practical clinical deployment.

Content Expert Review

I held a meeting with the project site manager who agreed to lead the collaboration within the content expert team in reviewing the pertinent literature provided in the evidence table, reviewing and validating the CPG using the AGREE II tool (see Appendix D), and providing constructive comments or suggestions to enhance the CPG. This task was done collaboratively, and each of the two members contributed to sharing their expertise to rate the guidelines based on its relevance, applicability, and clarity. The

use of AGREE II ensured that the guidelines were high quality and likely to enhance phlebotomy practice and training (see Bargeri et al., 2021).

Protections

The ethical considerations in this project were extensive. All project procedures were aimed at the protection of human subjects, and I received approval to conduct the project from the Walden University Institutional Review Board (06-20-24-0126796) prior to project implementation. I provided the reviewers with the IRB-approved consent form along with detailed information about the study, including its purpose, procedures, potential risks, and benefits. The anonymity and confidentiality of the data was ensured with the help of a de-identified data set. I stored data responsibly to prevent possible breaches. I informed participants of their right to withdraw at will and free of penalty. Participant recruitment and retention were secured by emphasizing the importance of the project's outcomes for nursing practice and patient care as well as through providing a flexible schedule to accommodate participation without affecting their clinical duties. Minimization of any possible harm to the participants was my ethical responsibility as the project leader.

Analysis and Synthesis

The quantitative data generated from participants' pre- and postintervention evaluations of phlebotomy skills were entered into a Microsoft Excel spreadsheet and analyzed using descriptive statistics. Rigorous data scrubbing, including outliers and missing data handling, was conducted in a standardized manner by applying established statistical techniques, such as imputation methods and sensitivity analysis. I also

conducted data abstraction, mapping of relationships among different themes, and detection of gaps in evidence.

I used both quantitative and qualitative methods to analyze the data from the experts' evaluations of the CPG using the AGREE II tool. Their ratings and comments were descriptively summarized in terms of the CPG's quality, applicability, and relevance, along with the most common patterns and possible divergence. I conducted an in-depth analysis of the experts' comments to understand their overall perceptions of the CPG's strengths and opportunities for further quality enhancement. Together, use of both methods helped to improve the CPG further through expert consultation and make it compliant with the evidence-based practice approach, which was helpful for the development of the nursing-phlebotomist competence.

Summary

In Section 3, I provided an overview of the methods used in data collection, from analysis to evidence synthesis. Empirical evidence provided in the participants' evaluations of the CPG using the AGREE II tool allowed for assessing the potential of simulation-based training in the strengthening of phlebotomy competence among practicing nursing professionals. In the section, I highlighted the need for more stringent evaluation, standardization, and development of CPGs to implement uniform and practical training methodologies. Development, implementation, and evaluation of this clinical practice guideline developed from the evidence will be the focus of Section 4.

Section 4: Findings and Recommendations

Introduction

Increased phlebotomy errors are a significant global health care concern, calling for an effective intervention to improve nurses' phlebotomy competency. I conducted this DNP project to address the gap in practice caused by the lack of effective guidelines by developing a CPG to enhance the competence of nurses in phlebotomy practices. The CPG offers the ground for health care professionals to infer that they should use the most current, evidence-based practices to ensure safe patient care. The CPG is comprehensive, easy to reference for daily clinical practices, and easy to incorporate into practice with experts' feedback for evaluating the effectiveness of venipuncture arm simulation (see McCoy et al., 2020).

The purpose of this project was to develop and evaluate an evidence-based and theory-supported CPG for enhancing nurses' phlebotomy. I sought to answer the following practice-focused question: Does evidence and theory support the establishment of an evidence-based practice CPG for evaluating the efficacy of using a venipuncture arm simulation training for phlebotomy? The evidence for this project was drawn from two sources: the evidence to develop the CPG and evidence to support the quality and usability of the CPG for practice.

The first evidence source was from peer-reviewed research articles, systematic reviews, meta-analyses, qualitative studies, and CPGs that addressed the efficacy and impact of venipuncture arm simulations in nursing education and training; the incidence, types, and underlying causes of preanalytical errors in phlebotomy; and the theoretical and practical frameworks supporting the integration of simulation-based learning in

clinical training. The evidence also addressed the development, implementation, and evaluation of CPGs in the realm of phlebotomy and the appraisal tools and instruments used in the appraisal of the quality and applicability of the CPG, specifically the AGREE II instrument and the OPT model of evidence-based implementation.

The second source of evidence was from quantitative and qualitative data drawn from the content expert evaluations of the CPG using the AGREE II tool. The experts' ratings and comments were descriptively summarized in terms of the CPG quality, applicability, and relevance, along with the identification of the most common patterns and possible divergence.

In Section 4, I discuss this study's findings, which included rather profound knowledge about policies concerning clinical practices. The CPG example of using simulation training enhances nurses' understanding that simulation training contributes to the rise of procedural competency among health care professionals (see Kodikara et al., 2023).

Findings and Implications

I invited two expert panelists to assist in evaluating the quality and applicability of the CPG developed in this project. Each expert independently used the AGREE II tool (see Appendix D). The experts' scores for individual domains were calculated as percentages. According to Zhou et al. (2023), a domain score above 60% is deemed high quality, and a mean item score of 6.0 or higher indicates satisfactory and high quality.

Domain 1: Scope and Purpose

For Domain 1 (see Table 2), the quality rating for the two panelists was 64%. This score indicates that the scope and purpose of the CPG were adequately explained. Item 3

received the lowest rating (*M* = 3.5), indicating that the health questions failed to sufficiently be addressed and specific. Consequently, I structured the health questions in the CPG with clearer and more specific queries. The formula used to calculate the percentage score for the domains is based on the number of items, number of expert panelists, and the scores provided (see Appendix E).

Table 2

Domain 1 Percentage Scores

	Domain 1			
	Item 1	Item 2	Item 3	Total
A	7	4	4	15
B	7	4	3	14
M	7	4	3.5	
Total	14	8	7	29

Note. Maximum score = 42. Minimum score = 6. Percentage score = 64%.

Domain 2: Stakeholder Involvement

For Domain 2, the overall quality score was 61%, indicating that stakeholder involvement in the CPG was adequately described (see Table 3). Items 5 and 6 received the lowest ratings (*M* = 4.5 each), showing that the perceptions, preferences, and views of the target population were not sufficiently considered. To develop the CPG, I relied on evidence-based articles and research from scientific databases and peer-reviewed journals. Item 4 had the highest rating (*M* = 5), suggesting that although the development involved professionals from relevant groups, the quality of the results was relatively low. Health care practitioners were included in the expert panel; however, the definition of the targeted users of the CPG was not sufficiently clear (i.e., Item 6).

Table 3

Domain 2 Percentage Scores

	Item 4	Item 5	Item 6	Total
A	5	5	5	15
B	5	4	4	13
M	5	4.5	4.5	
Total	10	9	9	28

Note. Maximum score = 42. Minimum score = 6. Percentage score = 61%.

Domain 3: Rigor of Development

For Domain 3, the total quality score was 55%, revealing that the rigor of development was less than satisfactory (see Zhou et al., 2023; see Table 4). Item 13 had the lowest rating ($M = 3$) and involved determining whether the guideline has been externally reviewed by experts prior to its publication. In the project, the expert review had not been involved in external reviewing of the guideline before it was reviewed by the content experts in this project. Item 11 had the highest ratings ($M = 5.5$) and involved consideration of the health benefits, side effects, and risks in the formulation of the recommendations. As such, although the results of this item approach a mean of 6.0, with 6.0 or higher indicating a rating that is satisfactory and of high quality, the result may show that these factors were insufficiently considered when generating relevant recommendations.

