International Journal of
Digital Health & Patient Care
e-ISSN : 3023-851X
https://ndpapublishing.com/index.php/

Assessment of Knowledge, Practices and Associated Factors of Nurses on Blood Sample Collection at Two Health Care Centers in Sri Lanka

Egodawaththe Gedara Kanchana Nılmını Egodawaththa[1], Saheed Shiffana[*2], Rathnayaka Mudıyanselage Madushanka Bhagya Rathnayaka[3], Hewageegana Thushara Naleen Hewageegana[1] And Samarakoon Jayasundara Mudiyanselage Shahini Hasanthika Thaldena [4]

[1]Teaching Hospital, Anuradhapura, Sri Lanka
[2]School of Medical Laboratory Technology, Peradeniya, Sri Lanka
[3]Base hospital, Rikillagaskada, Sri Lanka
[4]Open University, Sri Lanka

Article Info
Received: 18 March 2025
Revised: 17 May 2025
Accepted: 08 June 2025
Published: 30 June 2025

Keywords
Nurses
Knowledge
Practices
Blood Sample Collection

ABSTRACT
Accurate blood collection is crucial for reliable diagnostic and effective patient care. This study assesses nurses' knowledge, practices and associated factors influencing venous blood collection at Teaching Hospital, Anuradapura and base hospital Rikillagaskada. A cross-sectional study was conducted among 407 nurses, with knowledge and practice levels categorized as 75% or greater was considered good, 50% to 74% as moderate and less than 50% as poor knowledge or practices. Data were collected using pre-tested, self-administered questionnaire with analysis performed in SPSS version 22.0, using chi square tests to assess associations between demographic variables, training and experience from June to December 2023, considering $p<0.05$ as statistically significant. The majority were female (90.7%, n=369), with 37.8% (n=154) aged 30-39 years. Most participants were from Teaching Hospital, Anuradaphura (79.6%), while 20.4% were from Rikillagaskada. Findings revealed 57% of nurses had moderate knowledge, while 43% exhibited poor knowledge. ICU nurses ($p<0.001$) and those with less than five years of phlebotomy experience ($p=0.017$) demonstrated significantly better knowledge levels. Nurses from Rikillagaskada outperformed those from Anuradaphura in knowledge ($p<0.001$) and practice ($p<0.001$), highlighting possible regional disparities in training quality. In terms of practice, 56.8% demonstrated moderate adherence to protocols, while 43.2% had poor practice compliance. ICU nurses ($p=0.007$) and those with 5-10 years of phlebotomy experience ($p=0.027$) exhibited significantly better practice adherence. Although workshop participation was associated with higher knowledge and practice levels, the statistical significance remained limited. These findings highlight critical gaps, reinforcing the need for structured training programs to improve compliance with best practices.

1. INTRODUCTION

Blood specimen collection is one of the most common practical skill procedures in healthcare. Collected blood samples use for laboratory tests that important decisions in diagnosis, administration and medication are based on it. Therefore, correctly performed blood sample collection is of most importance to generate quality blood results [1]. Knowledge and practice are essential to blood collection. In hospital laboratories receive many complaints regarding clinically incompatible test results from the clinicians while analytical and post analytical phases are in control to the best of our knowledge. The analytical error rate has been reduced due to improvements in both reliability and standardization of analytical techniques, reagents, and instrumentation. Also advances in information technology, quality control and quality assurance methods [2,3]. There are higher numbers of percentages on pre-analytical errors, 46% to 68 % [4]. As such that most of those incompatibilities could result from erroneous of blood sample collection in pre-analytical phase [5].

There was a questionnaire survey conduct in Sweden to evaluate clinical practice that related in blood sample collection, data were collected over three-month period in 2006-2007. About 164 phlebotomy staff from 25 primary healthcare

*Corresponding author
*e-mail: sshiffana@gmail.com
ORCID ID: 0009-0005-6823-7076

Research Article/ DOI: 10.5281/zenodo.15777483

How to cite this article
Egodawaththa, E. G. K. N., Shiffana, S., Rathnayaka, R. M. M. B., Hewageegana, H. T. N., And Thaldena, S. J. M. S. H. (2025). Assessment of Knowledge, Practices and Associated Factors of Nurses on Blood Sample Collection at Two Health Care Centers in Sri Lanka. *Int. J. Digital Health & Patient Care*, 2(1), 24-30

centers in north Sweden. Their findings at the low proportions at patient identification (53%). However, regarding the correct procedure of always ensure patient ID and information on test request, the vast majority (79%) of the participants reported practices [6].

