South Asian Journal of Research in Microbiology

Volume 18, Issue 1, Page 35-43, 2024; Article no.SAJRM.111274
ISSN: 2582-1989

Determination of Perception and Knowledge of Specimen Rejection Criteria in the Laboratory among Medical Doctors in Southern Nigeria

Igunma A. Jeremiah [a], Bob-Manuel Mienye [b] and Ejime Ebeigbe [a*]

[a] Department of Medical Microbiology, University of Benin Teaching Hospital, Benn City, Nigeria.
[b] Department of Medical Microbiology, Rivers State University Teaching Hospital, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author IAJ conceptualized and designed the study. Author EE produced the manuscript draft, Author BM and EE analyzed the data, Author EE and IAJ contributed to drafting of the manuscript, Author BM reviewed the manuscript. All authors approved the manuscript for submission. All authors read and approved the manuscript.

Article Information

DOI: 10.9734/SAJRM/2024/v18i1341

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/111274

Original Research Article

Received: 01/11/2023
Accepted: 03/01/2024
Published: 13/01/2024

ABSTRACT

Background: Laboratory diagnosis plays a major role in the clinical management of patients, as such, specimen handling errors should be avoided at all costs. Laboratory results are largely dependent on the quality and conditions of the specimens received for analysis. Every laboratory has a set of standard rejection criteria for samples.
Since the pre-analytical stage of specimen handling lies in the purview of the medical practitioners who make the request, the aim of this study was to assess the knowledge of medical doctors regarding specimen appropriateness and their perception of specimen rejection criteria.

**Corresponding author: Email: ejimenicholas@googlemail.com;*

Methods: A descriptive cross-sectional survey was performed using a Google form which was distributed to medical practitioners practising in the southern part of Nigeria through various medical association WhatsApp groups, between April and September 2021. The self-administered questionnaire made up of three sections was used to obtain data on socio-demographic characteristics, the knowledge, and perception of medical doctors regarding good sample management practices.
Results: Most of the respondents were senior registrars, medical officers and consultants employed in Teaching Hospitals.
50 (50%) of the doctors had good knowledge of sample rejection, while 30(30%) had poor knowledge. In the same vein, 80(80%) of the respondents had good perception of specimen rejection criteria, while four (4%) had poor perception.
The relationship between the knowledge of respondents on sample rejection criteria and their office ranks was statistically significant ($p<0.05$) as well as the association between the facilities the doctors worked in and their knowledge of sample rejection criteria.
Conclusion: Since a significant percentage of doctors still demonstrate inadequate knowledge and perception, all hands must be on deck to improve knowledge regarding specimen collection and handling. The authors believe that this is remediable by improved training and quality assurance measures.

Keywords: Pre-analytical error; specimen rejection; laboratory error; perception, knowledge.

1. INTRODUCTION

The clinical laboratory plays a pivotal role in routine patient management, this dependence of patient management on laboratory output and data, emphasizes the need for ensuring optimal quality of these services [1,2]. The quality of a good laboratory stands on the tripod of precision, accuracy, and short turnaround time [3]. Due to the crucial role laboratory diagnoses play in the clinical management of patients, errors should be avoided at all costs. These errors may occur during the pre-analytical stage, analytical or post analytically. According to laboratory experts, the pre-analytical stage, a crucial part of laboratory medicine, accounts for 70% of errors [4,5]. According to the International Organization for Standardization (ISO)15189:2012, the pre-analytical phase is defined as processes that start in an arranged order from the doctor's request and, preparation and identification of Patients, collection of basic and implicated samples with movement to and within the laboratory and stops when the analytical step begins [6]. Laboratory results are largely dependent on the quality and conditions of the specimens received for analysis. The most trusted approach is to prevent pre-analytical errors through standardization of the pre-analytical process [7]. Hence, inappropriately collected, transported or preserved specimen should qualifies for rejection.

