Assessing the Major Pre-Analytical Sample Rejections coming in Laboratory at Medanta Hospital

Submitted to- Dr. Seema Mehta,
Professor, IIHMR University, Jaipur

Submitted by- Mahima Pahwa
Roll No.- 1740

About Medanta- The Medicity

After seeing the difficulties experienced by Indian patients who could not afford to travel outside for treatment, Dr. Naresh Trehan saw the need for an advanced super-specialty medical institution in India. So, he started the hospital in 2009, with following mission and vision:

Mission
Our mission is to deliver world class, patient-centric, integrated, and affordable healthcare through a dynamic institution that focuses on the development of people and knowledge.

Vision
The institute is governed under the guiding principles of providing affordable medical services to patients with care, compassion and commitment.

Amrit Ratna Samman by News 18 on India's 75th Independence Day

WORLD'S BEST HOSPITALS 2025
Newsweek
POWERED BY statista
MEDANTA THE MEDICITY

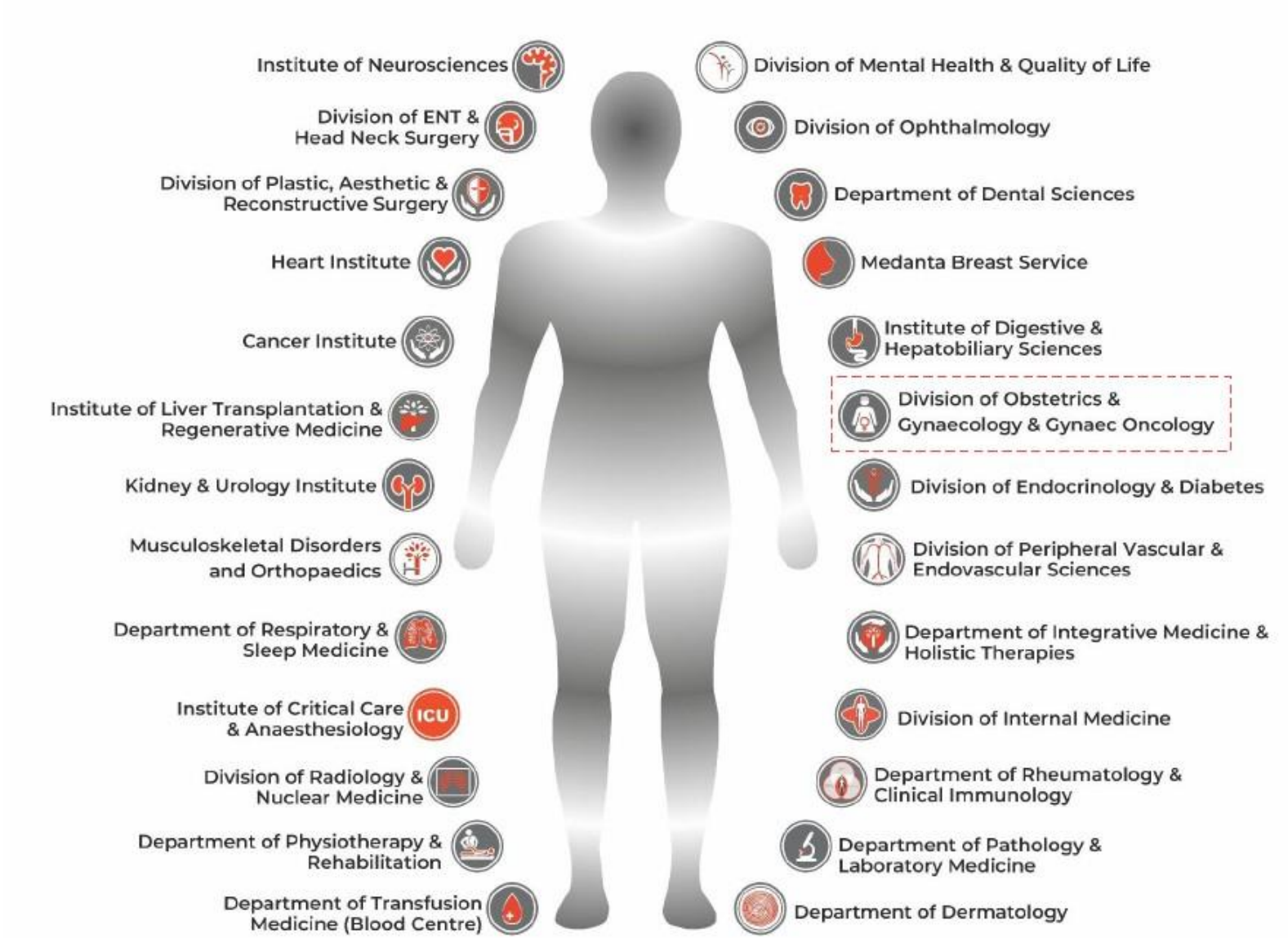
National and International Quality Accreditations

THE JOINT COMMISSION NATIONAL QUALITY APPROVAL

PATIENT SAFETY & QUALITY OF CARE NABH ACCREDITED

राष्ट्रीय परीक्षण और अंशशोधन प्रयोगशाला प्रत्यायन बोर्ड NATIONAL ACCREDITATION BOARD FOR TESTING & CALIBRATION LABORATORIES INDIA भारत