The cross-sectional survey study was to identify emergency nurses' knowledge, attitudes, and practices related to blood sample hemolysis prevention and explore associations between these factors and demographic characteristics. A study-specific instrument was used. 5000 Emergency Nurses Association members, and 427 usable surveys were returned (response rate=8.5%). Only 85 participants (19.9%) answered all 3 knowledge questions correctly. Answering the 3 knowledge questions correctly was significantly associated with being a certified emergency nurse (χ^2=7.15, P<0.01). Findings suggest that emergency nurses lack some knowledge related to blood sample hemolysis prevention best practices. Attitudes toward phlebotomy practices may be a reason practice has not changed [7].

In our day-to-day practice we have observed many pre-analytical errors which warrants sample rejection and incompatible test results. Erroneous of blood sample collection is one of the major reasons. Knowledge and practices on blood sample collection has a significant impact on this phenomenon. Therefore, assessment of knowledge and practices of nurses on blood sample collection is imperative. So far to the best of our knowledge no such study has been done in the two selected hospitals.

There have been a very few research studies conducted on this topic in Sri Lanka. Since, the findings of this study will be significant in many ways. It will catalyze more research on this topic. This study's findings will aid in determining the need for improving training and education of the nurses. The present study is significant for various reasons. First, this study aims to determine the knowledge and practices of nurses on blood sample collection. Second, this study will identify the demographic factors associated with knowledge and practice of nurses on blood sample collection. As a result, the findings of this study can help the medical staff to minimize the errors in the pre-analytical phase. Therefore, aim of this study was to describe the level of knowledge and practices of nurses on blood sample collection at teaching hospital Anuradhapura and district base hospital Rikillagaskada.

2. MATERIALS AND METHODS

2.1. Study Design, Settings, Period, Sample Size

A descriptive cross-sectional study design was adopted in two hospitals from Sri Lanka the Teaching Hospital Anuradhapura and the Base hospital Rikillagaskada during June 2023 to December 2023. The nursing officers who are attached to the teaching hospital Anuradhapura (1114) and base hospital Rikillagaskada (102) during the data collection period. Total sample size was calculated using Yamane formula [8]. Total sample size was 415. The convenience sampling technique was adopted for sampling from the teaching hospital Anuradhapura (324) and base hospital Rikillagaskada (83).

2.2. Study Population, Inclusion and Exclusion Criteria

The staff nurses who wished to participate with age more than 18 years, both gender working from different departments (such as wards, emergency, intensive care units, etc.) with different working shifts (day and night), diversity in experience and who gave informed consent were recruited for this study. Grade one nursing officers and special grade nursing officers, nursing officers attached to the pediatrics units and nursing officers who participated to the pre-test were excluded. Pediatrics units' nurses excluded because they are following special blood collection procedure.

2.3. Data Collection and Data Collection Tools

Data were collected from June to November 2023 with the pre-tested self-administered questionnaire which consists of three parts was administered to the study participants. The questionnaire was developed based on the experts' opinions, relevant guidelines available in Sri Lankan and global context and through extensive literature search. İnitially, questionnaire was prepared in English language then it was tranlated to local lagugages (Sinhala and Tamil). Content validity of the tool was assessed by group of experts after formal forward, backward translations. In Part A, it discovers the socio-demographic data (Age, Gender, Ethnicity, Marital status, Highest educational qualification, Duration of experience as a staff nurse and current working unit) (9 questions) while Part B goes through the knowledge towards blood sample collection for laboratory analysis (11 questions). Part C consists of questions related to participants' practice towards blood sample collection for laboratory analysis (21 questions). The majority of the questions were multiple choice type and best

answer type questions in part B and C. The pre-test was carried out among 10 staff nursing officers at the teaching hospital Anuradhapura and base hospital Rikillagaskada and reliability was checked. Participants asked to fill the questionnaire within 15-20 minutes under researchers supervision.

2.4. Ethical Approval and confidentiality

The study protocol was approved by the Ethics committee of the Open University, Sri Lanka. (Ethics Committee Approval: FH-ERC-30). Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participants' rights. The research strictly adhered to the ethical principles of the declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures and confidentiality measures. Names or identical details of person were not included in questionnaire. Serial numbers were used for collection of data.