Specimens are rejected by the laboratory if they do not meet predefined technical requirements for each specific analyte [8]. In the event of sample rejection, it is imperative to inform the clinical team who made the request that the sample is unsuitable for analysis and request a fresh sample to be collected [9]. In general, specimen rejection rate reflects the quality of the pre-analytical process of the laboratory workflow, which include tests selection, sample collection, appropriate laboratory form completion and specimen transport [8].

It is the responsibility of the laboratory to determine criteria for unacceptable specimens [10]. Quality pointers / common reasons for rejection for the pre-analytical phase include labelling errors, no test stated on the request form, illegible requests, clotting, inadequate blood volume, improper sample tube, haemolysis, and incorrect temperature during sample transport or storage [11,12,13]. Specimen rejection has clinical consequences on patient management such as delay in the performance and reporting of the results of the ordered tests, avoidable cost and associated complications including hematoma and iatrogenic anaemia [14,15].

The greater responsibility for ensuring optimal preanalytical stage is in the purview of the medical practitioners who make the laboratory requests. As a result, the study aimed to assess the knowledge of medical doctors regarding specimen appropriateness and their perception of specimen rejection criteria.

2. METHODS

A descriptive cross-sectional survey was performed using a Google questionnaire form which was distributed to medical practitioners in south-south geopolitical zone of Nigeria through various medical WhatsApp groups between April and September 2021. The inclusion criterion was medical doctors with practice experience. The form was used to collect data on the knowledge and perception of medical doctors regarding good sample management practices, knowledge and perception of what constituted rejection criteria, possible sources of error in the laboratory and to mitigate it. The questionnaire consisted of Likert scale and multiple-choice questions.

2.1 Variables

To assess knowledge of sample rejection, each correct response was given 1 point and 0 points for each wrong response. The overall knowledge was graded as good (score of 16 - 20), moderate (score of 11 -15), and poor (< 10 correct responses). The perceptions of the healthcare workers were assessed on essential components that constitute laboratory sample rejection criteria using 10 non leading questions. Responses on each were assessed with Agree, Disagree and Undecided (Agree was scored as 1 while Disagree and Undecided were scored 0) the higher the score the better the perceptions. The total perceptions score was computed and the overall score was categorized into good (8-10 correct responses), moderate (5-7correct responses), and poor (1-4 correct responses).

2.2 Analysis

Descriptive statistics and fitted bivariate logistic model was used to assess inferential relationships between the characteristics of the study population and the responses to the questions assessing their knowledge and perception about the subject matter. P-value <0.05.

3. RESULTS

Of the total participants, 78(78%) of the healthcare workers worked with the Tertiary care facilities, while the General/ District Hospitals, Primary Healthcare centres and Private Hospitals accounted for the other participants. Fig. 1. The majority of the participant were males accounting for 56%. Fig. 2. With regard to age distributions, 65(65%) of the respondent were age 30–39years, while 20 (20%) were in the range of 40-49 years. The Age 50years and above accounted for 10(10%), while 5 (5%) of the respondents were between age 20-29 years. The modal age group was 30-39years (Fig. 3).

Distribution according to department showed that pathology departments had the highest number of respondents, 28 (28%), followed by Internal Medicine with 17(17%) and Surgery with 16(16%).While the department with the least participation were Anaesthesia and ENT surgery with each having 2(2%) (Fig. 4).

