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Reduce Rejected Laboratory Samples and Enhance Specimen Acceptability

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Abstract: **Background: Clinical chemistry specimen rejections cause a delay in the availability of findings, which might affect patient care.**

The study's objective is to assess sample rejection.

Methods: The study measured specimen rejection rates and the contributions of different rejection reasons. The study undertook an intervention to reduce specimen rejection during 2019 intervention period. It compared rejections rates, number of months with rejection rates 1.2%, and distribution of rejection reasons between the two year-long intervals. The study also determined the origin for specimens rejected for the most common rejection reason during one month in the second period.

Results: The most common reasons for rejection in hematology and biochemistry areas were clotted blood specimen, improperly labeled specimen containers and hemolyzed blood samples.

Conclusions: Using Qualitative Methodology helped to formulate efficient plans to target this issue. reduce the rate of rejected samples. Moreover, the model shed the light on how crucial the pre-analytical phase for laboratory quality improvement process, its effect on cost reduction, and the importance of staff competency and utilization.

Keywords: **Rejection, Blood samples, pre-analytic error; quality indicators; specimen insufficient; specimen rejections.**

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I. INTRODUCTION

In order to evaluate quality, monitor critical standardized processes, improve performance, and ensure patient safety in clinical laboratories, it is essential to constantly collect and analyse data. These have an impact on 70% of medical diagnosis (1, 2)

One of the laboratory medicine preanalytical quality indicators is data on samples that were rejected owing to different preanalytical mistakes. There is a collection of important data with different kinds of faults. for instance, the appropriateness of the test order, the patient Inaccurate wristband identification, improper timing during sample and processing, and hemolytic and lipemic blood samples, improper transit, and insufficient and inappropriate tubes portion of the sample (2,3-4). However, the types of error in the preanalytical phase seem to have changed over time, but distribution of errors among other phases of total testing process (TTP) has remained the same. (5)

King Fahad Medical City is the largest and most advanced medical complex in the Middle East with a total capacity of 1200 beds, Riyadh, Saudi Arabia. This colossal medical facility built at a cost of 2.3 billion Saudi Riyals is comprised of four hospitals and four medical centers expected to treat more than 19,171in-patients annually and over 238,404 outpatients. The Main Hospital is a 181-bed hospital with specialty clinics for diagnosing and treating diseases. Rehabilitation Hospital is a 92-bed hospital offering multiple levels of care, including inpatient, day rehabilitation, and outpatients' services, a 224-bed Children Specialized Hospital and a 120-bed Women Specialized Hospital. In addition to the hospitals, King Fahad Medical City has 17 fully-equipped main operation rooms and supports the largest number of Intensive Care Beds in the region. King Fahad Medical City provides every citizen of the Kingdom of Saudi Arabia with the best health care service. In addition, King Fahad Medical City is a bridge of medical knowledge and research between the East and West. KFMC is keen to implement the best national and international standards to provide high quality services, as well as to continually improve the quality of these services. KFMC proudly earned the Joint Commission International Accreditation (JCIA), which makes us committed to the patient safety. The first phase of the laboratory testing cycle, the pre-analytic phase, begins with the written order for the laboratory test, identification of the patient, specimen collection and labeling, and ends with specimen transportation to the laboratory Blood specimen rejection rates in this phase have been the subject of many studies and remain an issue of concern with some studies finding up to 68.2% of all errors occurring in this phase. With laboratory test results comprising about 80% of the information base used by clinicians in their treatment decisions correct and timely blood specimen collection is integral to appropriate patient diagnosis and treatment. Working in direct opposition to obtaining high quality blood specimens is the over-crowded, high pressure in inpatient (surgical wards) work environment that demands rapid laboratory turnaround times leading to a “need for speed” atmosphere that fosters errors in blood collection, handling and transport processes caused by incorrect patient identification, specimen trauma, incorrect order of the draw, and inadequate mixing of the collected specimen tubes. These demands and errors can result in rejected specimens that require recollection and thus give rise to delayed treatment, extended patient stays, overcrowding, poor emergency patient throughput, and provider, staff and patient dissatisfaction result in blood

II. MATERIALS AND METHODS

A retrospective, intervention and prospective analysis of the samples rejected from the total samples received in our laboratories, during a nine month period from January to September 2019 at PCLM (Pathology and clinical laboratory medicine department) was undertaken. As a common laboratory practice, samples which were not acceptable for testing were rejected and the record of sample rejection (sample type, collection area, reason of rejection, etc.) was maintained in a sample rejection book.

Specimens brought to the laboratory may be rejected if conditions are present that would compromise the validity of the test results [6]. Criteria we follow for specimen rejection at PCLM (Pathology and clinical laboratory medicine department) are the following:

1. Improper request order
2. Inappropriate specimens’ container
3. Clotted Sample
4. Inadequate quantity of sample

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5. Improperly labeled samples
6. Clinical history not provided
7. Hemolyzed sample
8. Excessive delay
9. Diluted sample
10. Contaminated sample
11. Incorrect storage
12. Patient not properly prepared for test.
13. Others (not classified)

III. ETHICAL CONSIDERATIONS

Institutional Review Board review was not sought, as all of the changes being tested were evidence based. There was no control group and, therefore, no randomization.

