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Identification of Pre-analytical Errors in the Laboratory of National Institute of Infectious Diseases, Sri Lanka

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Abstract

Background: Laboratory investigations are the backbone of the diagnosis of diseases. Previous studies have shown that more than 70% of clinical laboratory specimens have to be rejected due to pre-analytical errors.

Objective: To determine the sample error rate and identify the causes of sample errors to prevent pre-analytical errors on a laboratory basis.

Methods: This is a cross-sectional study. Details were recorded on a data sheet from the received blood samples which were rejected. Sample rejection criteria were described using a formula.

Results: The overall sample rejection rate was found to be 71.15%. Incomplete request forms accounted for 54.2% of sample rejections for biochemical samples, while mislabelled blood samples accounted for 35.1% of sample rejections for complete blood counts.

Conclusion: According to the study findings, it has shown that relevant healthcare workers should pay more attention to patient investigations relevant to blood samples to provide appropriate patient management with minimal errors in investigation reports.

Keywords: Rejection rate, pre-analytical error, blood, hospital

Introduction

The laboratory reports play a major role in effective patient management. Therefore, the accuracy and precision of the laboratory results should be maintained. The quality of the laboratory procedures is associated with the three main phases such as pre-analytical, analytical, and post-analytical phases [1]. According to recent publications, up to 75% of total laboratory errors occurred in the pre-analytical phase influencing the quality of the laboratory reports [2]. The most important pre-analytical variables are specimen collection, handling, and transportation. All the samples that are received in the laboratory should be assessed for acceptability by the laboratory. We noted some errors in samples received at the laboratory as follows, haemolysed samples, clotted samples, samples received in improper containers, mismatched samples with the request forms, improperly labelled samples, leaking samples, overfilled and under-filled samples (for ESR and coagulation studies) that may lead to erroneous laboratory results. These errors are the most common reasons for repeat sample collection that may affect patient care and delay turnaround time [1].

Objective

To determine the sample error rate and identify the causes of sample errors to prevent pre-analytical errors on a laboratory basis at the laboratory of the National Institute of Infectious Diseases, Angoda.

Methodology

Study design

This was a cross-sectional study.

Data collection

Each rejected specimen's data sheet contained information about the blood samples that were rejected. Over the course of two weeks from 14th to 24th of August 2023, data of the samples received at the laboratory was gathered on 14 consecutive weekdays from 8:00 a.m. to 4:00 p.m.

The total sample rejection rate, rejection rates according to the rejection criteria and investigation were calculated.

Statistical Analysis

Microsoft Excel 2010 was used to illustrate the graphical presentation of data. The following formula was used to calculate the rejection rates.

The sample rejection rate =

$$\frac{[\text{Number of samples rejected}]}{[\text{The total number of samples received}]}\ X\ 100$$

Results

Within 14 consecutive weekdays, the pathology laboratory received 2000 samples in total, of which 1423 (71.15%) met the rejection criteria. Tables 1, 2, and 3 display the sample rejection rate of observed samples for, biochemistry tests, full blood count tests, and other tests based on the reason for rejection. Out of all the rejection criteria, incomplete request forms accounted for the majority of rejections (54.2%) for blood samples. The highest rejection rate was found for requests for biochemistry analysis, where the medical officer's signature and date of request were not mentioned on the request form.

Incorrect labelling had the highest rejection rate (30.1%) for full blood count tests, and among other rejection criteria, incorrect labelling had the highest rejection rate (5%) for other tests as well.