Scope of Clinical Services



Introduction

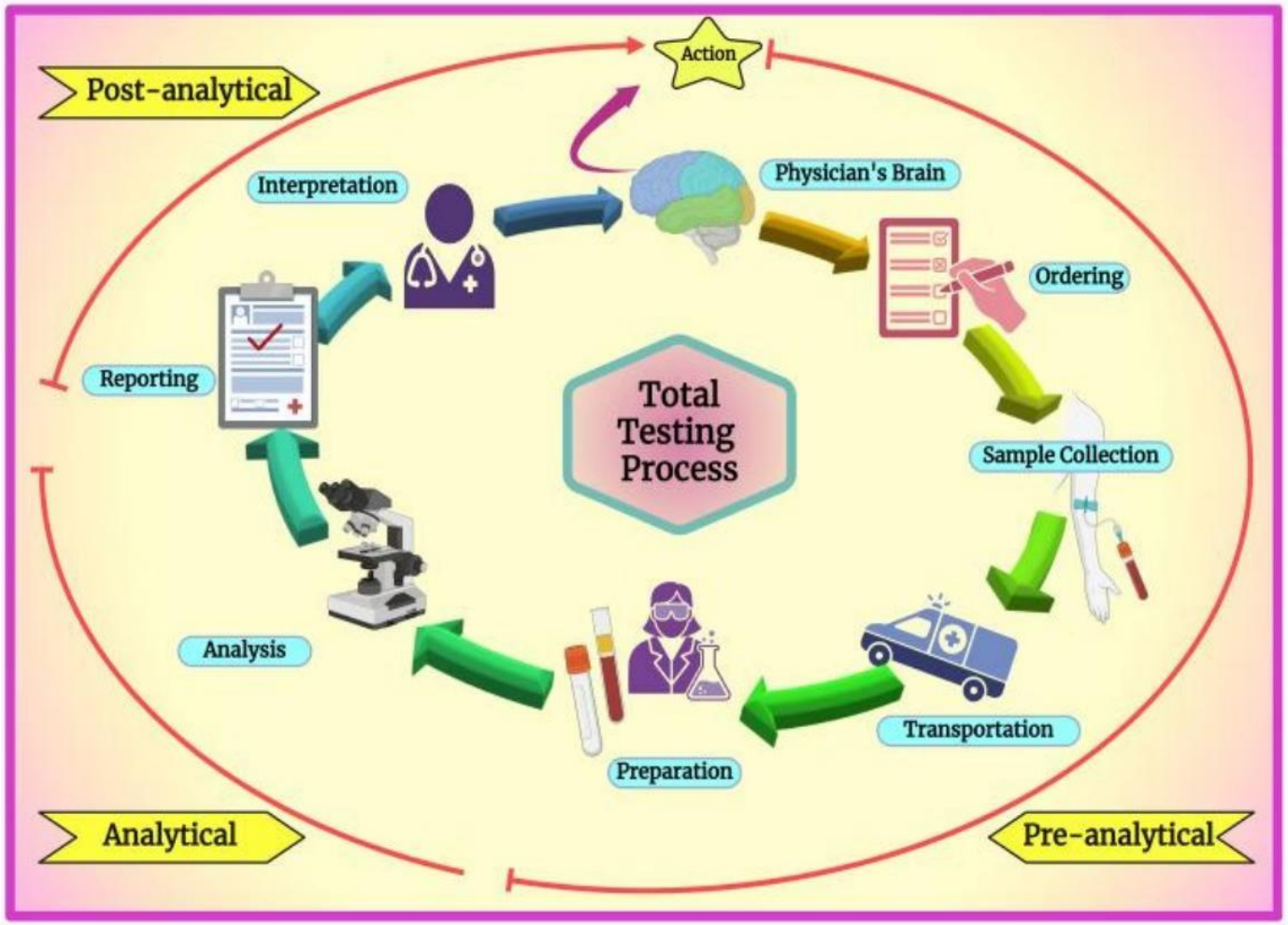


Figure 1: Schematic diagram showing the total testing process.

(image source- https://pmc.ncbi.nlm.nih.gov/articles/PMC10981510/)

Pre-Analytical Phase

- Includes requisition, collection, labelling, and transport
- Most error-prone phase in lab workflow

Impact of Errors

- Sample rejection delays diagnosis and raises costs
- Inaccurate results can lead to legal disputes and ethical concerns, particularly if they have led to patient harm

Sample Collection & Transportation Process

1

Patient Registration

Qmatic system and LED display for queue management

2

Sample Collection

Phlebotomists match UHID, Name and DOB with system & barcoded tubes used

3

Transportation

Samples handled by GDA or pneumatic chute to the lab

4

Receiving & Entry

Manual check by SRA staff, LMIS entry, automated sample quality check by department's equipment

Research Question

What are the predominant pre-analytical reasons for sample rejection coming in laboratory at Medanta- The Medicity Hospital over the last one year (from April 2024 to March 2025), and how can these be minimised?

Objective

- **Primary Objective:**

To assess pre-analytical sample rejection trends over the last year, and identifying the key causes, monthly variations, and department -wise patterns of rejection to enhance efficiency.

- **Secondary Objectives:**
  - To identify and categorize the major pre-analytical reasons of sample rejection coming in laboratory from hospital over the last year.
  - To examine monthly trends in rejection data over the past one year.
  - To compare rejection reasons across patient categories—In-Patient Department (IPD) and Out-Patient Department (OPD).
  - To analyze the number of sample rejection across different departments.

Methodology

Study Design:

Retrospective observational study based on secondary data from April 2024 to March 2025 at Medanta-The Medicity Hospital, Gurugram.

Study Tool/ Data Source:

- Laboratory Management Information System (LMIS): The primary data source from which rejection logs will be extracted.

- Supplementary Source: Observation of processes (sample collection and receiving process) during visits to the lab, SRA (Sample receiving area) and Departments.

Sample Size:

All clinical samples received in the lab in the last financial year which are around 2.24M samples that are processed over the last financial year according to LMIS data.

Unit of analysis: Each rejected sample that meets inclusion criteria (5042 samples)

Sampling Technique:

Total enumeration sampling was used, including all rejected samples meeting inclusion criteria to ensure unbiased, comprehensive analysis.

Inclusion/Exclusion Criteria

- **Inclusion Criteria:**
  - All blood, urine, and other body fluid samples rejected during the pre-analytical phase.
  - Samples collected between April 1, 2024, and March 31, 2025.
- **Exclusion Criteria:**
  - Samples rejected due to analytical (machine/test-related) or post-analytical (reporting, interpretation) errors
  - Samples with incomplete rejection documentation in LMIS

Data Collection Procedure:

Rejection logs will be extracted from the Laboratory Management Information System (LMIS). Each rejected sample will be analysed to identify the predominant reasons for rejection, the departments most frequently sending and receiving rejected samples, and the monthly trends in rejection patterns.

Ethical Considerations

- The study uses anonymized, retrospective data obtained from LMIS, posing no risk to patients.
- No raw data is disclosed.
- Administrative approval obtained from Medanta’s laboratory and administration department.