2.5. Statistical Analysis

Results were expressed in frequency and percentage. Proportion analysis, chi square test, Correlation and regression analysis were done using the Statistical Package for the Social Sciences (SPSS) version 22.0, with the p-value<0.05 considered as statistically significance. A score of 75% or greater was considered good, 50% to 74% as moderate and less than 50% as poor knowledge or practices [9].

3. RESULTS

3.1. Reliability Testing and Validation

According to reliability analysis Cronbach's alpha value was 0.820, which exceeds the generally accepted threshold of 0.70. So, the result suggests that the questionnaire has good internal consistency and reliably measures. Content validity was assessed by expert judgment.

3.2. Demographic Characteristics and Response Rate Of Study Participants

There was a preponderance of females among the study population (90.7%, n=369). Majority of participants were belonging to the 30 to 39 years age group (37.8%, n=154). All the participants were resonded to all the questions. Among study participants, 79.6% (n=324) were from Teaching hospital Anuradhapura and 20.4% (n=83) were from district base hospital, Rikillagaskada (Figure 1-3).

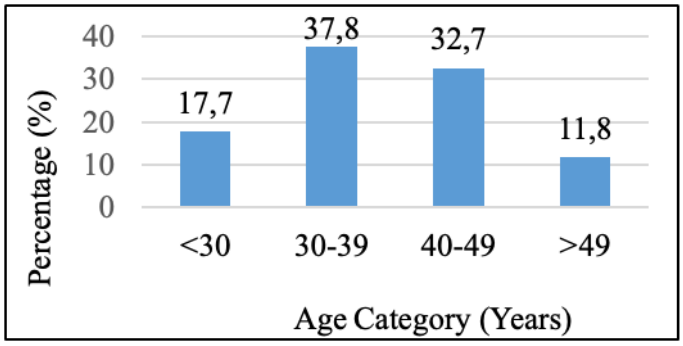

Figure 1. Age distribution among the participants

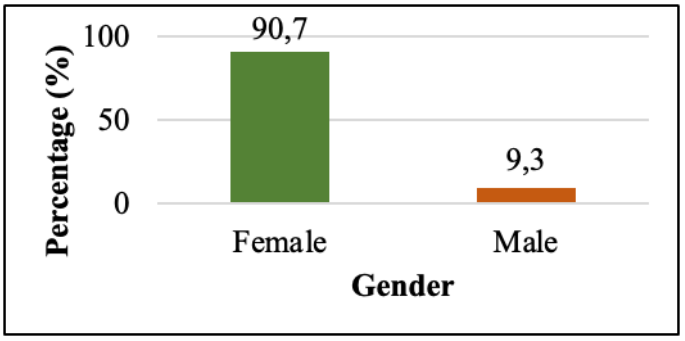

Figure 2. Gender distribution among the participants

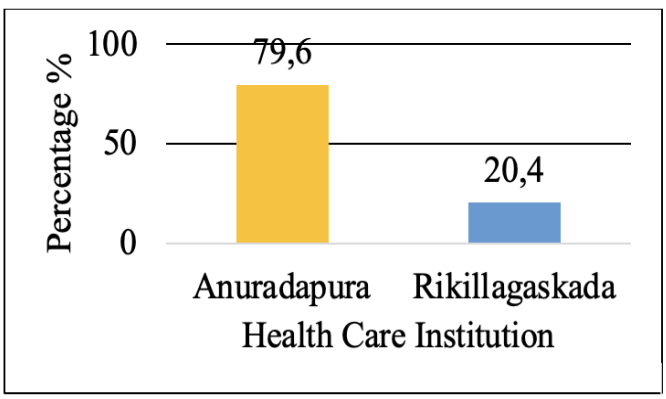

Figure 3. Healthcare institution distribution among the participants

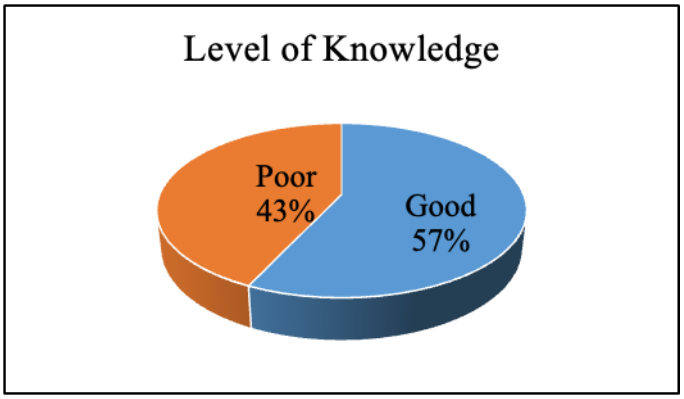

Figure. 4. Level of Knowledge among the participants

3.3. Nurses' Knowledge Towards Blood Sample Collection

Out of 407 participants, 57% (n=232) demonstrated moderate knowledge, while 43% (n=175) had poor knowledge (Figure 4). Female nurses exhibited slightly higher knowledge levels (71.0%) compared to male nurses (55.6%); however, the difference was not statistically significant (χ^2=0.518, p=0.066). Knowledge levels did not significantly vary across age groups (χ^2=0.43, p=0.934). Nurses from Rikillagaskada had significantly good knowledge levels (74.7%) compared to those from Anuradhapura (52.5%) (χ^2=13.322, p<0.001). knowledge levels were similar