Table 4

Domain 3 Percentage Scores

	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Total
A	5	4	5	5	6	4	3	4	36
B	4	4	5	4	5	4	3	4	33
M	4.5	4	5	4.5	5.5	4	3	4	
Total	9	8	10	9	11	8	6	8	69

Note. Maximum score = 112. Minimum score = 16. Percentage score = 55%.

Domain 4: Clarity of Presentation

Domain 4 had a total quality score of 31%, suggesting that the presentation was generally unclear (see Table 5). Item 17 had a mean low-quality rating (*M* = 3.5), revealing that the key recommendations were not easily identifiable, while Items 15 and 16 had the lowest rating (*M* = 2.5), indicating that the recommendations were somewhat unspecific and ambiguous and that the various options for managing the condition were not clearly presented.

Table 5

Domain 4 Percentage Scores

	Item 15	Item 16	Item 17	Total
A	3	3	4	10
B	2	2	3	7
M	2.5	2.5	3.5	
Total	5	5	7	17

Note. Maximum score = 42. Minimum score = 6. Percentage score = 31%.

Domain 5: Applicability

The total quality score in Domain 5 was 44%, suggesting that the CPG was

inapplicable (see Table 6). Items 18, 20, and 21 had the lowest ratings with a mean score of 3.5, which shows that the guidelines do not provide sufficient advice and/or tools on how the recommendations can be put into practice. These ratings also imply that the potential resource implications of applying the recommendations have not been properly considered and that the guideline does not clearly present monitoring and/or auditing criteria. Item 19 had the highest rating ($M = 4$) yet suggests that the guideline fails to comprehensively describe the facilitators and barriers to its implementation.

Table 6

Domain 5 Percentage Scores

	Item 18	Item 19	Item 20	Item 21	Total
A	4	5	4	4	17
B	3	3	3	3	12
M	3.5	4	3.5	3.5	
Total	7	8	7	7	29

Note. Maximum score = 56. Minimum score = 8. Percentage score = 44%.

Domain 6: Editorial Independence

In Domain 6, the total quality score was 58%, suggesting lack of total editorial independence. I did not receive funding, and there were no conflicts of interest (see Table 7).

Table 7

Domain 6 Percentage Scores

	Item 22	Item 23	Total
A	6	4	10
B	5	3	8
M	5.5	3.5	
Total	11	7	18

Note. Maximum score = 28. Minimum score = 4. Percentage score = 58%.

The Overall Quality Assessment

The two experts used the AGREE II tool for providing the overall quality review, with the overall quality rating between 1 and 7 (1 being the lowest and 7 being the highest,) and commented on whether they would recommend the utilization of the tool with or without modification by responding with "Yes," "No," or "Yes with modification." As far as Hoffmann-Eßer et al. (2017) are concerned, this should be a subjective rating. The CPG was rated by the health care providers with a mean domain score of 51.2%. Although according to Zhou et al. (2023), a domain score above 60% is of high quality the current CPG falls short of the high-quality rating. (see Table 8). Despite the less than high quality rating the content expert panelists reported that they would recommend the use of the CPG with some modifications.

Table 8

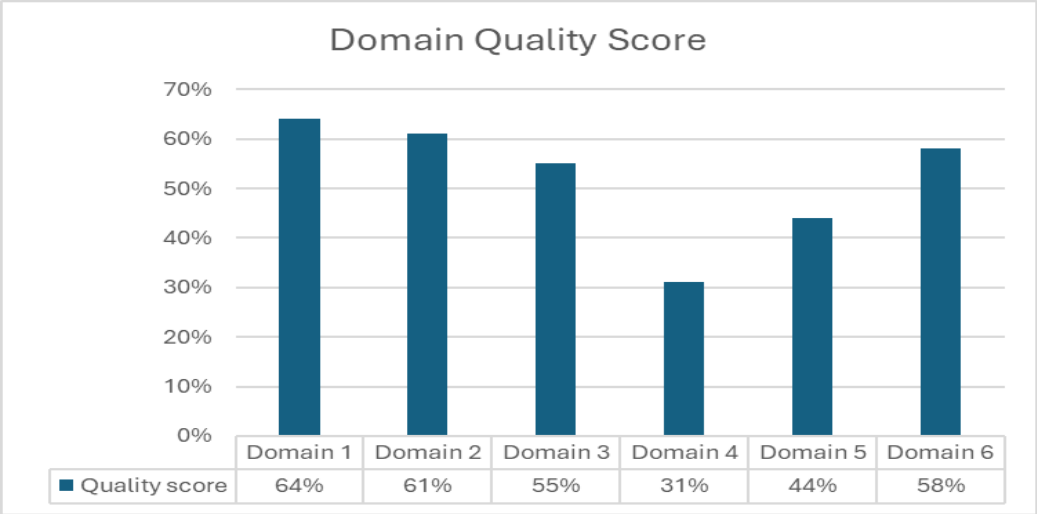
Overall Quality Score

Expert	Item 1	Recommendations		
		No	Yes	Yes with recommendation
A	5	0	0	1
B	3	0	0	1
M	4			

Generally, the CPG was rated below 60% in four domains, with insufficient information on the rigor of development, the clarity of presentation, applicability, and editorial independence. Figure 1 shows the total quality score for each domain. The mean item scores of these four domains ranged between 2.5 and 5.5. All the items were below the mean of 6, thus below the benchmark range described in Zhou et al. (2023), indicating that they are less than satisfactory and of lower quality. The quality domain scores ranged between 31% to 64% with a mean domain score of 52.1%; therefore, the CPG is rated as being of lower quality and without 100% of the expert panelists recommending use of the guideline as it is. As such, this guideline can be recommended to be used in health care facilities with some key modifications. With modification, this CPG has potential for clinical use because it provides valuable, actionable insights for enhancing venipuncture simulation and improving nursing practice.

Figure 1

Quality Score for the Six Domains



Recommendations

Guideline Overview

Content experts recommended that the guideline be used with modification. I have determined that adding an introduction and/or background statement to the CPG would enhance the clarity as would adding more information about the applicability of this guideline. I suggest that the following introductory statement be added to the final published guideline: This CPG aims to bridge a gap by providing evidence-based practice recommendations for evaluating the effectiveness of venipuncture arm simulation training aimed at increasing knowledge and improving competencies with an aim to reduce preanalytical errors.

Applicability

Using the AGREE II framework, the project has identified a significant opportunity for practice development among nurses and potentially mark positive social

change through reduced patient adversities related to phlebotomy and overall contribution to improving standard in clinical care. The application of the CPG in the clinical context is vital in improving nurses' skills in venipuncture and related health care. However, it has been determined that the CPG is below standards of applicability in actual practice, and as such can only be used practically subject to some specific modifications to improve its overall quality.

Recommendations from informal feedback from content experts include making clear and logical recommendations on the different alternatives for managing phlebotomy based on health concerns. Some patients have very difficult veins, and even the most skilled practitioner needs to look at comorbidities and other factors like patient occupation, hydration status and trying a different needle gauge. Another recommendation is considering the potential resource and the impact of applying the guideline. Most learners require practice with simulation, and having the right mentor will allow the student to grow. A good mentor does not rely 100% on the manikins, because unlike patients they do not change. My final recommendation is considering the competing interests of guideline development group members prior to application. Make sure that there is adequate staffing, because steps should not be missed.

