

# Reducing rejected blood samples project in male surgical wards using FOCUS-PDCA methodology

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**Abstract:** This article gives you important guidelines for the preparation of a research paper for publication in Research Publish Journals. Clinical laboratories play a vital role in patient diagnosis and management. However, blood specimens may be rejected for a variety of reasons, which may have substantial clinical consequences for patient safety. The quality team observed significant numbers of rejected samples from the surgical department and inpatient units due to hemolysis.

**Methods:** Retrospective study conducted at King Fahd Medical City, Riyadh, KSA, for six months' period; January 1, 2016 to June 1, 2016. Data were collected from Cortex (Health Care Operation System). The method was based on the FOCUS-PDCA quality improvement method focusing on the pre-analytical phase of the laboratory testing. The team identified pre-analytical errors as the primary reason for rejections. A multidisciplinary team was formed and tested several changes, including phlebotomy education, competency validation by direct observations, the use of appropriate consumables for sampling, and physician education for proper orders. All specimens sent for blood chemistry, arterial blood gas analysis, hematology, and coagulation tests were included. Microbiology test specimens and point-of-care testing samples were excluded.

**Results:** The data show that the rate of specimen rejection was high in the first three months of the year (Jan, Feb, and Mar) and duplicated test order was the commonest cause for rejection followed by cancelled specimens. which was a statistically significant reduction

**Conclusions:** Using FOCUS-PDCA Methodology we able to reduce the rate of rejected samples in Male Surgical wards 74.7% from the previous record. 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, Male Surgical Wards, Phlebotomy, Cortex, Blood samples, FOCUS-PDCA Methodology.

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## I. INTRODUCTION

The role of clinical pathology and laboratory medicine continues to grow as the single largest component in day-to-day clinical practice as well as long term follow-up. The result of any laboratory examination becomes good enough only if appropriate samples received in the laboratory.

Many national and international programs to track laboratory quality have reported laboratory specimen rejection rates ranging from 0.3% in outpatient facilities to 0.83% in hospital-based laboratories. [2]

It is known that approximately 56% of laboratory error occurs during the pre-analytic phase (processes that occur before testing of the sample) of laboratory testing. In 1997 Jones et al reported that pre-analytical errors constituted between 25% and 50% of the total errors in the clinical laboratory. [3] Pre-analytical errors are the responsibilities of the blood collector and include the following: [1]

- Monitoring of specimen ordering
- Correct patient identification
- Patient communication and safety
- Patient preparation
- Timing of collections
- Phlebotomy equipment
- Collection techniques
- Specimen labeling
- Specimen transportation to the laboratory
- Specimen processing

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 19,171 in-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 specimen recollection, and extend patient lengths of stay in some cases.

The pre-analytic phase, as it occurs in the surgical wards, is the focus of this study.

The FOCUS-PDCA model provides a model for improving processes. The model's name is an acronym that describes the basic components of the improvement process. The steps include:

- Find a process to improve
- Organize an effort to work on improvement

- Clarify current knowledge of the process
- Understand process variation and capability
- Select a strategy for continued improvement

PDCA is an acronym for Plan, Do, Check and Act. The PDCA cycle is a way of continuously checking progress in each step of the FOCUS process.

Specimens brought to the laboratory may be rejected if conditions are present that would compromise the validity of the test results [1]. Criteria we follow for specimen rejection at PCLM (Pathology and clinical laboratory medicine department) are the following:

1. Improper request order
2. Test request cancelled
3. Inappropriate specimens container
4. Clotted Sample
5. Inadequate quantity of sample
6. Improperly labeled samples
7. Haemolysed sample
8. Excessive delay
9. Diluted sample
10. Contaminated sample
11. Incorrect storage
12. Others (not classified )

## II. MATERIALS AND METHODS

Extensive pilot study was conducted at Phlebotomy section of Pathology and Clinical Laboratory Medicine Department of King Fahad Medical City, Riyadh, Saudi Arabia in rejected samples, Male Surgical Wards from January, 1, 2016 to June 30, 2016. Data were retrieved from Cortrex (Health Care Information System) based on the information from LIS (Laboratory Information System). [2] FOCUS-PDCA Methodology were used in this study to reduce the rate of rejected samples. [3]. Cause-and-effect analysis (Figure 1) and process mapping (Figure 2) were undertaken to identify the reasons for rejections, which were prioritized via Pareto analysis. In this article we describe our approach to reducing rejected laboratory samples and enhancing specimen acceptability.