among nurses with HND (56.7%) and those with BSc/MSc (57.5%), with no significant diffeence (χ^2=0.767, p=0.681). Nurses with less than 1 year of experience exhibited the moderate knowledge levels (69.7%), with statistically significance (χ^2=9.755, p=0.021). ICU nurses demonstrated the good knowledge levels (88.9%), with a significant assocoation (χ^2=32.163, p<0.001).

Nurses who attended workshops or training programs exhibited good knowledge levels (81.8%) compared to those who did not (66.7%), though the association was not significant association (χ^2=2.511, p=0.113). Nurses with less than 5 years of phlebotomy experience had the good knowledge levels (88.9%), and the association was statistically significant (χ^2=8.113, p=0.017) (Table 1).

Table 1. Summery of knowledge levels

Factor	Good Knowledge (%)	Statistical Test (χ^2)	p-value
Gender (Female vs Male)	55.6% vs 71%	0.518	0.066
Age Groups	Not significant	0.43	0.934
Location (Rikillagaskada vs Anuradhapura)	74.7% vs 52.5%	13.322	<0.001
Education (HND vs B.SC/MSc)	56.7% vs 57.5%	0.767	0.681
Experience (< 1 year)	69.7%	9.755	0.021
Unit of Work (ICU vs others)	88.9%	32.163	<0.001
Training Attendeance (yes vs No)	81.8% vs 66.7%	2.511	0.113
Phlebotomy Experience (<5 years)	88.9%	8.113	0.017

3.4. Nurses' Practice Towards Blood Sample Collection

Overall, 56.8% (n=231) demonstrated moderate practice, while 43.2% (n=176) had poor practice (Figure 5). Female nurses exhibited better practices (58.3% good practice) than male nurses (42.1% good practice), though the difference was not statistically significant (χ^2=3.666, p=0.056). No significant variation in practice levels was observed across age groups (χ^2=1.684, p=0.64). Nurses from Rikillagaskada demonstrated significantly (χ^2=44.594, p<0.001) good practices (89.2%) compared to those from Anuradhapura (48.5%).

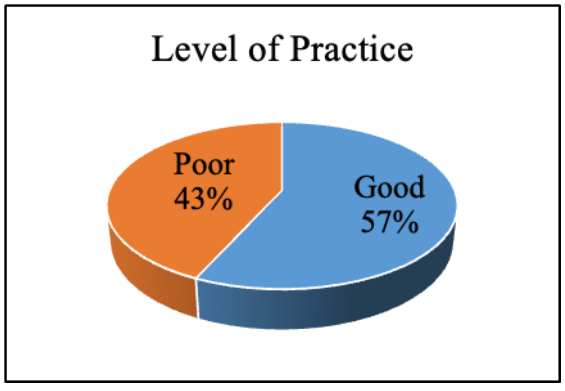

Figure 5. Level of practices among the participants

Practice levels were similar among nurses with HND (56.7%) and those with BSc/MSc (56.8%), with no significant difference (χ^2=0.765, p=0.682). Nurses with less than 1 year of experience had the highest practice levels (72.7%), with statistical significance (χ^2=9.79, p=0.02).