Practice

Based on the evidence supporting the practice of venipuncture arm simulation, several recommended solutions are suggested to consider the highlighted deficiencies and improve clinical practice guidelines. First, practice guidelines that include simulation-based training protocols among the existing best practices must be developed. Such guidelines should highlight the recommended simulation sessions' frequency and

duration across practicing care providers to enhance skill enhancement conformity and comprehensiveness (Saengpayab et al., 2021). Secondly, the policy issue in setting requirements for the use of simulation in professional certification and continuing education is necessary. This approach ensures that all health care professionals receive periodic competency checks concerning their venipuncture skills and updates of procedures and techniques in their practice. Studies have shown that repetitive training increases performance accuracy and reduces errors (de Souza-Junior et al., 2020). There should also be procedures for checking and evaluating skills in performing venipuncture after simulation. These protocols can encompass formative evaluations through simulative scenarios and assessing practical performance in clinical settings to determine competency levels and the facets requiring elaboration.

Organizational

In addition, incorporating competency assessments via simulation into the licensure and certification process fortifies professional norms. Simulation training as a core accreditation and credentialing requirement blankets healthcare practitioners with uniformity in their competency in venipuncture procedures. Besides these structural suggestions, the studies and quality improvement activities are also suggested for continuous updates. Ongoing assessment of the effect of simulation on the readjustment of clinical performance and patient satisfaction have supplied significant information to optimize recommendations and procedures. The outcomes of research studies should also quantify the possibilities and costs of incorporating simulation in other health care education and training systems. Finally, promoting an organizational culture that encourages simulation learning is crucial. This comprises garnering support from

leadership, provision of funds for simulation facilities, and fostering collaboration to augment training courses. Health care organizations can close a practice-performance gap concerning venipuncture procedures with these recommended solutions. These strategies empower and build capacity among healthcare providers and help raise the standard of patient safety and quality of care.

Secondary Products

There are proposed secondary products for the CPG project of venipuncture arm simulation: training modules, skill checklists, and feedback forms. The offered resources are hoped to increase the efficiency of health care professionals' venipuncture practice by providing instructions, quizzes, and feedback. Practice simulations, virtual reality upgrades, and continuing education resources give more training requirements. Quality improvement guides help efficiently assess the simulation effects on clinical significance (Gorski et al., 2021). A community of practice environment is cultivated for knowledge sharing through peer interaction supported by complex technical structures. Other potential partners enhance the rationale for future simulation use, while configurations guarantee its application across various health professions and practice environments. These secondary products undergird the project's objective of harnessing effective venipuncture simulation in clinical practice while advancing patient care through better and ongoing professional development.

Strengths and Limitations of the Project

The CPG project emphasizes evaluating the venipuncture arm simulation and its relative merits and benefits concerning procedural training. It was designed to enhance practitioners' competencies and safeguard patients' well-being by offering a more

comprehensive and ordered approach to learning. Challenges include accurate modeling of environments, keeping guidelines current, the efficacy of knowledge, skills retention over a long time, and clinical effectiveness. For it to be effective, a solid database and methods must be used to assess it. By acknowledging these strengths and limitations, the project's potential to enhance healthcare quality can be optimized while maintaining high theoretical and clinical applicability levels.

Section 5: Dissemination Plan

Informing and educating the project site institution experiencing the practice problem about the results and possible conclusion of the CPG project on venipuncture arm simulation entails having measures to ensure that any affected facility is reached and informed. With these plans in place, the institution can communicate the project results and ensure the use of evidence-based practices to improve the quality of venipuncture and, therefore, the quality of the services rendered to patients (see Bueno et al., 2020). Several steps will be involved in dissemination of the project's findings:

1. Report preparation: Gather all the requisite material and prepare a report containing the details and analysis of the project's goals, approach, results, and suggestions. This report should not contain specialized language and be accessible for clinical and administration staff to understand.
2. Presentation to stakeholders: Deliver targeted presentations to clinicians, nurses, educators, and administrators in an institution or health care setting. These presentations should focus on the advantages of the project (e.g., enhanced training effectiveness, simulation of standardized procedures, and perhaps, decreased patient distress).
3. Workshops and training sessions: Interfaces can then be provided to conduct workshops or training sessions to demonstrate the simulation techniques and guidelines derived from the project. More interaction might lead to health care providers' increased acceptance and implementation during the hands-on sessions.

4. Distribution of guidelines and materials: Publish the print or electronic versions of the CPG developed from the project. This is to ensure that these resources are available and readily visible for use in clinical settings and incorporate them into current teaching endeavors.
5. Feedback and continuous improvement: Engage the frontline staff and stakeholders and seek their opinions on the usefulness and success of the issued guidelines. This input can be used to periodically review and upgrade the guidelines to make them as practical and workable as possible.
6. Integration into continuing education: Coordinate with educational departments to incorporate simulated training and guidelines into professional development for health care providers. This also ensures that modern best practices are constantly being reinforced and implemented by the organization.
7. Documentation and institutional support: Record the dissemination procedures and ensure results are correctly documented. Look to the institution to support better sustainability, specifically gaining higher authorities' approval and incorporating sustainability into the policies.

Educating the nursing profession on the CPG project on venipuncture arm simulation is a purposive process in which specific audiences and venues that are critical players in nursing practice and education domains will be reached. Education through dissemination can be accomplished through several means, such as:

1. Professional conferences: Conveying study outcomes to national or global nursing association meetings such as American Nurses Association meetings,

the International Nursing Research Congress, or specific procedural and simulation specialty meetings.

2. Nursing journals: Writing articles for submission in peer-reviewed nursing journals on education, simulation, procedures, and quality improvement. Some scholarly journals include the *Journal of Nursing Education*, *Clinical Simulation in Nursing*, and the *Journal of Nursing Care Quality*.
3. Webinars and online platforms: Conduct webinars or use information technology techniques, such as websites (e.g. nursing associations' webinars or online learning sites) to reach many more nurses interested in enhancing their clinical practice and knowledge.
4. Professional organizations: Sharing the findings with nursing associations and organizations, like the National League for Nursing; the Society for Simulation in Healthcare; and discipline-specific professional nursing organizations, such as the Infusion Nurses Society.
5. Nursing schools and educational institutions: Sharing project findings with nursing schools and other learning institutions to ensure that the information is included in the teaching curriculum for undergraduate and postgraduate nursing students to impart knowledge to the next generation of nurse practitioners.
6. Workshops and continuing education: Hosting seminars or continuing education sessions in specific hospitals, nursing conferences, or even using professional development programs to educate the nurses on simulation skills and the rules and regulations.

7. Social media and online communities: Participating in social media platforms and online nursing communities to disseminate project briefs, research outcomes, relevant materials, and nurturing discussions among the action partners.

Analysis of Self

As a practitioner, scholar, and project manager of this CPG project focusing on the simulation of the venipuncture arm, I began to acquire new experiences and skills in all these capacities. Currently, as a practitioner, I have been involved in the technique of venipuncture and procedural training and have used an evidence-based approach that enhances the well-being of patients. By participating in this project, I improved patient safety, minimized their discomfort, and adopted best practices in my institution. In the long term, my professional aim is to advance to the following clinical practice level and, more importantly, keep abreast with the current changes in evidence and skills that would enable me to provide patients with excellent care.