Data Analysis

Major Reasons for Sample Rejection

Haemolysis

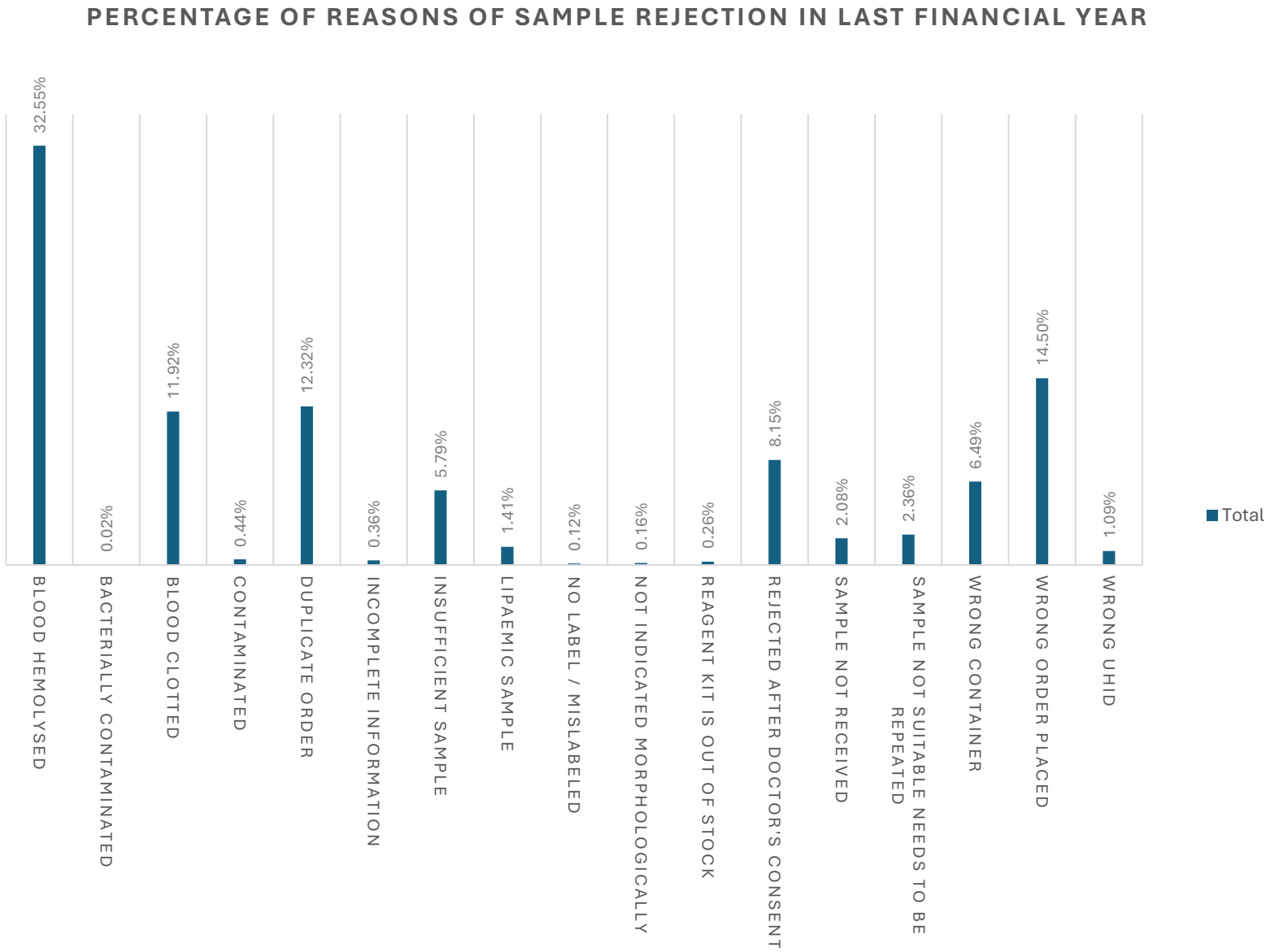
Leading cause with 32.55% rejections

Clotting & Order Errors

Clotting, wrong order placed and duplicate orders also significant

Contamination

Least frequent cause but requires vigilance



Monthly Rejection Trends by Patient Class

In-Patient Department (IPD)

Highest rejection rates (maximum in March-25 i.e., around 380)

Focus for improvement

Out-Patient Department (OPD)