ICU nurses demonstrated the moderate practices (58.3%), with a significant association (χ^2=17.64, p=0.007). Nurses who attended workshops had better practices (59.9%) compared to those who did not (54.5%), though the association was not significant (χ^2=1.187,

p=0.276). Nurses with 5–10 years of phlebotomy experience had the highest practice levels (67.6%), and the association was significant (χ^2=9.208, p=0.027) (Table 2).

Table 2. Summery of practice levels

Factor	Good Knowledge (%)	Statistical Test (χ^2)	p-value
Gender (Female vs Male)	58.3% vs 42.1%	3.666	0.056
Age Groups	Not significant	1.684	0.640
Location (Rikillagaskada vs Anuradhapura)	89.2% vs 48.5%	44.594	<0.001
Education (HND vs B.SC/MSc)	56.7% vs 56.8%	0.765	0.682
Experience (< 1 year)	72.7%	9.79	0.021
Unit of Work (ICU vs others)	58.3%	17.64	0.007
Training Attendeance (yes vs No)	59.9% vs 54.5%	1.187	0.276
Phlebotomy Experience (<5 years)	67.6%	9.208	0.027

4. DISCUSSIONS

The study assessed nurses' knowledge and practice regarding blood sample collection, revealing that a majority demonstrated moderate knowledge (57%) and practice (56.8%), while a substantial proportion exhibited poor levels in both domains. These findings underscore the need for targeted interventions to enhance competencies in phelobotomy and preanalytical procedures.

The observed moderate knowledge levels align with findings from Dilshika et al [10], who reported that nurses in a Sri Lankan tertiary hospital had average to good knowlwdge, with only a small fraction achoeving excellent scores. Similarly, knowledge did not significnatly differ by age of gender in both studies, suggesting that demographic factors may not be primarly determinants of phlebotomy knowledge.

Notably, nurses from Rikillagaskada exhibited significantly higher knowledge and practice levels than those from Anuradhapura. This regional disparity may reflect differences in institutional trainnig standerds, supervision or access to continuing education. Comparable regional variations were not explicitly reported in prior studies, indicating a potential area for further investigation.

Educational qualifications (HND vs BSc/MSc) did not significantly influence knowledge or practice echoing the finding of Dilshika et al [10], who also found no cosistent correlation between academic level and phlebotomy competence. This suggests that practical exposure and on-the-job training may play a more critical role than formal education alone.

Experience emerged as a siginficant factor: nurses with less than one year of experience showed higher knowledge and practice levels, possibly due to recent training or adherence to updated protocols. This contrasts with the assumption that experience correlates with expertise and highlights the importance of continuous professional development. İnterestingly, ICU nurses and those with less than five years of phlebotomy experience demonstraed significanlty better knowledge and practice, consistent with the idea that high-acuity setting demand stricter adherence to protocols [11].

Although workshop attendance was associated with improved knowledge and practice, the differeces were not statistically significant. This may reflect variability in workshop quality or retention of knowledge over time. Nonetheless, previous literature empasizes the value of structured training programs in improving preanalytical practices [10].

A substantial proportion of nurses exhibited inadequate comphrehension of optimal tourniquet application and appropriate needle gauge selection for venipuncture. This observation is consistent with studies by Lippi et al [12] and Melkie et al [13], Which identified improper tourniquet utilization as a primary contributor to hemolysis and erroneous laboratory results. Furthermore, Saleem et al [14] demonstrated that prolonged tourniquet application induces alternations in hematological parameters, reinforcing the necessity for rigorous procedural training.

While the majority of nurses correctly defined hemolysis, many lacked a nuanced understanding of its etiological factors and its implications for laboratory analytics. This finding corroborates the work of Dorotić et al [15], who reported that only 50% of surveyed nurses possessed a comphrehensive grasp of hemolysis-related interferences in biochemical assays. Additionally, nurses who had participated in structured trainnig programs exhibited superior knowledge levels, supporting the conclusions of Arslan et al [16], who demonstraed that systematic

educational interventions significantly mitigate preanalytical errors. Similarly, Bölenius et al [17] established that large-scale competency-based trainnig enhances adherence to venous blood collection guidelines.

A relatively small subset of nurese consistently adhered to proper specimen labeling protocols, a finding that parallels studies by Wallin et al [18] and Söderberg et al [19], which linked suboptimal labeling practices to paient misidentfication errors. Van Dongen-Lases et al [20] emphasized the critical need for harmonized labeling protocols to enhance Patıent safety and specimen traceability.