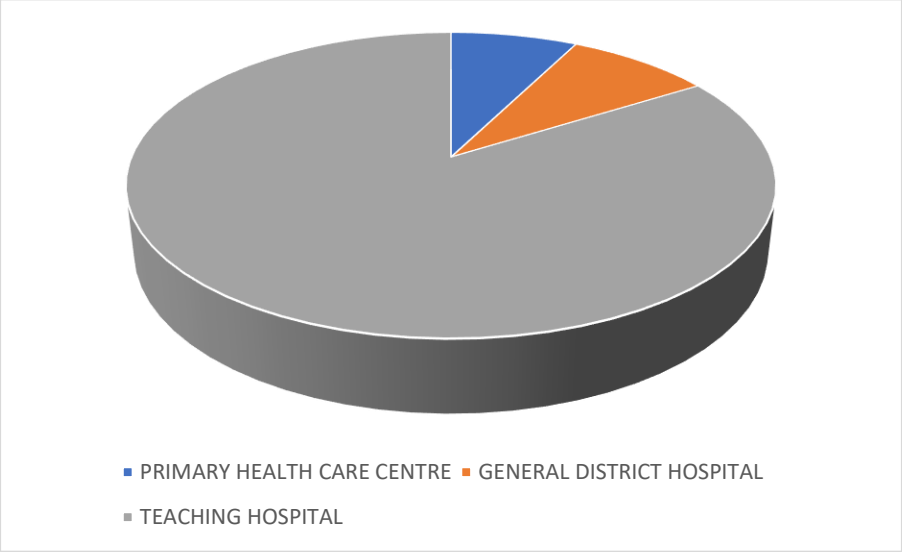

Fig. 1. Pie chart showing healthcare workers worked with the tertiary care facilities

