

INTERNSHIP REPORT ON
Turnaround Time of Blood Component Delivery System from
Transfusion Medicine to Ward/ICU/OT for Transfusion
A Study on Health Care Assistants (HCAs)

INTERNSHIP AT
Kokilaben Dhirubhai Ambani Hospital, Mumbai

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INTERNSHIP ORGANIZATION

- Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, commonly known as Kokilaben Hospital, is a renowned multispecialty tertiary care hospital and healthcare institution located in Mumbai. Named after Kokilaben Ambani, the wife of late industrialist Dhirubhai Ambani. The hospital has established itself as a premier medical center in the country
- The 750 bedded multi-speciality hospital became operational in 2009. Hospital spans over 17 acres and situated in Mumbai's Andheri West area. The hospital features well-equipped operation theatres, cutting-edge diagnostic facilities, and specialized departments covering a wide range of offers services in areas such as cardiology, oncology, neurology, orthopaedics, gastroenterology, nephrology, and many others.
- It is 3 times NABH and JCI accredited. For NABH hospital got reaccredited on 9th April 2022 valid till 9th December 2024 and from 17th April 2022 to 16th April 2025 for JCI. The laboratories here are CAP (January 2013) and NABL accredited.





ABSTRACT

The study describes the DMAIC (Define, Measure, Analyze, Improve, and Control) approach within a Lean Six Sigma framework for blood component delivery system to identify the areas of delay and improve the average turn-around time.

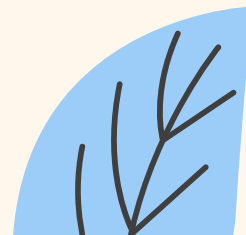
The study data was collected from 7th Apr 2023 to 22nd May 2023, focusing on the role of HCAs and blood issue counter actions.

Primary data was collected by real time tracking for relevant sub-processes, while secondary data was obtained from blood request forms and blood issue forms.

Within the different DMAIC phases, tools such as process mapping and why-why analysis were applied.

Microsoft Excel was used for result analysis and determining the total count, average, maximum, minimum TAT taken by blood issue counter to acknowledge request or sample, issue blood component and those exceeding the benchmark. Through Pareto analysis, the study identifies non-value-added activities within the current process.

Based on the analysis reason of delays, and interventions were designed to address them. The study provided recommendations for improving the existing process.



AIM

The aim of the study is to analyze the blood component delivery system to identify the areas of delay and improve the average turn-around time using DMAIC approach.

Research Objective

1. To identify factors that may contribute to delays in the delivery of blood components from blood issue counter to patients.
2. To determine the average total time consumed in blood or blood product issue, delivery, and transfusion to the patients

Research Question

Identify factors that may contribute in delayed delivery of blood components from blood issue counter to patients.

Scope

This research is conducted for assessing the TAT at different stages of blood issue process and identifying the key causes for delay in issuance & delivery.

Methodology

- **Study type** is Descriptive Cross-Sectional Study.
- **Setting of the study:** Kokilaben Dhirubhai Ambani Hospital, Mumbai.

Study Period

The study was conducted in hospital from 7th April to 22nd May

Sampling technique was Non- probability Purposive Sampling.

HCA's coming with blood request forms, blood issue form or blood sample from 9:00 AM to 7:00 PM were tracked. HCA's were observed from the time they come to the blood issue counter to the point they leave for their respective floor.

Data Collection

- Primary Data Collection: Real – time tracking with a mobile stopwatch focusing on HCA's and blood issue counter actions.
- Secondary Data Collection: Information gathered from Blood Request and Blood Issue Forms.

Data Analysis Tool

- The blood request form and blood issue form are used as reference tools and data collected using tracking sheet in MS Excel.
- The data used in the study was entered into a defined Excel sheet.

Sample Size

- 96 HCAs were observed between working hours of 9:00 AM to 7:00PM.
- 108 HCAs were observed between working hours of 9:00 AM to 7:00PM for Blood issue form.