Morever, a considerable proportion of nurses failed to comply with the prescribed order of draw or adequately homogenize blood specimens, corroborating findings by Melkie et al [13] identified these procedural lapses as significant sources of preanalytical variability. Simundic et al [21] underscored that deviations from CLSI guidelines exacerbate the risk of sample contamination, therby compromising diagnostic accuracy.

Although most nurses demonstrated adherence to hand hygiene protocols, few consulted standardized procedural guidelines when encountering uncertainly. This observation aligns with Nilsson et al [22], who reported frequent deviations from best practices among nuesing students due to insufficient exposure to competency-based training. Notably, nurses at Rikillagaskada exhibited superior knowledge and procedural compliance compared to their counterparts at Anuradhapura, potentially attributable to disparities in trainnig frequency and institutional quality assurence frameworks. This finding is consistent with Nilsson et al [6], who highlighted the pivotal role of workplace culture in shaping phlebotomy practices.

5. Conclusion

These findings underscore the necessity for targeted educational interventions to address knowledge and practice deficiencies in blood specimen collection. İmplementing competency-based training, standardizing procedural protocols and fostering a culture of adherence to evience-based best practices are essential to mitigating preanalytical errors and enhancing diagnostic reliability.

Limitations of the study

There were some limitations. Firstly, the sample size was low. Secondly participant selection was conveniance sampleing method.

Recommondations

Based on the findings of this study, several key recommedations can be proposed to improve nurses' knowledge and practice in blood sample collection. Firstly, competency-based training programs should be implemented, ensuring that nurses receive hands-on experience in venipuncture techniques, specimen labeling, and adherence to standerdized guidelines. Second, instituteions, should develop structured refresher courses to reinforce critical concepts over time, preventing knowledge decay and enhancing procedural adherence. Third, regional disparities in trainnig quality should be addressed by harmonizing educational frameworks, ensuring all nurses regardless of location have access to high quality instruction. Lastly, workshops and professional development programs should be optimized to provide evidance-based stategies for minimizing preanalytical errors and improving diagnostic accuracy. Strengthening thses interventions will help bridge the knowledge–practice gap, ultimatley improving healthcare outcomes.

Acknowledgement

Our sincere and heartfelt thanks to our study participants.

Conflict of Interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Committee

The study protocol was approved by the Ethics Committee of the Open University, Sri Lanka. (Ethics Committee Approval: FH-ERC-30).

Author Contributions

Study Design, EGKNE, RMMBR, SS; Data Collection, EGKNE, RMMBR, SJMSHT; Statistical Analysis, EGKNE, RMMBR, SS; Data Interpretation, EGKNE, RMMBR, SS; Manuscript Preparation, EGKNE, SS; Literature Search, EGKNE, RMMBR, SS; Questionnaire modification, SS, HTNH; Investigation, EGKNE, RMMBR, SS; Writing- review and editing, SS, EGKNE; Supervision, SS. All authors have read and agreed to the published version of the manuscript.

REFERENCES

1. Da Rin, G. (**2009**). Pre-analytical workstations:A tool for reducing laboratory errors. *Clinica Chimica Acta; International Journal of Clinical Chemistry, 404*(1), 68–74. [CrossRef] [PubMed]