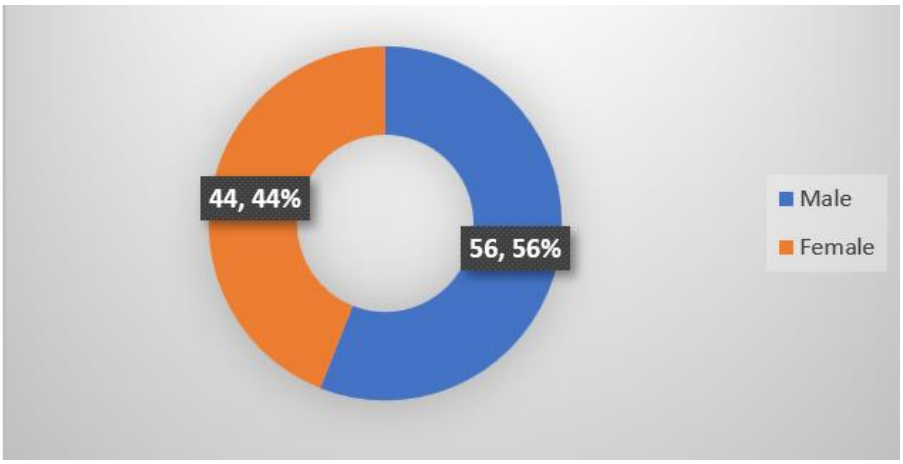

Fig. 2. Percentage sex distribution

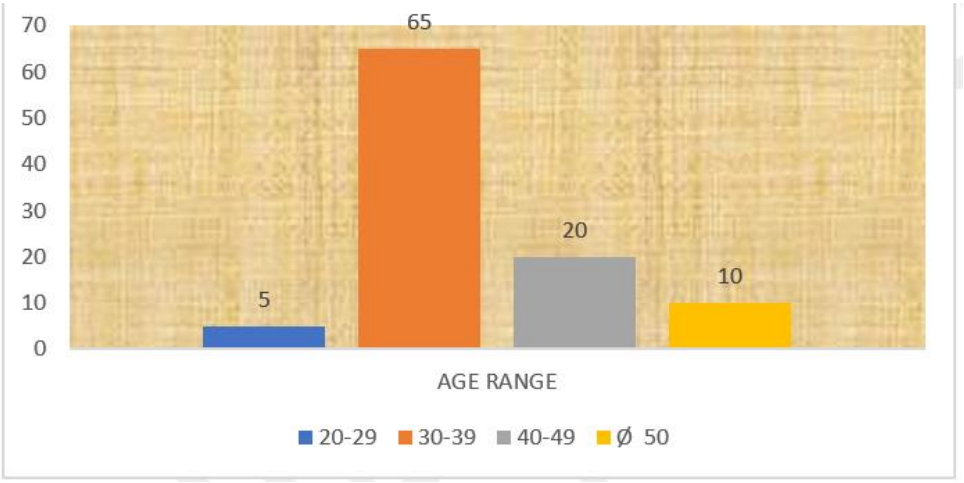

Fig. 3. Percentage age distributions of respondants

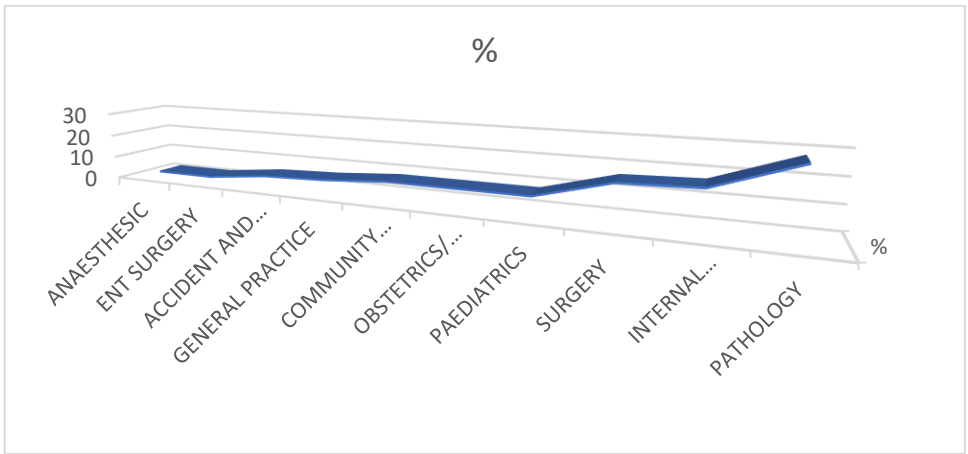

Fig. 4. Distribution according to department

In terms of rank, majority of the respondents were Senior Registrars,47 (47%), followed by Medical officers/ Registrars, 24 (24%). Consultants accounted for 23 (23%), while House officers and Principal/ Chief Medical officer had 5 (5%) and 1(1%) respectively Table 1.

Concerning possible causes of sample rejection, 100(100%) of the respondents believed lack of competence, lack of documented rejection criteria and difficulty with obtaining patient sample are strong contributors. However, only 47(47%) believed that a specimen sent with a request form devoid of patient clinical details should be rejected, Table 2.

Of the total respondents, 50(50%) had good/high knowledge of what constitutes sample rejection criteria, 20(20%) had moderate knowledge, and 30(30%) had poor knowledge (Table 2.a).

On the perception of respondents on sample rejection criteria. 80(80%) of doctors believe that the pre-analytical stage is the stage of sample processing that contributes the most to laboratory errors, all the respondents , 100(100%) agree that sample collection, handling and transportation significantly contribute to the quality of laboratory results. For question on how to minimize sample errors;98 (98%) agree that orientation of house officers will help, 83(83%) of the Doctors agree that increasing the use of automation and electronic laboratory forms will help reduce laboratory errors, 93(93%) believe that reviewing of critical results such as blood culture, CSF etc. by the pathologist before leaving the labs will reduce laboratory errors. (Table 3).

Table 3.a shows the categorization of the responses of doctors to the questions on the perception of sample rejection criteria. 80(80%) of the respondents had good perception, 16(16%) had moderate perception and 4(4%) had poor perception.

52.2% of the Consultants had good knowledge of sample rejection compared to 42.6% of Senior Registrars and 41.7% of Registrars/Medical Officers who both had good knowledge of sample rejection criteria.Table 4.

There was a statistically significant association between the level of knowledge and office ranks (P-value=0.004, P<0.05.). Also, 52.6% of respondents who work with tertiary healthcare facilities have better knowledge of sample rejection. This was statistically significant association between the level of knowledge and office ranks (P-value=0.011, P<0.05.) (Table 4).