As a scholar, I have researched, collected data, and integrated information to formulate sound clinical practice recommendations. The knowledge of research methods and quality improvement processes developed in this project has helped me better understand evidence-based practice in health care settings. As part of my long-term professional goals, I would like to advance the field of nursing knowledge further by writing articles for peer-reviewed journals and engaging in research that contributes to clinical practice and education.

As a project manager, I have managed a team of professionals, synchronized the project work, and guided the team on how it should follow set schedules and goals. I have

acquired organizational skills and collaborative styles as well as enhanced my ability to plan strategically while managing this project. My professional goals include pursuing even more significant-scale health care improvement initiatives and assuming positions that might allow me to shape health care policy and practice at a national level. As a result, this project has directly contributed to my present state of practice and scholarship. I have gained practical skills, a theoretical understanding of the subject, and an enhanced sense of the principles of evidence-based practice.

Moving forward, I would like to forge ahead in my efforts to translate evidence into practice to make a positive social change through enhancing health care practice and working to elevate nursing as a profession. Ultimately, my goal is to assume leadership roles to enhance patient safety and improve the quality of health care facilities and services in the long run with the support of my practice, academic, and project management experiences. In summary, in this project, where I developed a CPG regarding venipuncture arm simulation, was an invaluable experience that enhanced my professional skills as a nurse as well as provided me with an opportunity to work towards my future goals of pursuing excellence in the field of nursing and contributing to scholarly work and innovative health care projects through identifying various challenges and solutions and providing significant insights.

Several challenges were faced in this project. Looking for productive and voluminous research data from various health care professionals in different clinical areas and maintaining the reliability and objectivity of collected data was a challenge I encountered during data collection. Communicating with project stakeholders to facilitate the project objectives and gather information on available resources in the nursing,

education, and clinical departments was also a challenge besides the need for a transparent methodology. To avoid spending hours and even days answering questions, such as “What are you studying?” and “How are you going to do that?,” while simultaneously outlining and adhering to the expectations of ethics committees, methodologists, and other peers, it was crucial to delineate the research aims and strategies at the early stages of the project.

To address these challenges, I employed a structured data collection process and followed strengthening procedures for using similar data-gathering methods to ensure comparability between varied clinical settings and health care providers. Effective communication that involves setting up formal and informal contacts and touchpoints with the different stakeholders to heed their complaints, update them on the advancements made, and gain their commitment throughout the undertaking was also necessary. This further underlined the significance of exploiting knowledge-based recommendations in enhancing clinical results and adopting some processes such as venipuncture.

I learned from previous approaches and fundamental concepts that acknowledge the benefits of school-based management on confidence, practice, and safety for practitioners as an impact of simulation, which is one of the insights I gained. Additionally, I gained insights into interdisciplinary learning by engaging with other professionals in the discipline and different fields, which enhanced the project’s results and ideas. When applying the pragmatic approach, continuous improvement is critical, where every quality improvement project requires amendments to the guidelines due to changes instigated by the findings and feedback.

The scholarly process of this project affirmed the emphasis on evidence-based practice, translation of theories into context-specific factors, and the sharing of information to benefit nursing. The scholarly sources highlighted the need for effective scheduling to ensure time, scope, and quality align with stakeholder expectations and deliver tangible results (Korhonen et al., 2023; Maurer et al., 2022). In addition, the project further fueled my continuous pursuit of education, training, research, and health care quality improvement as future endeavors. Overall, the CPG project showed me how to overcome obstacles by implementing the proper strategies and helped me gain insights that contributed to developing my future scholarly and nursing objectives.

Summary

Completing this doctoral project on venipuncture arm simulation reemphasized the impact of evidence-based practice and simulation training. Through overcoming difficulties, establishing successful strategies, and obtaining essential knowledge, this project is a testament to the promotion of patient safety, the optimization of the processes and the number of procedures, and the advancement of nursing by focusing on the research component and collaborations. When viewed from the perspective of the unrelenting quest for improved quality of health care services, the project's findings carry an important message regarding the enhancement of nurses' knowledge and skills to address the changing needs of patients and health care organizations.

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Appendix A: Evidence Table

Author(s)/ Year	Purpose	Patients/ Participants	Study Design	Measures Treatment/ Condition Type	Treatment/ Condition Type	Outcome/ Conclusion	Implication/Relevance
Abd El et al. (2015)	To investigate the effectiveness of interactive distraction and cutaneous stimulation in reducing venipuncture pain in school-aged children.	School-aged children undergoing venipuncture	Randomized controlled trial (Comparative)	Pain assessment using standardized pain scales	Interactive distraction and cutaneous stimulation during venipuncture	Both methods effectively reduced pain, but interactive distraction was more effective in managing venipuncture pain	The study signifies the importance of incorporating pain management techniques in children's phlebotomy guidelines, which can enhance patients' comfort and cooperation when blood is drawn. These findings suggest that CPGs should incorporate specific pain reduction protocols tailored for pediatric patients to reduce pre-analytic errors related to patient movement.
Addisu et al. (2023)	To assess pre-analytical errors in request format and phlebotomy practice in hematology tests at a specialized hospital	393 samples and request forms from Hawassa University Comprehensive Specialized Hospital	Observational cross-sectional study	Evaluation of request forms and observation of phlebotomy practices for errors	Observational study of existing practices	Significant pre-analytical errors in both request forms and phlebotomy practice, indicating the need for improved procedures and training	The study brings to light the massive effect of errors made before analyzing hematology tests — thus showing the need for better training and standardizing practices during sample collection and handling to improve diagnosis accuracy in clinical settings while ensuring patient safety. This emphasizes strict standards on phlebotomy practices, especially regarding proper request handling and sample collection. Such findings advocate for CPGs that focus on strict compliance with phlebotomy protocols to prevent pre-analytical

							errors.
Aggarwal et al. (2022)	To identify phlebotomy errors through direct observation of sample collection procedures in an NABL Accredited Hospital	200 patients	Observational study	Direct observation of phlebotomy procedures and identification of errors	Monitoring and assessment of phlebotomy practices	Identified a high prevalence of phlebotomy errors, indicating a need for enhanced training and standardized procedures	This research focuses on underlining the importance of monitoring phlebotomy practices to reduce pre-analytical errors-clinical guidelines intended for enhancing laboratory precision through improved training accompanied by strict adherence to procedures for the sake of patient care. The study found that the existence of pre-analytical errors can significantly reduce sample quality and undermine patient safety. This understanding is essential in CPGs aimed at enhancing phlebotomy practices to secure sample integrity and patient safety.
Ahlin et al. (2017)	To evaluate nursing students' knowledge and skills in performing venipuncture and inserting peripheral venous catheters	Nursing students	Descriptive study	Assessments of knowledge and practical skills in venipuncture and catheter insertion	Educational assessment	Variability in students' knowledge and skills highlighted the need for enhanced training and education in these critical clinical procedures.	Nursing students should be tested on their ability to carry out venipuncture and catheter insertion skills since it is necessary for ensuring compliance with clinical guidelines regarding safe patient care; this also backs up the CPG's aim towards improving educational programs within nursing curriculums. This study focuses on how well-organized educational programs can help improve procedural skills to minimize pre-analytical errors. It is recommended that CPGs contain all-inclusive training protocols