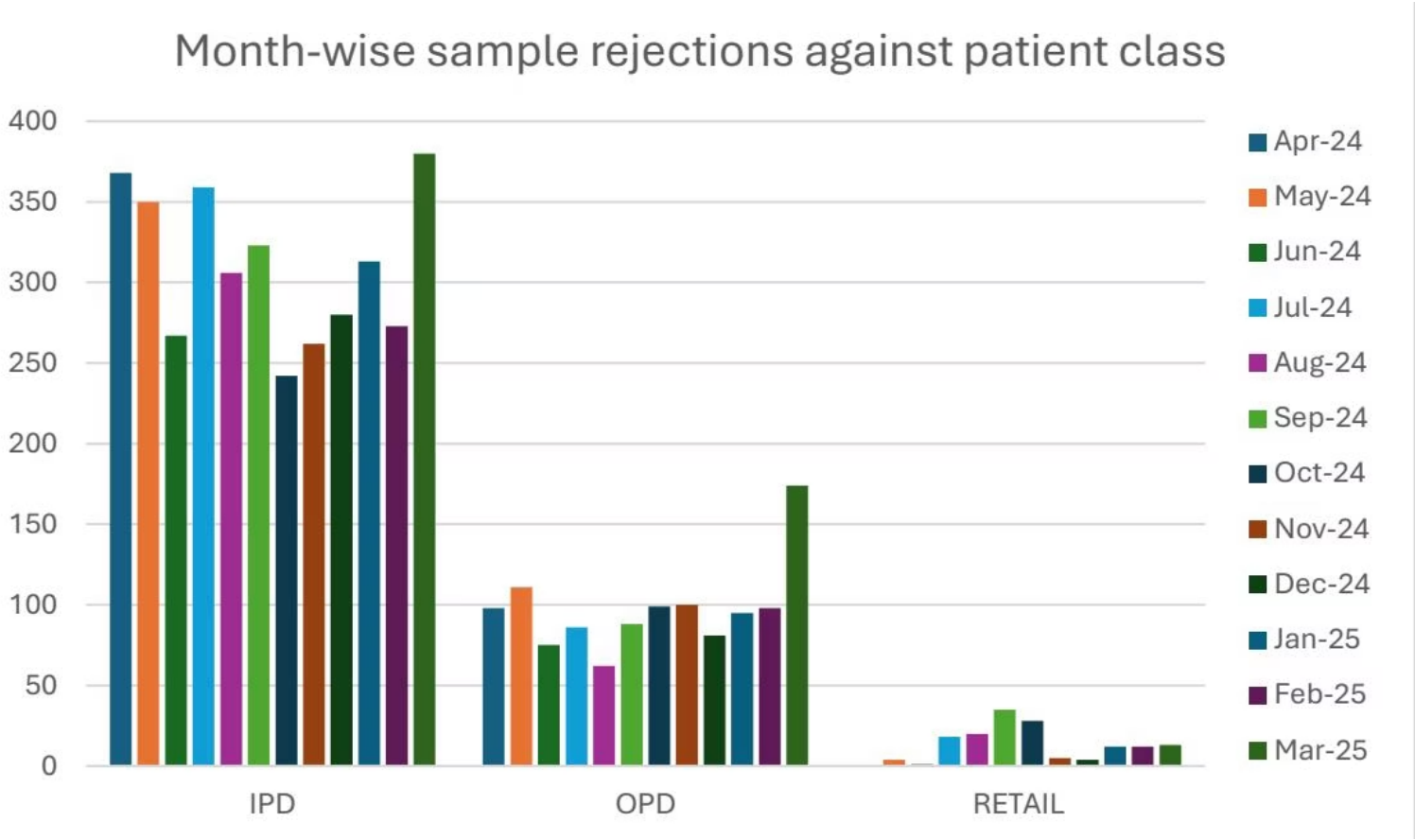
Lower rejection, spike in March 2025 (approx. 170)

Comparatively Controlled collection environment

Retail Patients

Spike was seen in Sept- 2024

Overall, the Rejection rates are quite insignificant



Rate of Rejection Reasons by Patient Category

Top IPD reasons:

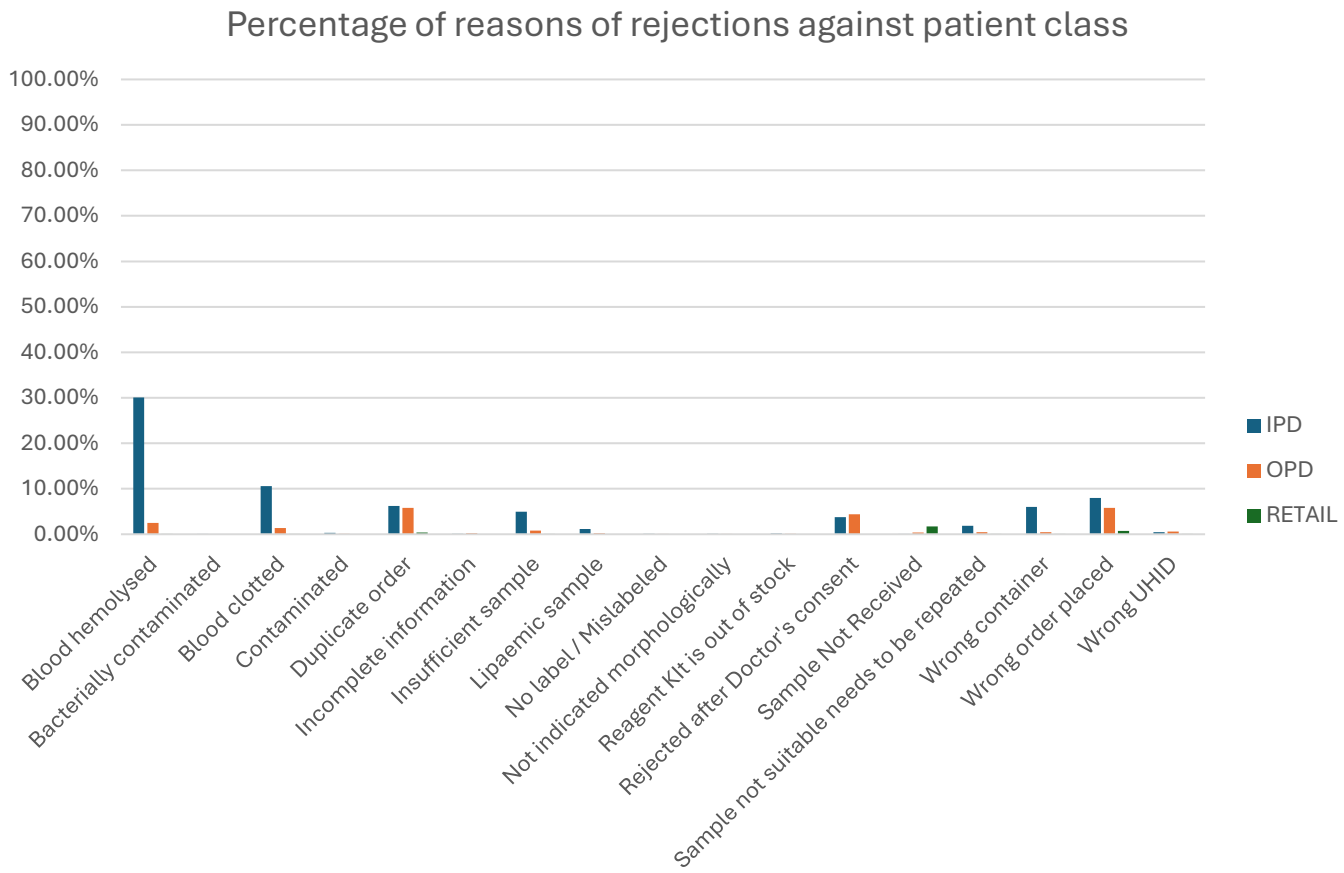
- Hemolysis
- Clotting

Top OPD reasons:

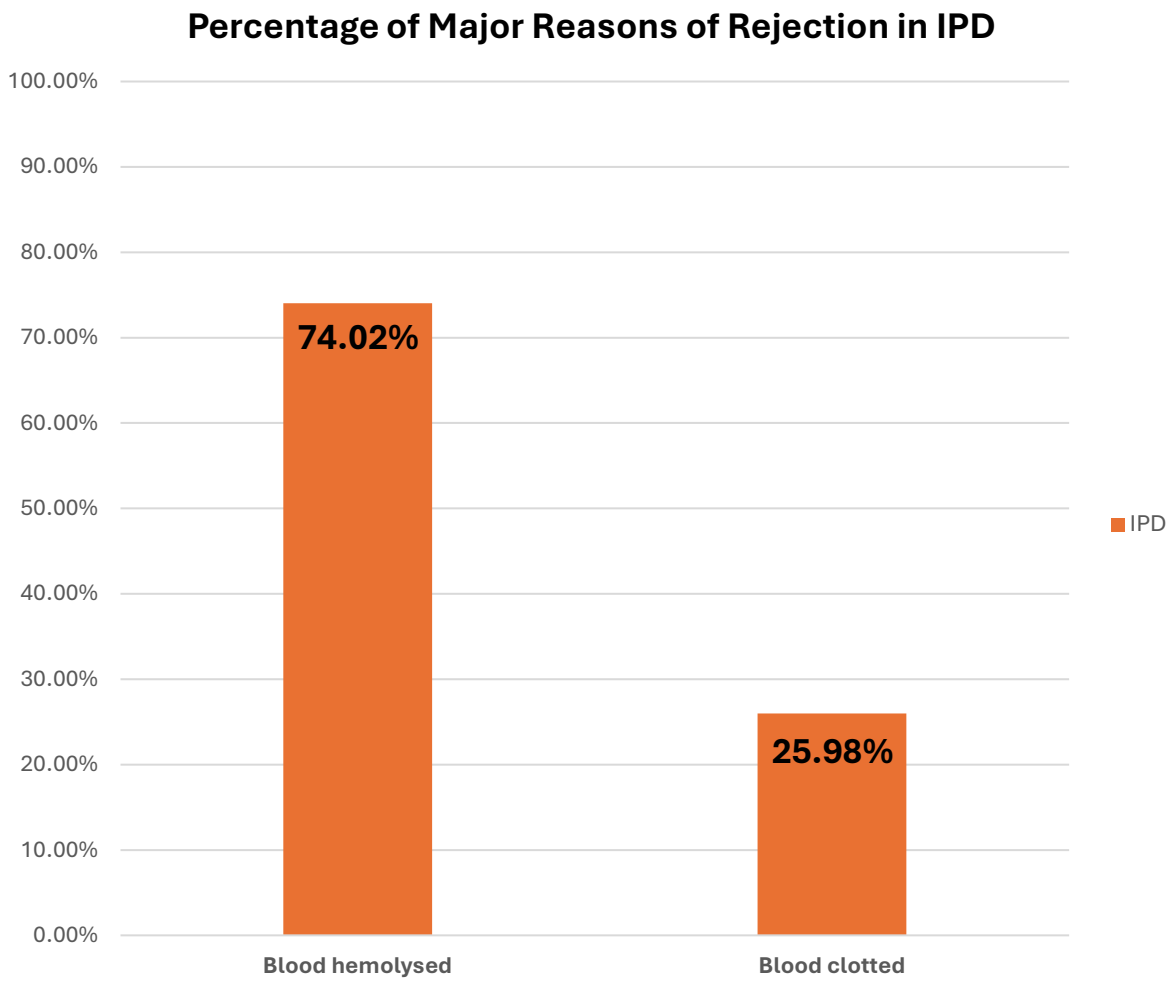
- Wrong order
- Duplicate order
- Rejected after Doctor’s consent

Retail

- Insignificant



Percentage of Major Rejection reasons in IPD

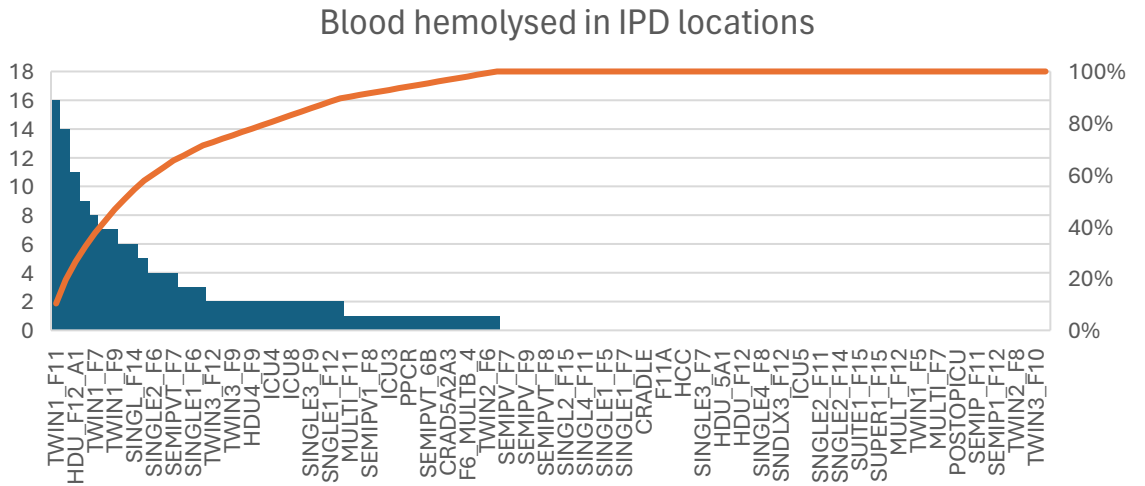


- As discussed earlier, **IPD** accounts for the **highest number of sample rejections**.
- Within IPD, percentage of top causes of rejection are:
  - **Haemolysis:** 74.02%
  - **Clotting:** 25.98%