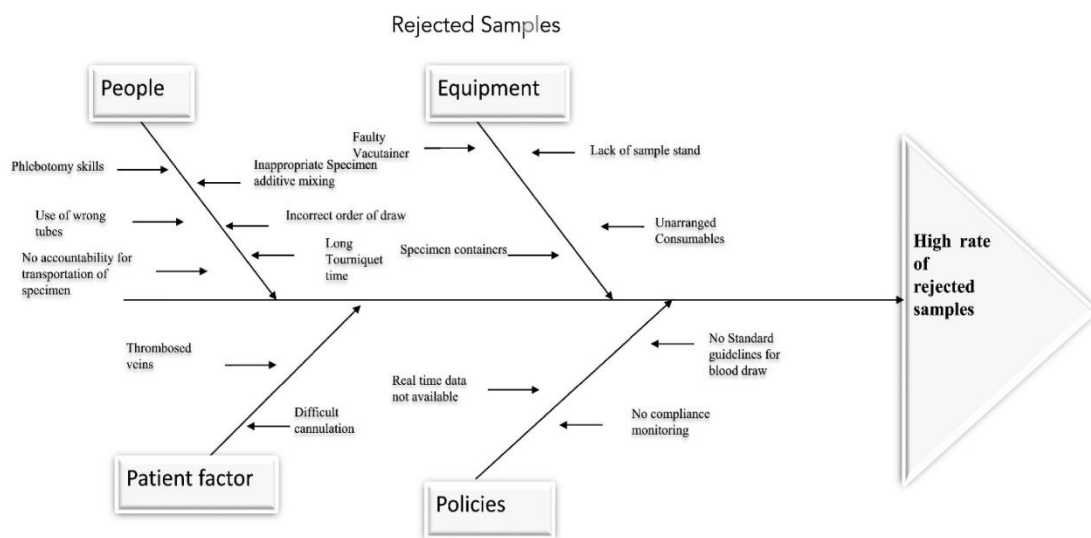


Figure 1. This cause-and-effect (Ishikawa) diagram displays reasons for rejected sample.