							as well as evaluation methods to ensure competence in venipuncture and catheter insertion, which are essential in enhancing patient safety.
Arslan et al. (2018)	To assess the impact of training on reducing preanalytical errors among phlebotomists	454 health professionals, nurses	Pre- and post-training intervention study, with survey questionnaires	Implementation of a training program on preanalytical processes	Educational and training interventions embarked on preanalytical errors in phlebotomy	Training improved the correct response rates on questionnaires and reduced preanalytical error rates	The investigation proves that organized training programs effectively improve phlebotomists' skills and reduce errors. These findings can be incorporated into CPG by recommending regular mandatory training with certificates of completion for all phlebotomists to minimize preanalytical mistakes, particularly those related to arm simulation trains aimed at enhancing practical knowledge on phlebotomy in real-life situations where such errors occur most frequently.
Aykal et al. (2020)	To determine the effects of close follow-up in conjunction with theoretical training on the proficiency of trainees in venipuncture and phlebotomy	127 trainee students undergoing summer internships at a medical hospital	Observational study, incorporating before-and-after assessment and unannounced follow-ups	Theoretical training followed by monitored and unannounced evaluations of phlebotomy practice	Intensive monitoring and hands-on training in clinical settings	The study concluded that continuous and unannounced monitoring was crucial for maintaining and enhancing phlebotomy skills post-training	The findings stress the need for continuous assessment and hands-on experience to achieve excellence in phlebotomy, which is critical in minimizing preanalytical errors. This is consistent with CPG development goals that call for ongoing evaluation and immediate feedback to improve training results, especially in procedures such as clinical phlebotomy, where they are most critical.
Banković Radovanović (2020)	To reduce non-conformities in hemostasis testing	Nurses at a secondary healthcare center	The quality improvement project, with	Assessment of sample non-conformities,	Structured education program on	Significant reduction in sample non-	The study demonstrates the efficiency of aimed learning approaches toward

	samples through nurse education and assess the effectiveness of these interventions		pre-intervention data collection, an educational intervention, and post-intervention assessment	delivery of an educational program, and subsequent evaluation of sample quality	proper blood sampling techniques	conformities post-education, significantly reduced instances of clotted samples, indicating improved phlebotomy practices	minimizing pre-analytical errors, especially concerning tests for hemostasis. This method is in line with CPG's proposals for continuous training among employees, which lead to better samples and fewer misdiagnoses during the venipuncture process.
Cassidy et al. (2021)	To assess the use and impact of different implementation strategies for clinical practice guidelines in nursing	Not applicable (systematic review)	Systematic review	Analysis of existing studies on the implementation of practice guidelines in nursing	Implementation strategies for practice guidelines, such as educational sessions, reminders, and audits	Practical implementation strategies can significantly influence the adoption and effectiveness of practice guidelines in nursing.	This study can be beneficial in increasing the adoption and continued use of new clinical protocols while ensuring that guidelines are followed consistently in practice. The study supports incorporating evidence-based implementation plans in CPGs for better compliance and efficacy, especially in procedures that reduce pre-analytical errors during blood collection.
Dey et al. (2023)	To evaluate the knowledge, attitude, and practice (KAP) of nurses regarding phlebotomy in a tertiary hospital setting	119 nurses working at the All India Institute of Medical Sciences, Patna	Cross-sectional survey	Survey based on the KAP model regarding phlebotomy practices aligned with WHO guidelines	Not applicable	Nurses displayed good knowledge and practice with a solid positive attitude towards phlebotomy but identified gaps suggesting improvement.	This investigation emphasizes the need for ongoing training and supervision in phlebotomy to sustain quality, thus making it important to establish norms that would require frequent KAP assessments as components of clinical management.
du Toit et al. (2022)	To determine the impact of laboratory staff training on reducing coagulation specimen rejection rates	Laboratory staff	Interventional study	Implementation of training workshops aimed at improving the	Staff training focused on proper coagulation specimen	Reduction in specimen rejection rates post-training, indicating	The findings suggest that there should be regular and comprehensive training for laboratory staff on CPGs to reduce pre-analytical errors

				accuracy of specimen collection	collection technique	successful knowledge transfer and application	in coagulation testing, which is important for accurate diagnosis and patient management.
Fujii et al. (2014)	To compare the effects of different venipuncture equipment on the promotion of more effective simulation education	44 Nurses	Comparative equipment study	Analysis of the performance and effects of various venipuncture tools in a simulated environment	Venipuncture equipment (20 ml syringe, other syringe sizes, vacuum tubes)	Different equipment influences the puncture angles and inward needle movement, affecting the safety and effectiveness of venipuncture practice	The study compares different devices used for venipuncture; this helped choose the best tools for training programs under the project, which could make blood collection techniques taught to new medical personnel more efficient and safer.
Fujii (2014)	To examine the difference in skill in novice nurses before and after venipuncture simulation practice	Nine novice nurses	Pre-post intervention study	Motion of straight and butterfly needles during venipunctures performed on a simulated model arm	Venipuncture simulation practice	Post-intervention, nurses exhibited improved venipuncture skills, demonstrating the effectiveness of simulation practice in skill acquisition.	The research sheds light on post-simulation practice skills development among novice nurses in venipuncture, thereby underscoring the need for simulation-based training through the clinical guidelines to heighten staff competence levels in nursing. Validates the use of simulation training in CPGs for improving phlebotomy skills and decreasing pre-analytic errors
Gupta et al. (2021)	To implement a quality improvement initiative aimed at reducing the rate of rejected laboratory samples and enhancing specimen acceptability	Laboratory staff and patients	Quality improvement study	Interventions involving process changes and staff training to improve sample collection and handling	Implementation of best practices and training protocols to reduce sample rejection	The initiative significantly decreased the sample rejection rate, indicating improved compliance with proper sample	The study shows that training and process improvements effectively eliminate pre-analytical errors; these can be included in CPG for laboratory sample handling to improve diagnosis accuracy and patient safety.