Inclusion Criteria

- Data collected of all the HCAs coming to blood issue counter with Blood request forms, with or without samples for cross match, antibody screening in the time between working hours of 9:00 AM to 7:00PM.
- Data collected of all the HCAs coming to blood issue counter with Blood Issue Forms in the time between working hours of 9:00 AM to 7:00PM.

Exclusion Criteria

- Blood Request Forms and Blood Issue Forms arriving at blood issue counter in the time after working hours of 7:00 PM to 8:00 AM.
- HCAs arriving at blood issue counter with sample requests for ABO grouping.
- HCAs arriving at blood issue counter with feedback forms and empty transfused bag.
- Orders are composed during Sunday, public holidays.

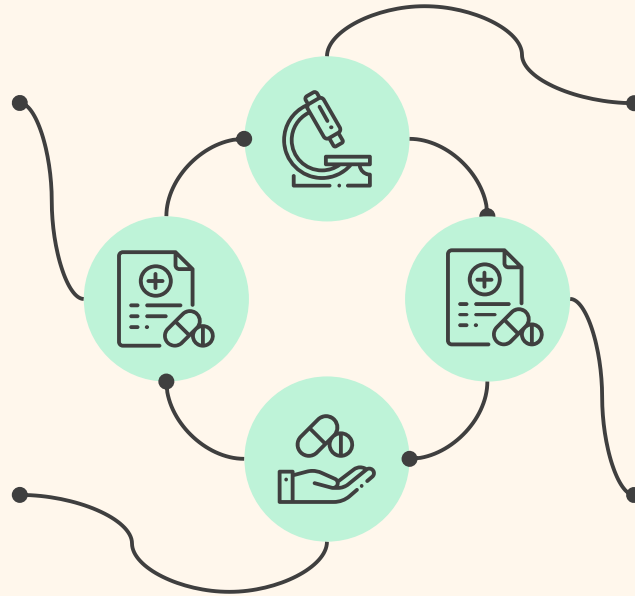
STUDY PROCEDURE