Table 1. Rank wise distribution

RANK	Frequency	Percentage
Senior registrar	47	47%
Registrar/medical officer	24	24%
Consultant	23	23%
House officer	5	5%
Principal/chief medical officer	1	1%

Table 2. Trascription error

	Trascription Error			
		Yes (%)	No (%)	Maybe (%)
1.	Unlabeled or incorrectly label container	95	5	0
2.	Specimen sent with a request form that does not contain patient clinical details	47	26	27
3.	Specimen sent with request form not showing patient demographic details	55	22	23
4.	Request form sent without any specimen	96	2	2
5.	Appropriately labeled specimen bottle for urgent request sent to the laboratory without a request form	78	13	9
6.	Date and time of sample collection not indicated on request form	80	11	9
7.	Specimen sent with blood stain request form	31	31	38
8.	Specimen sent without name or contact of requesting doctor	44	22	34
9.	Lack of competent of sample collector	100	0	0
10.	Lack of knowledge of rejection criteria / lack of or inadequate orientation	100	0	0
11.	Difficult patient or lack of appropriate patient counseling	100	0	0

	Trascription Error			
		Yes (%)	No (%)	Maybe (%)
	Inappropriate Specimen	**Yes (%)**	**No (%)**	**Maybe (%)**
12.	Insufficient blood specimen in sample bottle	80	12	8
13.	Wound biopsy specimen for culture sent in a fixative	69	12	19
14.	Blood sample received in anticoagulant bottle not compatible/inappropriate for the test	98	0	2
15.	Specimen for culture receive in a non-sterile container	93	4	3
16.	Date and time of collection not indicated in in the request form	60	18	22
17.	Urine specimen for culture sent after two hours of collection.	51	22	27
18.	CSF sample sent after an hour of collection.	66	6	38
19.	Semen sent an hour of collection.	67	9	24
20.	Blood culture sample left in the ward overnight.	64	22	14

Table 2.a. Showing the categorization of respondents knowledge

Category	Criteria	Frequency	Percentage (%)
16-20	High	50	50
11-15	Moderate	20	20
1-10	Poor	30	30

Table 3. Perception

S/N	Question	Agree (%)	Disagree (%)	Undecided (%)
1.	Requesting doctors and clerical staff are contribute most to laboratory errors.	47	13	40
2.	The pre-analytical stage is the stage of sample processing that contribute the most laboratory errors.	80	13	7
3.	Do sample collection handling and transportation contribute significantly to the quality of the laboratory result?	1	0	0
4.	Have you experienced or observed sample rejection before?	89	11	0
	How To Minimize Laboratory Error			
5.	Orientation of house officers will help minimize errors	98	0	2
6.	Increase in automation will help reduce laboratory errors	83	17	0
7.	The use of electronic laboratory forms will minimize laboratory errors	83	17	0
8.	Clinical result should be review by the pathologist before leaving the laboratory	93	7	0
	Difficult To Obtain Specimen			
9.	Urine for culture from patient with oligouria /anuria should not b4e rejected irrespective of the state on arrival in laboratory	80	14	6
10	Blood for blood culture from extremely low birth weight neonates should not be rejected irrespective of the volume.	60	15	25

Table 3.a. Showing the categorization of respondents perception

Category	Criteria	Frequency	Percentage(%)
8-10	High/Good	80	80
5-7	Moderate	16	16
1-4	Poor	4	4

Table 4. Relationship between knowledge and perception with gender, age group, office rank, type of health facility

		Knowledge				Perception			
Factors		**Poor**	**Moderate**	**Good**	**P-value**	**Poor**	**Moderate**	**Good**	**P-value**
Gender	Male	20	16	20	0.64	4	8	44	0.82
	Female	10	4	30		0	8	36	
Age group	20-29	11	5	11	0.97	2	3	12	0.89
	30-39	3	6	15		0	6	22	
	40-49	5	7	15		0	4	32	
	>50	11	2	9		2	3	14	
Office Rank	Senior Registrar	12	15	20	0.004	0	5	42	0.53
	Registrar /Medical Officer	12	2	10		1	5	18	
	Consultant	8	3	12		3	4	16	
	House Officer	5	0	0		0	2	3	
	P/Cmo	0	1	0		0	0	1	
Type of Health Facility	Primary Health Center	1	3	3	0.011	2	3	2	0.43
	General/ District Hospital	1	3	4		1	4	3	
	Private Hospital	2	3	2		0	4	3	
	Teaching Hospital	26	11	41		1	5	72	

P<0.005 is statistically significant

4. DISCUSSION

To our knowledge, this is the first study to focus on the knowledge and perception of doctors about specimen rejection. We have included all levels of doctors from interns to consultants from all the clinical departments, and from different level of healthcare facilities our study had provided an in-depth insight of knowledge and perception of cross sections of medical doctors that work in most health facilities in southern states of Nigeria about specimen rejection.