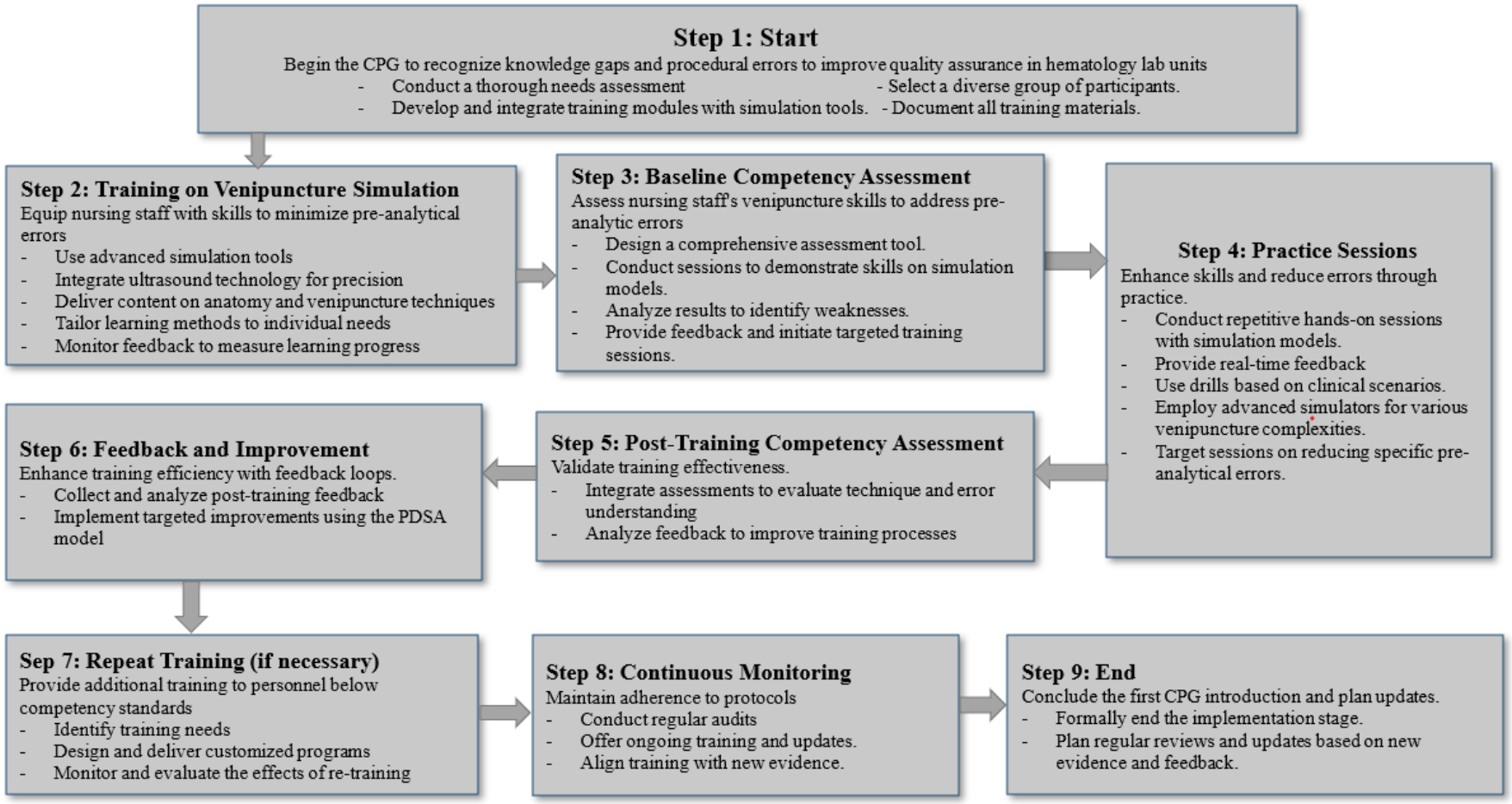
						handling protocols.	
He et al. (2020)	To improve adherence to facility protocol and reduce blood culture contamination rates in an intensive care unit through a quality improvement project	Staff and patients in an ICU	Quality improvement project	Educational interventions and revised protocols for blood culture collection	Training ICU staff on updated protocols for collecting blood cultures	Successful reduction in blood culture contamination rates, improving sample quality and potentially patient outcomes	Protocol adherence and staff training are significant in reducing pre-analytical errors during blood culture collection. This supports CPGs for infection control and sample integrity in ICUs.
Iqbal et al. (2023)	To analyze and report the frequency and types of preanalytical errors in a hematology laboratory at a tertiary care center	Outpatients and inpatients in a hospital laboratory setting	Retrospective study	Data collection from laboratory records focusing on types and rates of sample rejection due to pre-analytical errors	Not applicable	Identified high rates of specific pre-analytical errors, particularly insufficient and clotted samples, showing areas for improvement in sample collection practices	The outcomes point out that it is necessary to follow phlebotomy rules strictly and train staff frequently, as this can be added to CPGs, which helped decrease preanalytical errors and enhance the accuracy of laboratories besides the safety of patients.
Jarintanan et al. (2016)	To develop and evaluate a new model of a rubber arm with a fluid system for venipuncture training to improve clinical skills education	84 medical science students	Descriptive study with subjective assessment through questionnaires	Perceptions of realism (arm size, color, vein visibility), effectiveness in venipuncture technique practice, confidence, and satisfaction after training	Use of a rubber arm model with an integrated fluid system for educational purposes	The rubber arm with a fluid system was highly rated for its realism, ease of use, and effectiveness in training, significantly enhancing students' confidence and skills in venipuncture	Creating a rubber arm with a fluid system used during this study relates directly with improving hands-on training by offering a realistic and low-cost teaching aid for clinical education. Supports the involvement of more sophisticated models in CPGs for phlebotomy training to quicken skills acquisition and minimize pre-analytical errors.
Kodikara et	To assess skills	Pre-clerkship medical	Prospective	Venipuncture	Pre-clerkship	Training	This study examines pre-

al. (2023)	acquisition and durability in pre-clerkship procedural training in venipuncture among medical students	students	cohort study	skill acquisition before and after training and skill retention over time	procedural training in venipuncture	significantly improved venipuncture skills among pre-clerkship medical students, with notable skill retention indicating the effectiveness of the training module.	clerkship venipuncture training as it focuses on skill acquisition and retention, thus guiding the development of practical modules informing clinical guides to ensure skill retention among medical practitioners. The training of students in medical schools should be structured. It is suggested that this training should be included in CPGs to ensure that students attain the required skills and reduce errors before analysis.
Lee N. Y. (2019)	To reduce pre-analytical errors in the clinical laboratory at the University Hospital of Korea through targeted quality improvement activities	Staff members at a clinical laboratory	Cross-sectional study (comparing pre-intervention and post-intervention)	Implementation of a quality improvement program, including staff education and process modifications	Education and training programs targeting the reduction of pre-analytical errors	Reduction in pre-analytical error rates from 0.42% to 0.32% after intervention, with significant improvements in staff knowledge and handling practices	The study emphasizes that ongoing education and quality improvement can help to decrease pre-analytical errors. This implies that systematic training programs should be made part of CPG to sample quality and safety in phlebotomy better
Oliveira et al. (2016)	To evaluate nurse training on the use of ultrasound in peripheral venipuncture, focusing on skill acquisition and technological adaptation	14 nurses	Descriptive quantitative study as part of an analytical cross-sectional study	Effectiveness of ultrasound-guided peripheral venipuncture training, competency evaluation scores, and training assessment through subjective evaluation	Ultrasound training for peripheral venipuncture	Training provided valuable skill enhancements and increased professional visibility for nurses, though a more prolonged period was needed to assimilate this technological	This research illustrates the significance of including advanced technological training in nursing practice through a study on ultrasound training for peripheral venipuncture. It suggests ultrasound-guided techniques to improve accuracy when establishing venous accesses, reducing attempts made and patient discomfort. It shows the importance of