2. Ceriotti, F., Cappelletti, P., Caputo, M., Serio, F. D., Messeri, G., Ottomano, C., Plebani, M., & Soffiati, G. (**2012**). A risk-analysis approach to the evaluation of analytical quality. *Clinical Chemistry and Laboratory Medicine, 50*(1), 67–71. [CrossRef]
3. Lippi, G., Avanzini, P., Sandei, F., Aloe, R., & Cervellin, G. (**2013**). Blood sample contamination by glucose-containing solutions: Effects and identification. *British Journal of Biomedical Science, 70*(4), 176–179. [CrossRef]
4. Najat, D. (**2017**). Prevalence of pre-analytical errors in clinical chemistry diagnostic labs in Sulaimani City of Iraqi Kurdistan. *PLOS One, 12*(1), e0170211. [CrossRef] [PubMed]
5. Ashavaid, T. F., Dandekar, S. P., Keny, B., & Bhambhwani, V. R. (**2008**). Influence of blood specimen collection method on various preanalytical sample quality indicators. *Indian Journal of Clinical Biochemistry, 23*(2), 144–149. [CrossRef]
6. Nilsson, K., Juthberg, C., Söderberg, J., Bölenius, K., Grankvist, K., Brulin, C., & Lindkvist, M. (**2015**). Associations between workplace affiliation and phlebotomy practices regarding patient identification and test request handling practices in primary healthcare centres: A multilevel model approach. *BMC Health Services Research, 15*, 503. [CrossRef] [PubMed]
7. Burchill, C. N., Seballos, S. S., Reineks, E. Z., & Phelan, M. P. (**2021**). Emergency nurses' knowledge, attitudes, and practices related to blood sample hemolysis prevention: An exploratory descriptive study. *Journal of Emergency Nursing, 47*(4), 590–598.e3. [CrossRef] [PubMed]
8. Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper and Row.
9. Mehta, A., & Diwakar, M. K. (2021). Impact of educational intervention on knowledge, attitudes, and practices of laboratory technicians regarding universal work precautions at a tertiary health care center in central India. *Applied Biosafety, 26*(Suppl 1), S27–S33. [CrossRef] [PubMed]
10. Dilshika, L., Bandara, W., & Karunanayaka, A. (**2020**). A study on sample rejection rates due to pre-analytical errors: Associated factors and knowledge, attitudes, and practices of nurses on blood sample collection for haematology at a teaching hospital in Sri Lanka. *Journal of Health Sciences and Innovative Research, 1*(01). [CrossRef]
11. OpenStax. (**2024**). Blood sampling. In *Clinical nursing skills*. *Medicine LibreTexts*. [CrossRef]
12. Lippi, G., et al. (**2011**). Preanalytical quality improvement: From dream to reality. *Clinical Chemistry and Laboratory Medicine, 49*(7), 1113–1126. [CrossRef] [PubMed]
13. Melkie, M., Girma, A., & Tsalla, T. (**2014**). The practice of venous blood collection among laboratory and non-laboratory professionals working in Ethiopian Government Hospitals: A comparative study. *BMC Health Services Research, 14*, 88. [CrossRef] [PubMed]
14. Saleem, S., et al. (**2009**). A prospective study of causes of haemolysis during venepuncture: Tourniquet time should be kept to a minimum. *Annals of Clinical Biochemistry, 46*(Pt 3), 244–246. [CrossRef] [PubMed]
15. Dorotić, A., et al. (**2015**). Hemolysis from a nurses' standpoint—Survey from four Croatian hospitals. *Biochemia Medica, 25*(3), 393–400. [CrossRef] [PubMed]
16. Arslan, F. D., Karakoyun, I., Basok, B. I., Aksit, M. Z., Celik, E., Dogan, K., & Duman, C. (**2018**). The effects of education and training given to phlebotomists for reducing preanalytical errors. *Journal of Medical Biochemistry, 37*(2), 172–180. [CrossRef]
17. Bölenius, K., et al. (**2013**). Impact of a large-scale educational intervention program on venous blood specimen collection practices. *BMC Health Services Research, 13*, 463. [CrossRef] [PubMed]
18. Wallin, O., Söderberg, J., Van Guelpen, B., Stenlund, H., Grankvist, K., & Brulin, C. (**2010**). Blood sample collection and patient identification demand improvement: A questionnaire study of preanalytical practices in hospital wards and laboratories. *Scandinavian Journal of Caring Sciences, 24*(3), 581–591. [CrossRef]
19. Söderberg, J., et al. (**2010**). Is the test result correct? A questionnaire study of blood collection practices in primary health care. *Journal of Evaluation in Clinical Practice, 16*(4), 707–711. [CrossRef]
20. van Dongen-Lases, E. C., et al. (**2016**). Patient identification and tube labeling—A call for harmonisation. *Clinical Chemistry and Laboratory Medicine, 54*(7), 1141–1145. [CrossRef] [PubMed]
21. Simundic, A.-M., et al. (**2015**). Compliance of blood sampling procedures with the CLSI H3-A6 guidelines: An observational study by the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) working group for the preanalytical phase (WG-PRE). *Clinical Chemistry and Laboratory Medicine, 53*(9), 1321–1331. [CrossRef] [PubMed]
22. Nilsson, K., Grankvist, K., Juthberg, C., Brulin, C., & Söderberg, J. (**2014**). Deviations from venous blood specimen collection guideline adherence among senior nursing students. *Nurse Education Today, 34*(2), 237–242. [CrossRef]

Copyright: © 2025 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/ licenses/by/4.0/).