Table 1: Error rates according to the cause of errors for Biochemistry tests

Rejection criteria	Number of errors identified (n=890)	Error percentage (%)
1.Insufficient volume	07	0.8
2.Haemolysed samples	13	1.5
3. No signature and date in the request form	482	54.2
4. No ward number in the request form	190	21.3
5. No patient's name in the request form	02	0.2
6. No Gender in the request form	410	46.1
7. Unclearly labelled	04	0.4
Total	1108*	

**NB: Number of errors that has been identified is higher than the total number of samples due to one sample was having more than one error at a time.*

Discussion

Laboratory reports play a major role in modern medicine which rely highly on clinical diagnosis data [3]. The rejection of laboratory samples may lead to delay in proper patient management. The rejection of laboratory samples may be caused by an increase in the turnaround time of the laboratory reports. In case of increasing the turnaround time of laboratory investigation reports may affect the productivity of healthcare services [4]. In a study conducted in a tertiary laboratory in Cape Town, Africa, out of a total of 32910 samples that had been received during the study period,

Table 2: Error rates according to the cause of errors for Full Blood Count Test

Errors	Number of samples with errors (n=830)	Error rate (%)
Insufficient volume	02	0.2
Illegible request forms	13	1.6
Mismatched samples	06	0.7
Incorrect labelling	250	30.1
Clotted samples	01	0.1
The outer surface of the tube is contaminated with blood.	12	1.4
Total	284	

a rejection rate of 1.46% was recorded [4]. The overall rejection rate of the haematology samples in the current study was 34.21%. Therefore, the overall sample rejection rate in the current study was higher than in the above study.

In the current study, out of all the rejected samples, 30% of the rejection rate was due to improper labelling of the sample. Out of all biochemistry samples, 50% of the rejection rate was due to incomplete request forms. From the rejected samples (n=3) for the PT/INR test, about 12.9% were rejected due to overfilling. A similar study conducted by the Teaching Hospital Karapitiya recorded the rejection rate of the overfilled samples in the PT/INR test as 90% out of the total rejected samples in the PT/INR test [5]. Compared to the above study the current study reordered a lesser rejection rate of overfilled samples received in the PT/INR test.

In contrast to sample collection procedures, the current study's highest rejection rates were found to be the result of incorrect request forms and improper sample labelling. The accuracy of the laboratory reports may be primarily impacted by mislabelled items and incomplete request forms. Inaccurate request forms, such as those that omit the ward or department, can result in lost laboratory reports and needless patient specimen duplication. The study also revealed that request forms were lacking the medical officer's signature and the requested date is a serious issue. This could end up in audit queries and ambiguous situations for laboratory professionals.

The continuous educational program of laboratory sample collection, storage, and transportation is recommended to improve the productivity of laboratory service. This study shows that the knowledge of nurses still needs to be updated in certain aspects such as the suitable specimen collection containers for several investigations, the amount of blood needed for several tests, the importance of mixing anticoagulant and blood in the container, the importance of mentioning proper patient details in both request forms and labels. Finally, the findings of the current study encouraged laboratory staff to prepare and distribute specimen rejection criteria documents for nursing officers in all wards at the National

Table 3: Error rates according to the cause of error for other tests (PT/INR, APTT, ESR, and UFR)

Errors	Number of samples with errors (n=280)	Error rate (%)
Insufficient volume	09	3.2
Overfilled samples	04	1.4
The sample was collected into an improper container	04	1.4
Incorrect labelling	14	5
Total	31	

(PT/INR - Prothrombin Time/International Normalized Ratio, APTT - Activated Partial Thromboplastin Time, ESR - Erythrocyte Sedimentation Rate, UFR - Urine Full Report)

Institute of Infectious Diseases, Angoda. Furthermore, to improve the awareness among nurses on how to mitigate sample collection errors and pre-analytical errors was carried out as part of this study.

Conclusion

The overall rejection rate for the blood specimens was 71.15%. Incomplete request forms accounted for the majority of rejection rates (54.2%), while the rejection rate of haematology samples was 34.21% due to improper sample labelling.

Therefore, according to the study findings, it has shown that relevant healthcare workers should pay more attention to patient investigations relevant to blood samples to provide appropriate patient management with minimal errors in investigation reports.

Recommendations

Capacity building programmes for medical officers, nursing officers and other relevant health staff categories on blood sample collection, storage, and transportation. Based on this study's findings, we further recommend that there is a need for guidelines on sample collection, sample acceptance, and rejection criteria.

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