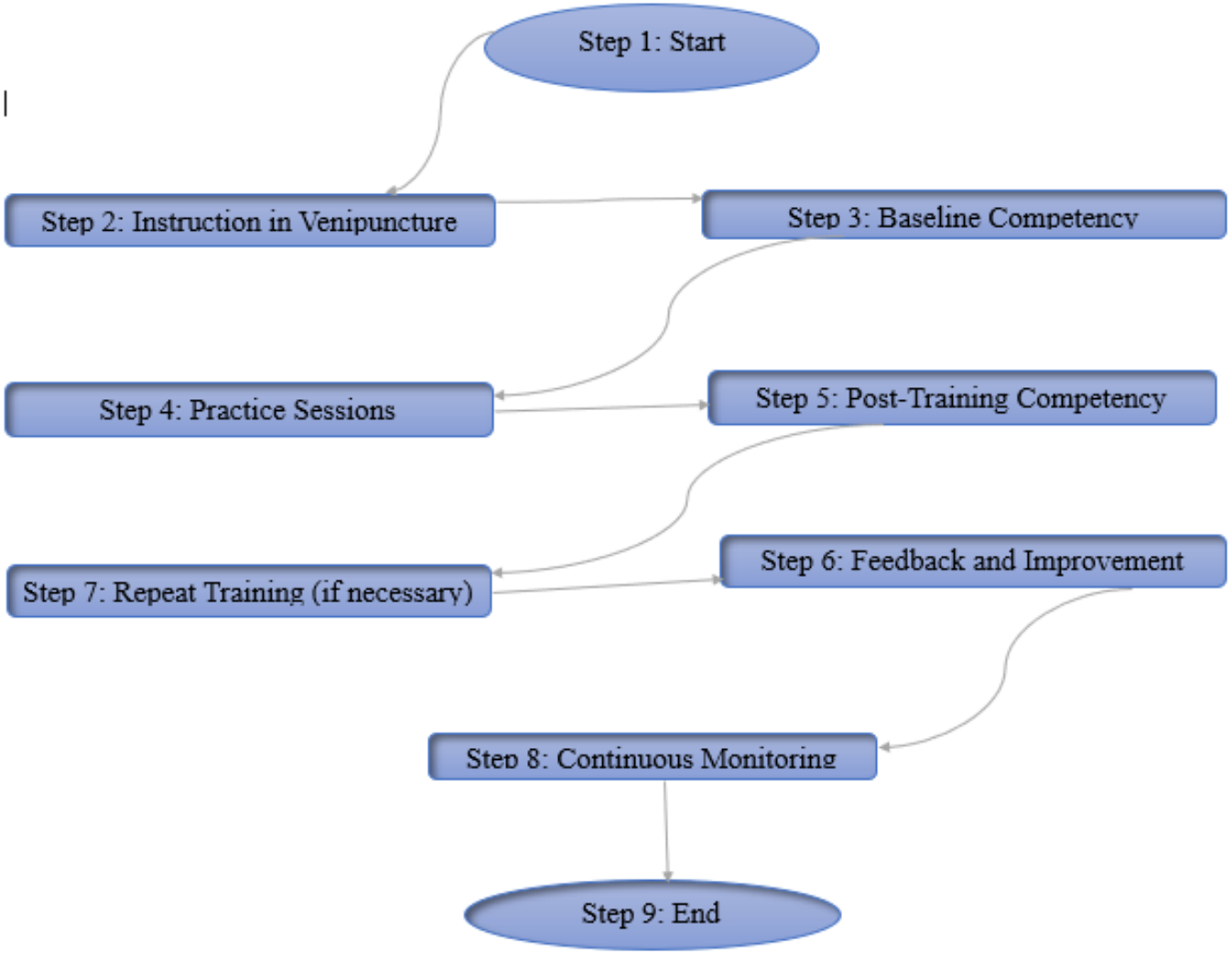
				instruments		innovation into safer clinical practice completely.	nursing training for peripheral venipuncture using ultrasound technology. It suggests that CPGs should adopt ultrasound as a standard teaching tool to increase success rates and safety in venipuncture.
Reed et al. (2017)	To evaluate the impact of deviations from the guideline venipuncture procedure on efficiency and failure rates using a computer simulation model	Not applicable (Simulation study).	Simulation model study	Probability of successfully obtaining a blood sample, procedure completion time, impact of deviations on hemolysis rate	Venipuncture procedure variations	Deviations from the venipuncture procedure guidelines can significantly increase blood sample hemolysis and laboratory rejection. Efficiency is influenced by equipment layout and patient vein prominence.	The study emphasizes that standardizing venipuncture procedures and equipment arrangements would benefit healthcare facilities, thereby backing up CPG development for training that ensures uniform and error-free blood collection practices across different places.
Siju et al. (2023)	To develop a standardized method for the education, training, and competency assessment of clinical staff to improve healthcare delivery	Clinical staff, including nurses and unlicensed assistive personnel, in an ambulatory care network	Descriptive article	Development and implementation of a comprehensive framework for new hire orientation and ongoing staff competency	Structured education and training program	Successful establishment of a standardized training and competency evaluation method, enhancing staff performance and patient care quality	Supporting the necessity of imposing well-organized training schemes in CPGs which are designed to enhance clinical personnel's competence, particularly those who specialize in phlebotomy, to minimize pre-analytical errors and improve patient outcomes
Stankovic et al. (2023)	To assess the competency of blood collectors/phlebotomists across multiple healthcare institutions and improve pre-	447 blood collectors/phlebotomists from 46 healthcare institutions	Q-Probes study	Competency assessment of staff involved in the preanalytical phase of	Evaluation and improvement of preanalytical competencies among blood collectors	Identification of critical areas for improvement in preanalytical processes,	The study highlights that continuous competence assessment is essential for upholding high levels of quality in pre-analytic stages, which applies to

	analytic processes			laboratory testing		fostering enhanced training and standardization	CPG development targeting phlebotomy training to minimize pre-analytical errors.

Appendix B: Practice Guideline



Flowchart: CPG Process



Clinical Practice Guideline Steps

Step 1: Start

Goal: Begin the CPG for venipuncture simulation training to recognize knowledge gaps and procedural errors that cause preanalytical errors (e.g., insufficient sample, hemolyzed sample, incorrect sample identification), thus improving quality assurance of hematology laboratory units.

Process:

i. **Gap identification and needs assessment:** Conduct a thorough needs assessment to identify current phlebotomy error rates related to the pre-analytical phase, such as wrong patient identification, use of the tourniquet wrongly, or not cleaning venipuncture site adequately, among others, which account for up to 70% of all lab errors, hence necessitating targeted interventions (Aggarwal et al., 2022; Addisu et al., 2023).

ii. **Target audience selection and training sites:** Diversify participants by including both new and experienced phlebotomist nurses; different healthcare workers from various settings should be prioritized while choosing where these training should take place due to high-frequency areas associated with pre-analytical errors, which maximized effectiveness in terms of learning outcomes.

iii. **Development of Training Modules:** Design modules that address identified gaps exhaustively, covering correct patient identification; appropriate application of tourniquets during phlebotomy procedures; effective cleaning techniques for venous puncture sites using the latest evidence-based methods informed by findings from recent research studies (Aggarwal et al., 2022; Addisu et al., 2023).

iv. **Integration of Simulation Tools:** Incorporate more advanced simulators such as rubber arms with fluid systems that mimic real-life situations, thus allowing trainees to gain hands-on experience within a controlled environment, which enhances their skills before they are exposed to actual patients (Jarintanan et al., 2016; Addisu et al., 2023).

v. **Documentation:** All training materials should be well documented and recorded following current best practices for greater stakeholder transparency and continual improvement through learning.

Step 2: Instruction in Venipuncture Simulation

Goal: Provide nursing staff with knowledge and skills to minimize pre-analytical errors during venipuncture through simulation training.