Blood Request Form

Blood Samples

Health Care Assitant

Blood Issue Form

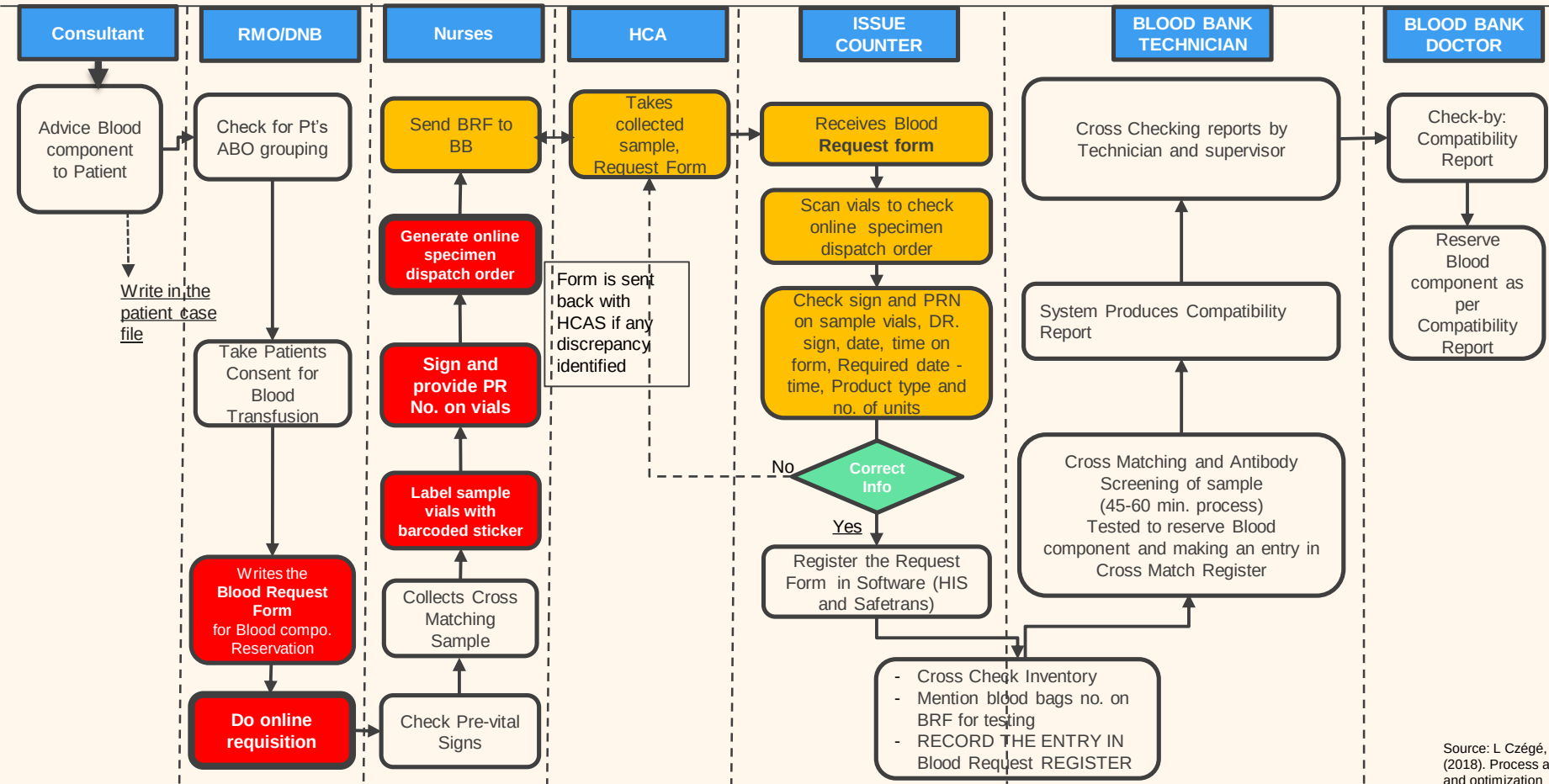


The research applied the six-sigma to identify and improve the quality and approach used in the study is DMAIC. The acronym stands for five phases: Define, Measure, Analyze, Improve, and Control.

BLOOD REQUEST FORM



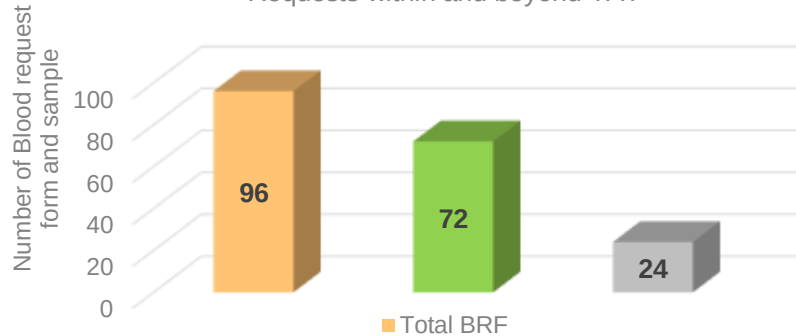
SWIMLANE DIAGRAM DEPICTING BLOOD REQUEST FORM PROCESS FLOW IN HOSPITAL



Analysis done for Blood Request Form and sample acceptance request: sample size (N) = 96

1. Calculated number of Blood request form and sample acceptance request which were within and beyond the benchmark TAT of 5 minutes.
2. Calculating average, maximum, minimum TAT by blood issue counter for Blood request form and sample acceptance.