Location-Wise Rejection Hotspots in IPD

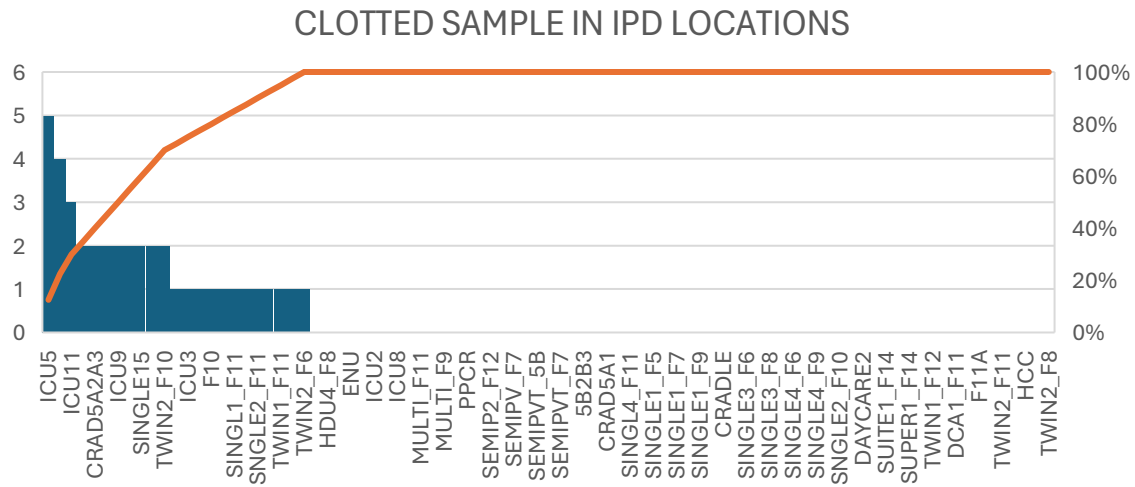
Haemolysis Hotspots

- Floors 11,12,7,9,14
- ICUs 4 & 8

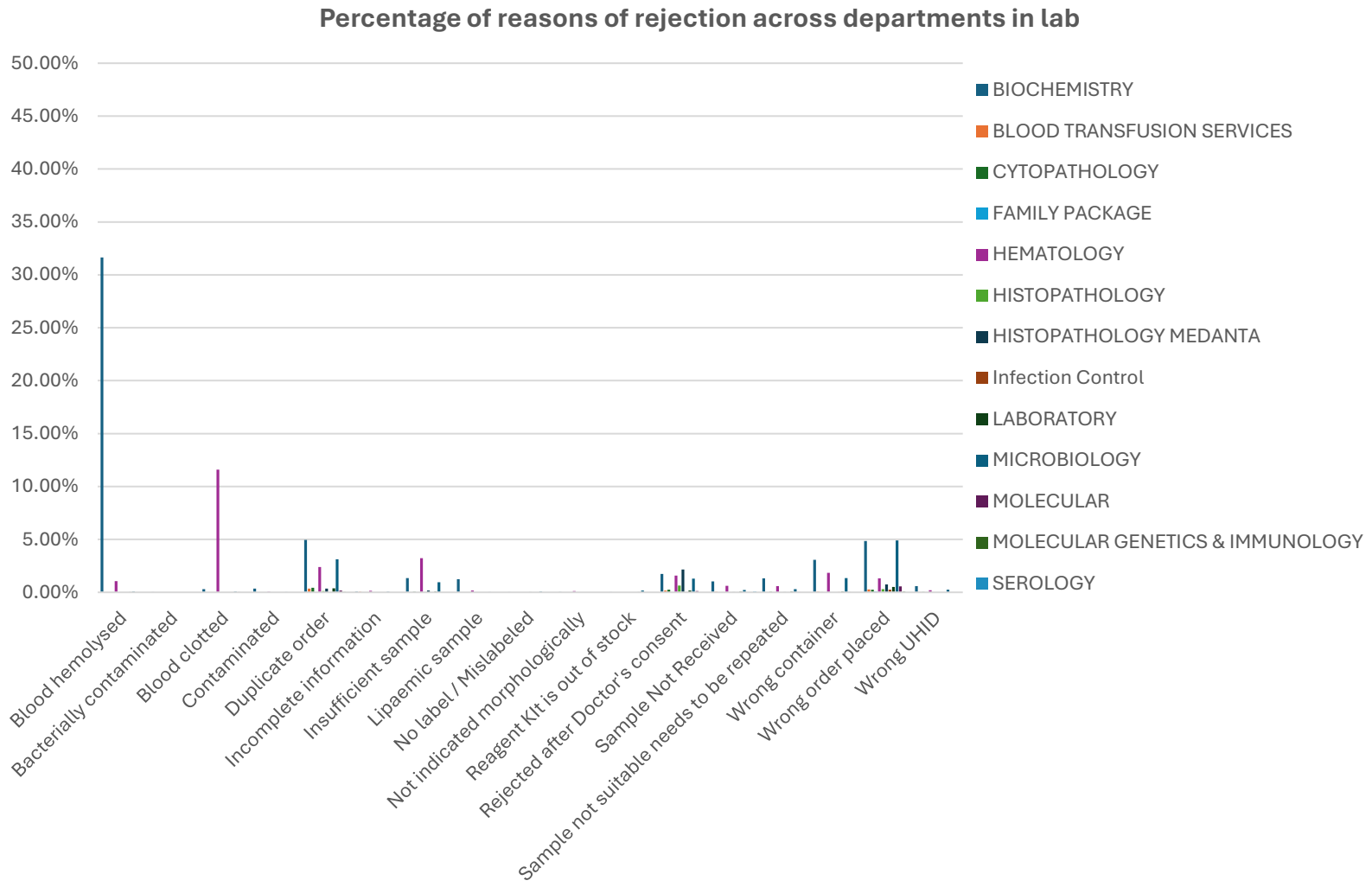


Clotting Hotspots

- ICUs 5,11,9,3,10,11
- Floors 5,15,10,11



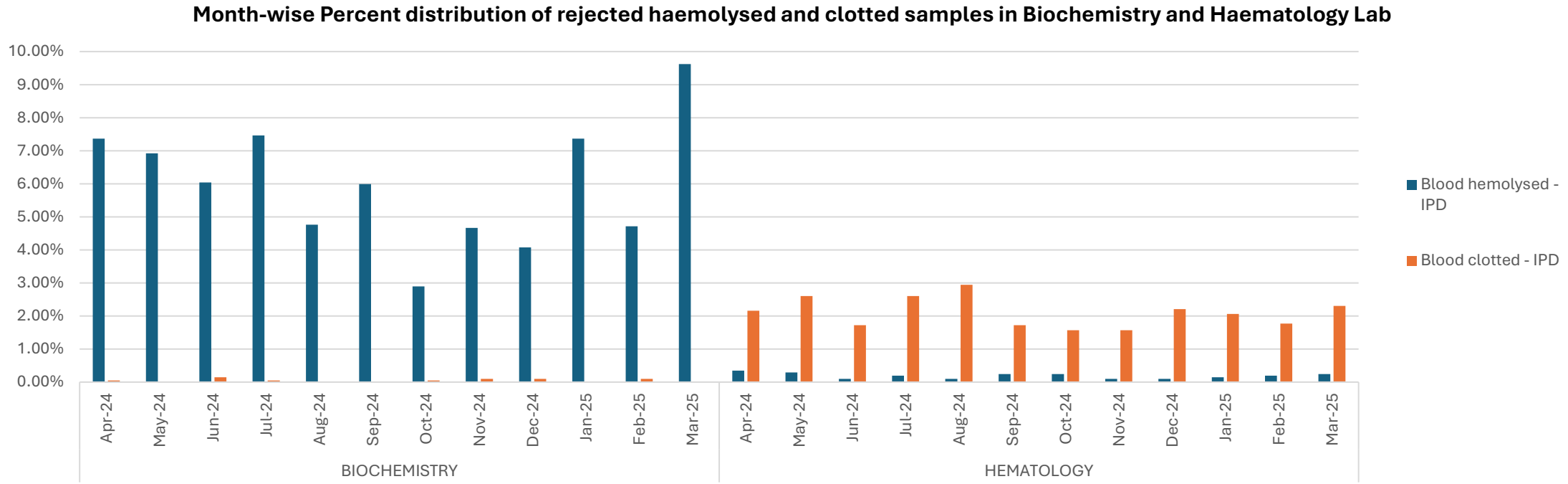
Lab's Department-Wise Sample Rejection Breakdown (Last FY)



According to the graph, Biochemistry lab and Haematology lab receives