Process:

i. **Choosing Tools for Simulation:** Use more advanced simulation tools, such as rubber arms with fluid systems, to provide a realistic environment where learners can practice without making errors (Jarintanan et al., 2016).
ii. **Technology Integration:** Integrate ultrasound technology into challenging venipunctures to enhance success rates and precision (Oliveira et al., 2016).
iii. **Delivery of Content:** Combine theory-based learning about anatomy, techniques used during venipuncture, and how to prevent pre-analytical errors (Fujii et al., 2014; Oliveira et al., 2016).
iv. **Personalized Learning Methods:** Create modules that cater to different levels of skills among trainees; use visual aids when necessary; adjust difficulty levels according to the needs of individual learners – this helped them achieve desired goals quickly within their comfort zones.
v. **Evaluating Progress in Learning:** Monitoring feedback gained from simulated activities or exercises during training to measure progress made by an individual towards acquiring competent knowledge on various venipuncture skills.

Step 3: Baseline Competency Assessment

Goal: Conduct a baseline competency assessment of nursing staff in venipuncture procedures to detect and deal with pre-analytic errors.

Process:

i. **Designing the Assessment Tool:** Create an assessment tool that tests theoretical and practical knowledge on various phlebotomy areas (Dey et al., 2023).
ii. **Conducting the Assessment:** Organize sessions where nurses can demonstrate their skills on simulation models; they should also be able to understand pre-analytical variables alongside correct procedures through the KAP model questionnaire.
iii. **Analyzing Results:** Review the assessment's findings to identify strengths and weaknesses while prioritizing those areas that might lead to pre-analytical errors (Aggarwal et al., 2022; Addisu et al., 2023).

iv. **Feedback and Initial Improvement Actions:** Give prompt feedback and start with targeted training sessions to address critical gaps discovered during assessments made earlier.
v. **Documentation and Reporting:** Record all findings; then prepare detailed reports about essential skills and areas that need improvement to guide further development of training programs.

Step 4: Practice Sessions

Goal: Enhance venipuncture skills and reduce pre-analytical errors through specific practice sessions built on essential knowledge and skills obtained from previous training.

Process:

i. **Skill Reinforcement and Error Reduction:** Carry out repetitive hands-on practice sessions using typical and complex simulation models to reinforce skills and correct errors (Kodikara et al., 2023; Aggarwal et al., 2022).
ii. **Incorporation of Real-Time Feedback:** Offer immediate feedback through direct observation and mechanisms that provide real-time feedback to foster learning and enhance competence (Dey et al., 2023).
iii. **Scenario-Based Drills:** Employ drills based on complex clinical scenarios to promote quick thinking when under pressure.
iv. **Use of Advanced Simulators:** Use sophisticated simulators that imitate various venipuncture complexities to improve procedural accuracy and tactile skills.
v. **Focused Sessions on Preanalytical Error Reduction:** Have sessions targeting the reduction of particular pre-analytical errors using case studies and current research findings that illustrate consequences and best practices (Iqbal et al., 2023).
vi. **Documentation and Continuous Improvement:** Record all the sessions, feedback given or received, and any improvements made; such data should be used regularly to improve training approaches (Lee, 2019).

Step 5: Post-Training Competency Assessment

Goal: Validate training effectiveness by assessing practical competency and error reduction.

Process:

i. **Designing the Assessment Tool:** Integrate assessments to evaluate venipuncture technique and error understanding (Ahlin et al., 2017).

ii. **Execution of the Assessment:** Conduct assessments under observed conditions to simulate real-world challenges.
iii. **Analysis and Feedback:** Analyze data, give feedback, and use findings to improve training processes.
iv. **Documentation and Reporting:** Record performance trends and training effectiveness.
v. **Continuous Improvement:** Adjust training based on outcomes for ongoing enhancement.

Step 6: Feedback and Improvement
Goal: Improve training efficiency with feedback loops and process quality improvement.

Process:
i. **Feedback Collection:** Conduct a post-training survey and analyze qualitative and quantitative data.
ii. **Implementation of Improvements:** Modify training after targeted improvements have been suggested to improve training (Gupta et al., 2021).
iii. **Continuous Quality Improvement:** Use the PDSA model for the training to evolve with the best practices and feedback.

Step 7: Repeat Training (if necessary)
Goal: Provide more training to the personnel who do not meet the competency standards.
Process:
i. **Identification of Training Needs:** Assess and receive feedback to identify needs.
ii. **Design and Implementation of Tailored Training Programs:** Delivery of customized programs according to the detected needs and up-to-date practices (Kodikara et al., 2023; Lee et al., 2019).
iii. **Monitoring and Evaluation:** Monitor and assess the effects of re-training on skills and error rate.
iv. **Feedback Integration:** Keep improving training upon receiving feedback.
v. **Documentation and Reporting:** Record actions and results to direct future approaches.

Step 8: Continuous Monitoring
Goal: Consistently comply with venipuncture protocols and best practices through constant audit and training.
Process:
i. **Regular Audits:** Carry out periodic audits to evaluate and confirm protocol compliance.

ii. **Ongoing Training and Refresher Courses:** Offer continuous training to ensure the staff stays updated on the best practices and new technologies.
iii. **Alignment with New Evidence and Technologies:** Revise training and protocols per current developments.

Step 9: End

Goal: To close the first CPG introduction and design regular updates.

Process:

i. **End:** Formally end the implementation stage after training results have been validated.
ii. **Periodic Review and Update:** Plan regular reviews of the CPG as new evidence and review feedback (Cassidy et al., 2021).
iii. **Implementation Review and Update:** Stankovic et al. (2023) recommend continuously reviewing and adjusting the CPG to ensure its efficacy.

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Appendix C: AGREE II Evaluation Tool

Domain	**Item**	**AGREE II Rating**						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
Scope and purpose	1. The guideline's overall objective(s) is (are) specifically described.							
	2. The health question(s) covered by the guideline are (are) specifically described.							
	3. The population (patients, public, etc.) to which the guideline is meant to apply is specifically described.							
Stakeholder involvement	4. The guideline development group includes individuals from all the relevant professional groups.							
	5. The views and preferences of the target population (patients, the public, etc.) have been sought.							
	6. The target users of the guideline are clearly							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
	defined.							
Rigor of development	7. Systematic methods were used to search for evidence.							
	8. The criteria for selecting the evidence are clearly described.							
	9. The strengths and limitations of the body of evidence are clearly described.							
	10. The methods for formulating the recommendations are clearly described.							
	11. The health benefits, side effects, and risks were considered when formulating the recommendations.							
	12. There is an explicit link between the recommendations and the supporting evidence.							
	13. Experts							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
	externally reviewed the guideline before its publication.							
	14. A procedure for updating the guideline is provided.							
Clarity of presentation	15. The recommendations are specific and unambiguous.							
	16. The different options for management of the condition or health issue are presented.							
	17. Key recommendations are easily identifiable.							
Applicability	18. The guideline describes the facilitators and barriers to its application.							
	19. The guideline provides advice and tools on how the recommendations can be implemented.							
	20. The potential							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
	resource implications of applying the recommendations have been considered.							
	21. The guideline presents monitoring and auditing criteria.							
Editorial independence	22. The views of the funding body have not influenced the guideline's content.							
	23. The competing interests of guideline development group members have been recorded and addressed.							

Overall Guideline Assessment	1. Rate the overall quality of this guideline.	**1** *Lowest possible quality*	**2**	**3**	**4**	**5**	**6**	**7** *Highest possible quality*
Overall Guideline Assessment	2. I would recommend this guideline for use.	*Yes*		*Yes, with modifications*				*No*

https://www.agreetrust.org/wp-content/uploads/2013/10/AGREE-II-Users-Manual-and-23-item-Instrument_2009_UPDATE_2013.pdf