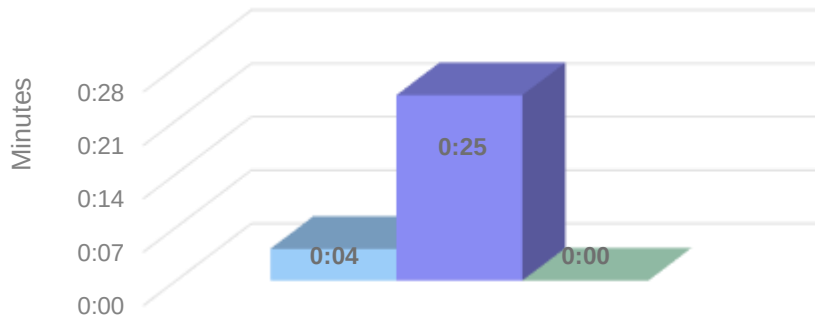
Requests within and beyond TAT



Interpretations

- Graph represents number of Blood request form & sample accepted within standard TAT (5 minutes)
- It's been observed 75% request (72) were accepted within 5 minutes and 25% request (24) were accepted beyond 5 minutes
- Observed delay caused due to following reasons:
 - Incomplete and Incorrect forms
 - Heavy inflow of requests
 - Protocol not followed or HCA unaware of protocol

Average, Maximum, Minimum time taken by blood issue counter for Blood request form and sample acceptance

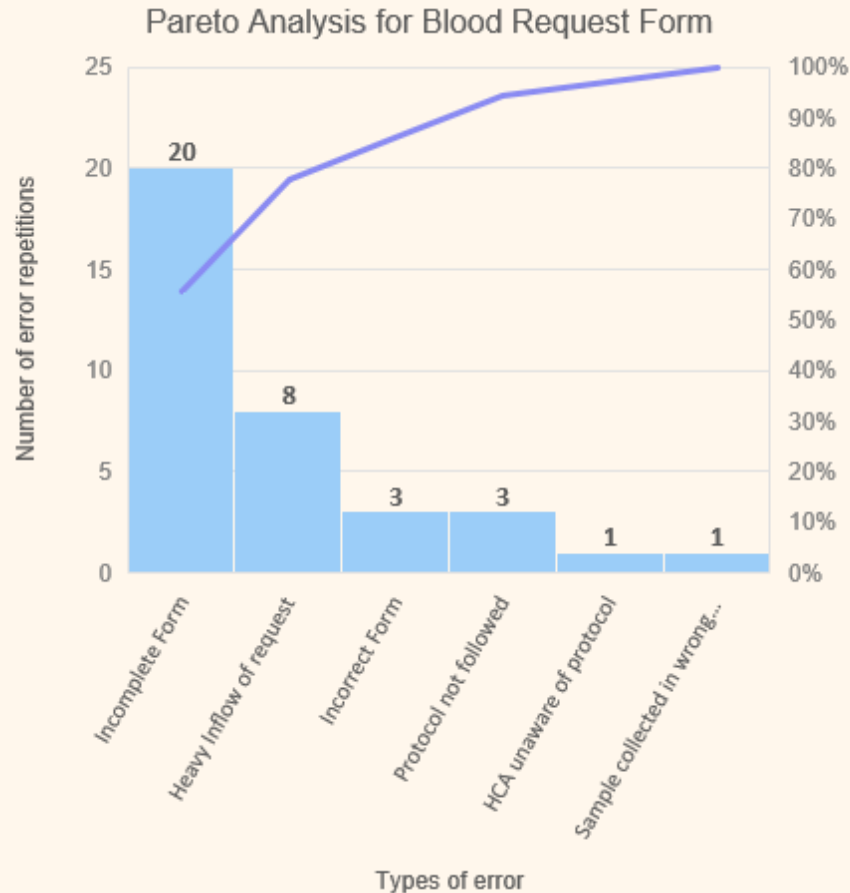


Interpretations:

- Above graph represents the average time of 4 minutes taken by Blood issue counter to process a request
- Highest time observed as 25 minutes at Blood issue counter to process a request and also noted immediate responsiveness in some cases



- **Pareto Analysis** was done to calculate the frequency or occurrence of errors for different categories.
- Sample size (N) = 96



Interpretations: Pareto Analysis reveals that 80% of the variation in blood request form is due to