majority of rejected samples whose major causes are same here also –

- Blood haemolysis
- Clotting.

Lab's Department-Wise Major Rejection causes in last FY



Biochemistry

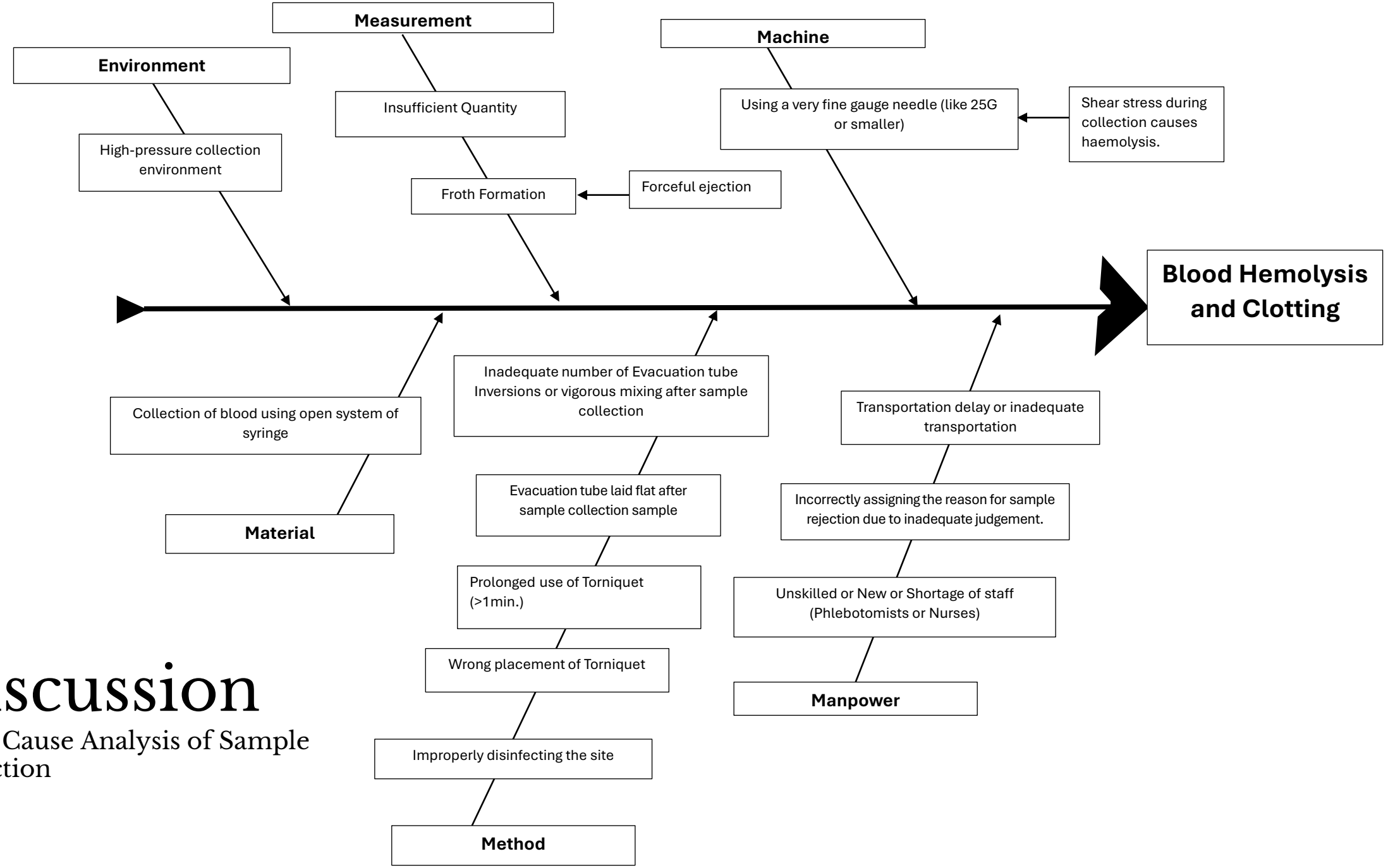
Hemolysis increased significantly in March-25 (approx. 9.8%)

Haematology

Clotting being the prevalent cause has fluctuating trend which is fairly at constant value of around 2% over the last FY.