Sometimes, investigations cannot be performed in the laboratory if samples fall short of the recommended qualities, volume or other eligibility criteria. In these cases, the sample may qualify for rejection. The summary list of reasons for sample rejection are incorrect sample types, samples in incorrect containers, insufficient sample received, no sample received, labelling or form issues (mislabeled/ unlabeled/ no forms/no clinical information, clotted/ haemolysed/ lipaemic /icteric samples-depending on the test requested. Other rejection reason include: extended time lag between sample collection and submission of samples for culture in non-sterile containers or in formalin [3].

In this study, 50 (50%) of the respondents had good knowledge about specimen rejection criteria , 30(30%) had poor knowledge. However, all the respondents agreed that lack of knowledge of these rejection criteria, inappropriate patient preparation and improper sample collection could lead to sample rejection. All these can be mitigated by starting in-depth education seminars for healthcare personnel (residents, intern doctors, nurses) especially those working in EDs and ICUs in relation to venipuncture techniques, adequate tourniquet application, use of appropriate tubes with additives, order of tubes, gentle mixing and transport(8). Other studies have shown efficient phlebotomy as a method to address particular acceptability problems, such as avoidance of hemolysis and inaccurate labelling [16-19].

The pre-analytical stage is a major part of Laboratory Medicine and accounts for 70% of errors [4,5] majority (80%) of the respondents in our study agreed. The investigation request

entails requested examinations, patient preparation and identification, sample collection, and sample transportation to the laboratory, and it terminates at the start of the analysis step. The quality and circumstances of the samples obtained for examination have a significant impact on the quality of the laboratory results [3]. Almost half of the respondents 47(47%) agreed that the requesting physician, and clerical staff who receive the sample contribute significantly to laboratory errors. Most of the physicians ,89 (89%) in our study agreed to haven experienced or observed sample rejection previously. On how to minimize laboratory errors, majority of our respondents agreed that orientation programs for house officers and other newly employed physicians will help as also suggested by Dikmen et al, 2015 [3]. The use of automated system and electronic laboratory information system was another way to reduce possible laboratory error, this also agreed with response of the majority of our respondents. Where advanced automated laboratory instruments help minimize specimen volumes and dead volume in the emergency laboratory [3].

Most of the doctors were of the opinion that critical results be reviewed by the pathologist before leaving the laboratory to minimize errors. This is most likely because they have they have the knowledge and expertise to authorize or withhold results as necessary depending on various clinical scenarios. Difficult to obtain specimens like cerebrospinal fluid or blood for culture from an extremely low birth weight neonate should not be rejected irrespective of volume or state they get to the laboratory [6].