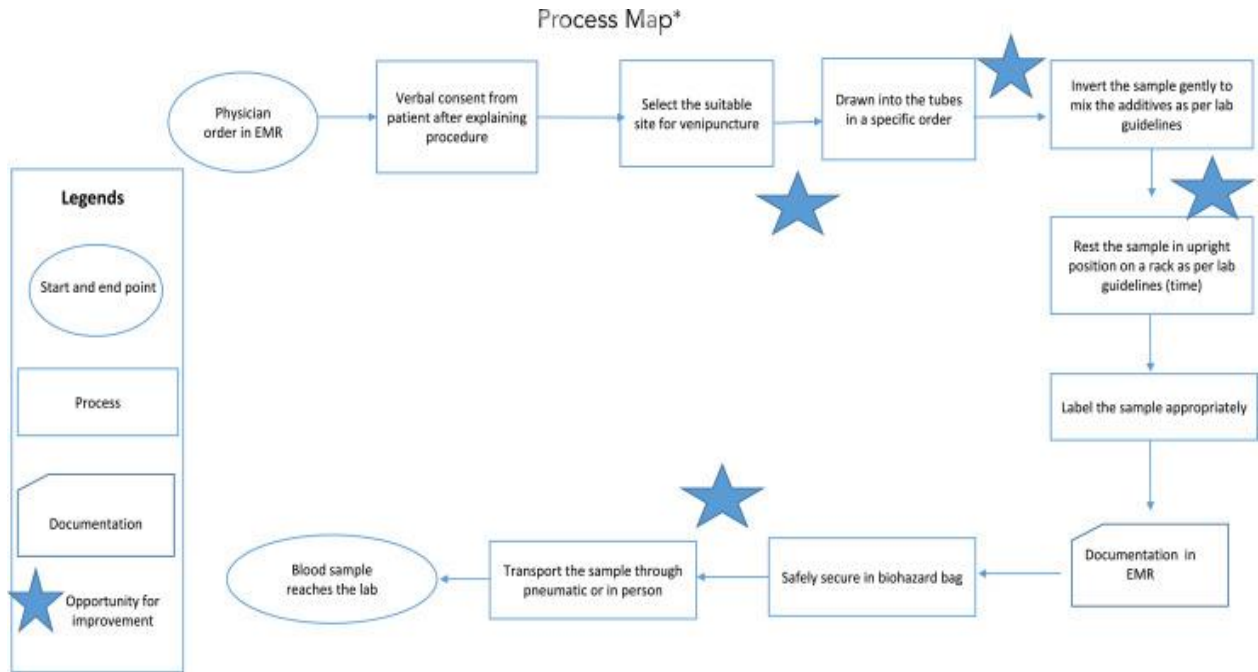


Figure 2. This process map illustrates the blood collection process. EMR, electronic medical record.

### 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

The total number of rejected samples were collected. The areas of collection (Male Surgical Wards) as well as the reason of rejection were recorded and the result were as follows.

Table 1 shows the highest numbers of rejection seen on month of Feb 143 (28.8%). Followed by month of Mar 136 (27.4%) and Jan 92 (18.5%). Also it shows the highest cause of rejection was duplicated sample 132(26.6%), followed by test request cancelled 79(15.9%) and others 79(15.9%).

Table 1. Rejection specimens in male surgical wards during 6 months within the reason of rejection.

No.	Reason of rejection	Pre			Total 3M	Post			Total 3M	Total 6M	%
		Jan	Feb	Mar		Apr	May	June			
1	Duplicated Sample	21	61	28	110	15	7	0	22	132	26.6
2	Test request cancelled	25	15	25	65	11	0	3	14	79	15.9
3	Others	7	34	19	60	3	11	5	19	79	15.9
4	Haemolysed sample	11	5	15	31	5	6	11	22	53	10.6
5	Improper request order	10	6	29	45	4	2	0	6	51	10.2
6	Clotted sample	5	5	10	20	1	8	8	17	37	7.4
7	Inadequate quantity	3	3	10	16	3	6	2	11	27	5.4
8	Excessive delay	8	7	0	15	6	0	0	6	21	4.2
9	Wrong tube	2	5	0	7	0	3	3	6	13	2.6
10	Diluted urine	0	2	0	2	0	1	0	1	3	0.6
11	Incorrect storage	0	0	0	0	0	1	0	1	1	0.2
Total		92	143	136	371	48	45	32	125	496	100
%		18,5	28.8	27.4	74,7	9.6	9	6.4	25.2	100	100

## V. DISCUSSION

During the study, the highest rate of rejection sample in Male surgical Wards was in first 3 months of the year compare to the next 3 months as shown in figure (3), and the most common cause for rejection was duplicable test order followed by test request cancelled this is due to inappropriate request order as shown in figure (4) . In general we can summarize cause of rejection in 3 points:

1. Limited laboratory phlebotomy personnel resources assignment of the inpatient non-critical care areas leaving laboratory specimen collection in the hands of the nurses.
2. Nurses are requesting blood test instate of physicians.
3. Using poor collection techniques (using syringe, not following order of draw, mixing of samples, etc.)