Discussion

Root Cause Analysis of Sample Rejection



Conclusion

Pre-analytical sample rejection remains a major challenge at Medanta- the Medicity hospital, primarily due to modifiable human and operational factors.

- Majority of the rejections are stemming from the **IPD**
- **Haemolysis and clotting** are the most significant contributors in IPD's sample rejection causes.
- **Floor- 6th, 7th, 9th, 11th, 12th, and 14th floors, as well as ICUs 4 and 8**—had a higher frequency of haemolyzed samples. Similarly, **ICUs 5, 9, 11, and 3**, along with multiple floors, were repeatedly linked to clotting-related rejections.
- The problem areas were further traced to specific departments in laboratory, from which it was analysed that major departments receiving rejected samples are **Biochemistry and Haematology**.
- There also the major reasons of rejection were **Hemolysis (in Biochemistry) & Clotting (in Haematology).**

Using a root cause analysis through the Ishikawa diagram, it is identified that issues across manpower, methods, materials, measurement, and environment as key sources of error. These errors, if addressed strategically, can reduce rejection rates, improve operational efficiency, and enhance patient safety.

Recommendations to Reduce Rejection Rates

- Enhance Staff Training and Competence
- Develop a Real-Time Error Tracking System
- Conduct Regular Quality Audits and Feedback Sessions
- Root Cause Analysis for Recurring Errors
- Optimize Sample Transportation Protocols

- Implement Quality Improvement Tools (e.g. Pareto Analysis)
- Promote a Non-Punitive Error Reporting Culture
- Standardize Equipment and Sample Collection Kits
- Educational Campaigns and Culture Building
- Research and Continuous Improvement

Limitations of Study

Retrospective Design Limits Control
As a retrospective observational study, there was no control over how data was originally recorded. This may affect consistency, and restrict the ability to investigate variables not captured in LMIS logs.

Single-Centre Study
The study is confined to one hospital—Medanta – The Medicity hospital, Gurugram. While the hospital has a high sample volume, findings may not be directly applicable to other healthcare settings with different processes, staffing, or patient loads.

Possible Data Incompleteness or Inaccuracy
The study relies on LMIS-generated logs, which may have errors due to incorrect data entry, misclassification, or failure to document reasons for rejection accurately.

Unaccounted Changes in Hospital Operations
Operational changes during the year (e.g., staff turnover, SOP revisions, or system upgrades) could affect sample handling and rejection patterns. These dynamic variables are not captured in the study.

Rejection Classification May Be Overgeneralized
Some rejection types (e.g., “clotted” or “insufficient volume”) might be used as broad categories in the LMIS. Without deeper breakdowns, important distinctions within error types (such as whether clots occurred during transport or collection) may be lost.

Lack of Intervention Testing
Although recommendations are made, the study does not implement or test proposed solutions (e.g., training or SOP redesign), which limits its ability to measure the actual effectiveness of those interventions.

References-

1. Hammerling JA. Preanalytical errors in clinical laboratory testing at a glance. Lab Med. 2012;43(2):62–66. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10981510/
2. Lippi G, Becan-McBride K, Behúlová D, Bowen RA, Church S, Delanghe J, et al. Preanalytical quality improvement: from dream to reality. Clin Chem Lab Med. 2011;49(7):1113–1126. Available from: https://doi.org/10.1515/CCLM.2011.600
3. Lippi G, Salvagno GL, Montagnana M, Brocco G, Guidi GC. Reducing preanalytical laboratory sample errors through educational and technological interventions. *Clin Chem Lab Med.* 2012;50(7):1247–1254. Available from: https://pubmed.ncbi.nlm.nih.gov/23163106/
4. Plebani M. The detection and prevention of errors in laboratory medicine. Ann Clin Biochem. 2010;47(Pt 2):101–110. Available from: https://pubmed.ncbi.nlm.nih.gov/19952034/

5. Ali A, Ahmad S, Zaman S, Zaman F, Basit A, Sattar A, et al. Frequency and types of pre-analytical errors in a clinical laboratory of a specialized healthcare hospital. Pak J Med Sci. 2023;39(1):215–219. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10844902/
6. Dhananjay K, Shrivastava P, Jaiswal S. An audit of preanalytical errors as a quality measure in central clinical laboratory of a rural tertiary care hospital in Eastern Uttar Pradesh. J Diagn Pathol Oncol. 2019;4(4):123–127. Available from: https://www.jdpo.org/html-article/10264
7. Alavi N, Khan SH, Saadia A, Naeem T. Challenges in preanalytical phase of laboratory medicine: rate of blood sample nonconformity in a tertiary care hospital. EJIFCC. 2020;31(1):7–13. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7109505/
8. Singh P, Bhatia D, Verma R. A study on identifying the pre-analytical phase errors leading to biochemistry and haematology sample rejection by using FMEA & Pareto's principle. Int J Adv Res. 2020;8(3):1172–1177. Available from: https://www.journalijar.com/article/29619/a-study-on-identifying-the-pre-analytical-phase-errors-leading-to-biochemistry-and-hematology-sample-rejection-by-using-fmea--paretos-principle/

9. Patel C, Chauhan S, Makwana H, Parmar J. Study of pre-analytical errors in clinical biochemistry laboratory in Dhiraj General Hospital, Piparia. Int J Health Sci (Qassim). 2023;7(1):1–5. Available from: https://sciencescholar.us/journal/index.php/ijhs/article/view/11204/6685
10. Chathurika HLS, Nanayakkara R, Priyanka HL**.** Evaluation of issues pertaining to the pre-analytical phase within the Biochemistry laboratory of the National Hospital of Sri Lanka: A case study. *Int J Sci Res Publ.* 2024;14(7):15108. Available from: https://www.ijsrp.org/research-paper-0724/ijsrp-p15108.pdf

THANK YOU

Any Questions?