IV. RESULTS

Out of the 32,548 samples (for tests of hematology, biochemistry and microbiology) received during Jan–Sep 2019, 177 samples (0.54%) were rejected for various reasons that could compromise the quality of the end results. During the first 3 months of analysis (January to March 2011), 0.36% of the samples were rejected. Further analysis of the next 3 months (April to June 2019) showed an increase in the rejection rate to 0.71 percent. The specimens received from the operating rooms (OT) and intensive care units were the most troublesome locations (ICU). According to a root cause analysis, the most frequent reason for defective sample collection was handled by unskilled new hires and lack of knowledge about the proper sample collecting methods and the value of it. Upon implementing these remedial actions, a quarterly Follow-up analysis for (July to September 2019) was completed. It was located.

Identification of problematic areas and results of corrective interventions

The maximum number of rejections was seen in the specimen sent from OT and ICU, throughout the period. However, it was noted that after corrective interventions, the number of sample rejections decreased from these areas and also reflected an overall decrease in the total number of sample rejections.

Table 1: Rejection specimens 6 months within the reason of rejection.

Rejection criteria	Jan-11 Mar-11	Apr-11 Jun-11	Jul-11 Sep-1	Total rejections	Percent of rejection
1. Improper request order	**0**	**2**	**0**	**2**	**18.2**
2. Inappropriate specimens' container	**0**	**0**	**0**	**0**	**0.0**
3. Clotted Sample	**0**	**0**	**0**	**0**	**0.0**
4. Inadequate quantity of sample	**0**	**0**	**0**	**0**	**0.0**
5. Improperly labeled samples	**0**	**1**	**1**	**2**	**18.2**
6. Clinical history not provided	**1**	**1**	**0**	**2**	**18.2**
7. Hemolyzed sample	**0**	**0**	**0**	**0**	**0.0**
8. Excessive delay	**1**	**0**	**1**	**2**	**18.2**
9. Diluted sample	**0**	**0**	**0**	**0**	**0.0**
10. Contaminated sample	**0**	**0**	**0**	**0**	**0.0**
11. Incorrect storage	**0**	**0**	**2**	**2**	**18.2**
12. Patient not properly prepared for test.	**0**	**0**	**0**	**0**	**0.0**
13. Others (not classified)	**0**	**0**	**1**	**1**	**9.1**
Total Rejections	**2**	**4**	**5**	**11**	**100**

V. DISCUSSION

As many as 0.6% of all laboratory test results may be erroneous [7] with pre-analytical and post analytical errors accounting for 46– 68.2% and 18.5–47% of the total errors respectively [9] One study has reported that 77% [8] of errors may occur in the pre-analytical phase. While we did not estimate the percentages of pre and post analytical errors in this study, the incidence of sample rejections was 0.36% to begin in the first quarter which rose to 0.71% in the 2nd quarter. The increase in sample rejections in the 2nd quarter was most likely a result of new staff inductees in the form of leave vacancies etc. during the period. Following corrective action it dropped down to 0.57%. Some other studies have reported net sample rejection rates of 0.57% [9] and 0.3% [10]. These studies reported on hematology and biochemistry specimens. While our findings correlated to a large extent with these, our study also included microbiology specimen rejections. Another study [11] reported specimen rejection rates of 1.4% for CBC samples and 1.2% for clinical chemistry samples. In our set up, the hematology and biochemistry diagnostic services maintain a common sample rejection log. The rejection criteria for microbiology specimens are different.

In our context, there is a training programme in place for nurses and other pertinent professionals. Regular academic activities are also held. But the presence of new employees, multitasking, and a packed schedule could cause mistakes. The remedial measure comprised targeted retraining on procedures for collecting samples, including the use of suitable containers, using containers appropriately, collecting through IV catheters, using barcode labels, drawing in the right order, and meeting requirements Use of aseptic procedures for sample rejection and its consequence when obtaining microbiological specimens, etc. Nursing director and related laboratory in charge both led the training and departments of computers.

Quality assurance is an ongoing process in laboratory practice and regular education programs with respect to staff training [12], introduction of automated technology [2]; updates and regular internal audits [13] at the work site would help improve upon reducing pre analytical errors. Computerized bar -coding systems help improve the accuracy of specimen labeling and patient identification as has been shown in one study [14]. A combination of these efforts in a concerted and coordinated manner would result in better laboratory practices and patient care outcomes.

VI. CONCLUSION

In our investigation, clotted blood, labelling mistakes, and hemolyzed samples for the hematology and biochemistry sections were the most frequent reasons for specimen rejection. These included labelling mistakes and specimens gathered in the improper containers for the microbiology department. Computerized barcoding and training sessions are two types of intervention the samples could aid in lowering sample rejection rates. Larger tudies conducted over a longer time frame are necessary to clearly What part does intervention play in reducing pre-analytical errors

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