5. CONCLUSION

The significant statistical association between the level of knowledge of rejection criteria and office ranks, suggests that experience in practice would potentially result in better specimen management. Since a significant percentage of doctors still demonstrated inadequate knowledge and perception, all hands must be on deck to improve knowledge regarding specimen collection and handling. The authors believe that this is remediable by improved training and quality assurance measures. We recommend policies and procedures specific to specimen collection, transportation, and preparation be made available to medical practitioners and should be strictly adhered to.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Solomon Getawa, Melak Aynalem, Mulugeta Melku, Tiruneh Adane. Blood specimen rejection rate in clinical laboratory: A systematic review and meta-analysis. Pract Lab Med. 2023;33e00303. ISSN 2352-5517. Available:https://doi.org/10.1016/j.plabm.2022.e00303
2. Chawla R, Goswami B, Singh B, Chawla A, Gupta VK, Mallika V. Evaluating laboratory performance with quality indicators. Lab. Med. 2010;41(5):297–300.
3. Dikmen ZG, Pinar A, Akbiyik F. Specimen rejection in laboratory medicine: Necessary for patient safety? Biochem Med (Zagreb). 2015;25(3):377-85. DOI: 10.11613/BM.2015.037 PMID: 26527231; PMCID: PMC4622196.
4. Plebani M, Carraro P. Mistakes in a stat laboratory: Types and frequency. Clin Chem. 1997;43:1348–51.
5. Carraro P, Plebani M. Errors in a stat laboratory: Types and frequency 10 years later. Clin Chem. 2007;53:1338–42. DOI:10.1373/clinchem.2007.088344
6. International organization for standardization. ISO 15189:2012: Medical laboratories: Particular requirements for quality and competence. Geneva, Switzerland: International Organization for Standardization; 2012.
7. Lippi G, Guidi GC. Preanalytic indicators of laboratory performances and quality improvement of laboratory testing. Clin Lab. 2006;52:457–62.
8. Kamal F, Saman WAWM, Monir MA, Rahmat M. Analysis of sample rejection and the impact on quality of care in patients in a single tertiary healthcare facility in Malaysia. Environment-Behaviour Proceedings Journal. 2020;5(13):175–181.
9. Shiferaw MB, Yismaw G, Getachew H. Specimen rejections among referred specimens through referral network to the Amhara Public Health Institute for laboratory testing, Bahir Dar, Ethiopia. BMC Res. Notes. 2018;11(1):1–6.
10. Sciacovelli L, Plebani M. The IFCC Working Group on laboratory errors and

patient safety. Clin Chim Acta. 2009;404:79–85. DOI:10.1016/j.cca.2009.03.025

11. Abbas M, Mukinda FK, Namane M. The effect of phlebotomy training on blood sample rejection and phlebotomy knowledge of primary health care providers in Cape Town: A quasi-experimental study. African journal of primary health care & family medicine. 2017;9(1):1–10.
12. Plebani M, Sciacovelli L, Aita A, Padoan A, Chiozza ML. Quality indicators to detect preanalytical errors in laboratory testing. Clin Chim Acta. 2014;432:44–8. DOI:10.1016/j.cca.2013.07.033. [PubMed]
13. Grecu DS, Vlad DC, Dumitrascu V. Quality indicators in the preanalytical phase of testing in a stat laboratory. Lab Med. 2014;45:74–81. DOI: 10.1309/LM9ZY92YBZRFPFQY
14. Tesfaw HM, Segaye A, Hassen F. Frequency of specimen rejection and associated factors at St. Paul's hospital millennium medical college, addis ababa Ethiopia. Journal of Multidisciplinary Research in Healthcare. 2015;2(1):1–16.
15. Karcher DS, Lehman CM. Clinical consequences of specimen rejection: A college of American pathologists Q-Probes analysis of 78 clinical laboratories. Arch. Pathol. Lab Med. 2014;138(8):1003–1008.
16. Bolenius K, Soderberg J, Hultdin J, Lindkvist M, Brulin C, Grankvist K. Minor improvement of venous blood specimen collection practices in primary health care after a large-scale educational intervention. Clin Chem Lab Med. 2013;51:303–310.
17. Heyer NJ, Derzon JH, Winges L, et al. Effectiveness of practices to reduce blood sample hemolysis in EDs: A laboratory medicine best practices systematic review and meta-analysis. Clin Biochem. 2012; 45:1012–1032.
18. Munnix IC, Schellart M, Gorissen C, Kleinveld HA. Factors reducing hemolysis rates in blood samples from the emergency department. Clin Chem Lab Med. 2011;49:157–158.
19. Brown JE, Smith N, Sherfy BR. Decreasing mislabeled laboratory specimens using barcode technology and bedside printers. J Nurs Care Qual. 2011;26:13–21.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/111274