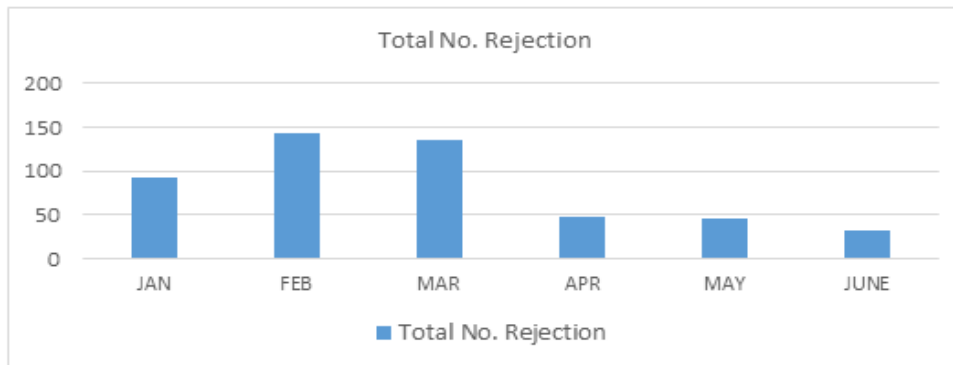


Figure 3. Total number of rejections in 6 months.

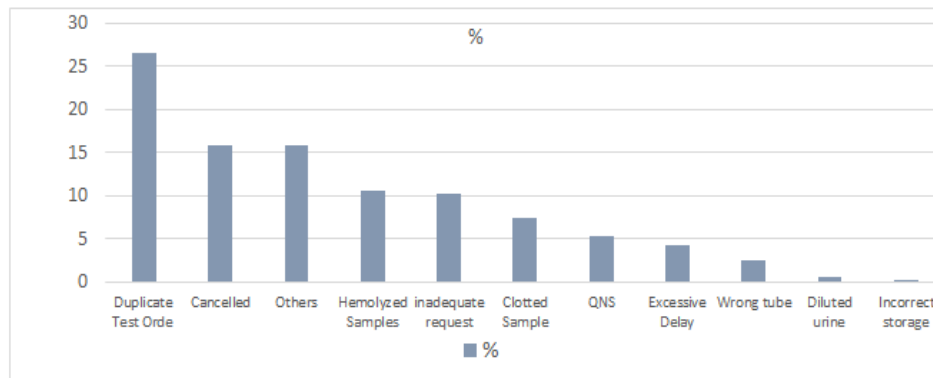


Figure 4. Rejection samples by reason of rejection.

### Use FOCUS-PDCA Methodology

#### F Find an opportunity

To reduce the rejection samples rate.

#### O Organize a team

Team leader: Franklin Lim, Supervisor, Phlebotomy Section (PCLM)

Coordinator: Yasir Awad Ahmed, Senior Lab Tech, Phlebotomy Section (PCLM)

Team members:

1. Noorazlina B. Abdulhamid , Head Nurse (MSW)
2. Aileen E. Cayton, Nursing Education (MSW)
3. Lolita Salanga, chargin nurse (MSW)
4. Ahmed Dahi Al-Enezi , Phlebotomist
5. Ayed Hamad Al-enezi, Phlebotomist

**C Clarify the current process**

1. Limited laboratory phlebotomy personnel resources assignment of the inpatient non-critical care areas leaving laboratory specimen collection in the hands of the nurses.
2. Nurses are requesting blood test instate of physicians.
3. Using poor collection techniques (using syringe, not following order of draw, mixing of samples, etc.)

**U Understand the cause**

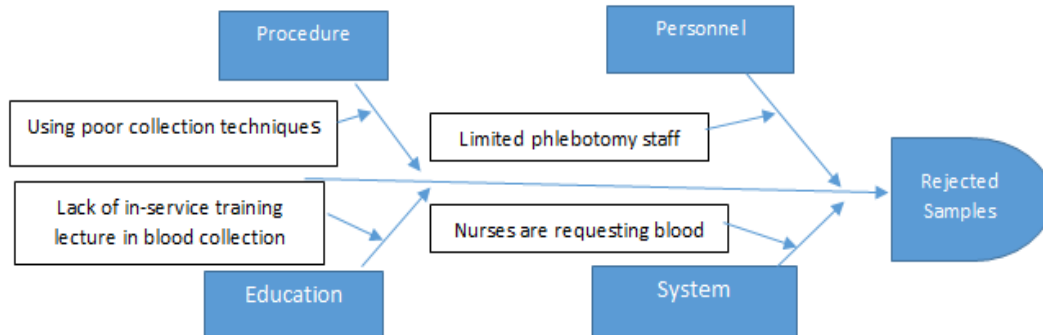


Figure 5.

**S Start the P-D-C-A**



Figure 6. PDCA diagram.

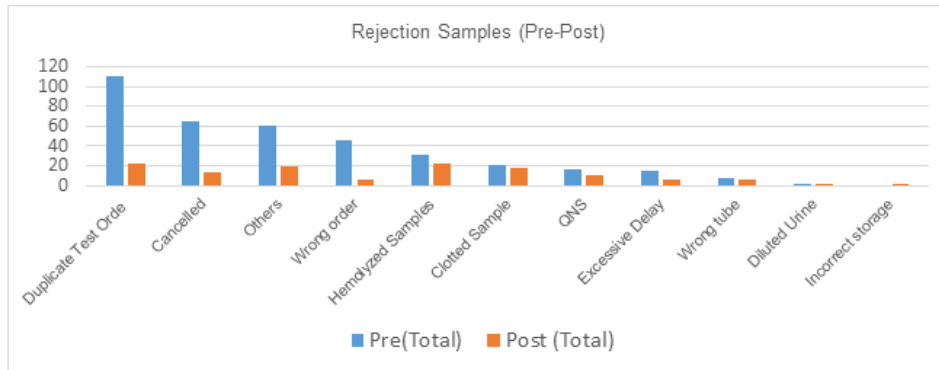
**P Plan:**

- Forming a group (male surgical wards teams and phlebotomy teams)
- Physicians are advised to request blood test orders in state of nurses.
- Conduct in-service training lecture to all ward’s nurses.
- Provide A booklet of the best practical blood collection techniques to all ward’s nurses.
- Nurses are advised to use venipuncture techniques in state of using syringes.
- Provide poster about how to use venipuncture techniques and order of draw to ward head nurse.
- Check rejection rate weekly.

**D Do:**

- Conducted lectures on best practical blood collection techniques.
- Informed physician to request blood test orders for all patient.
- Monitored rejected samples rate weekly.
- Collaborated with the phlebotomy team on a daily basis.

**C Check:**



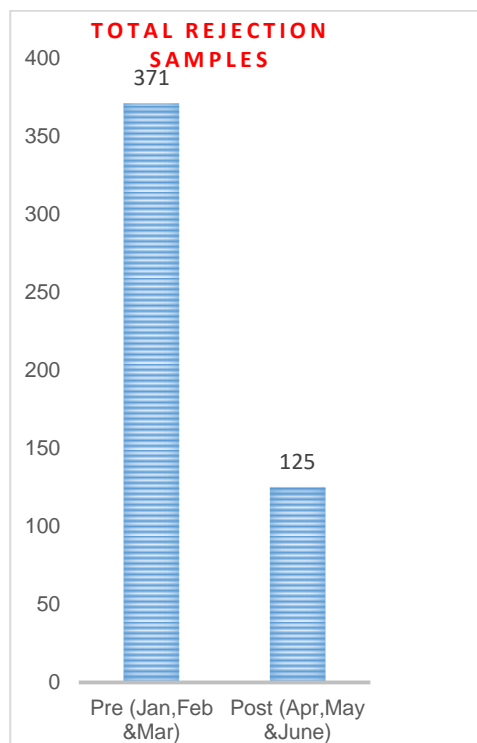
**Figure 7. Monthly rejection samples based on the reasons of rejection.**

**A Act:**

1. Continue education and training of the staff nurses on reducing sample rejection.
2. Develop a train the trainer program with the nursing education department.
3. Let the physicians order the blood work investigation for the patient.
4. Continue data collection-Measure to Manage.

In this study, we chose Male surgical wards for calculating the rate of specimen rejection and the reason of rejection during 6 months period. The result point clearly to inappropriate request order and in addition to defect in the phlebotomy technique.

Recommendations to solve such issue is to organize a team of phlebotomists as well as nursing educators staffs in conjunction with the quality department to provide health care personnel with concise information on the proper techniques to collect quality blood specimens with minimal patient discomfort. So as to minimize the errors encountered in blood collection that can lead to unsuitable specimens eventually rejected when received in the medical laboratory. [4] Also physician must advise to request investigations order instate of nurses.



**Figure 7.**

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