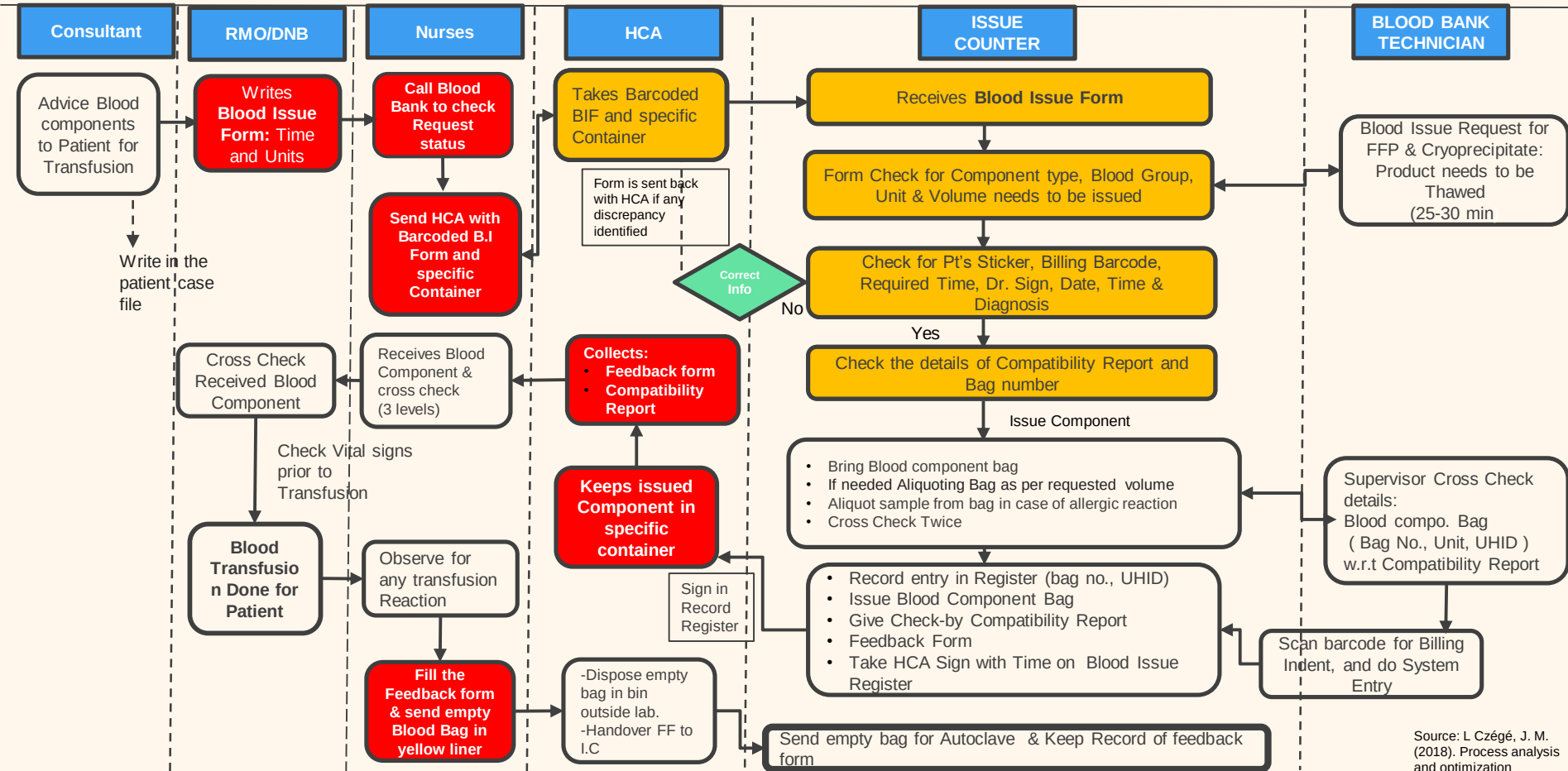
- Incomplete or Incorrect forms written by doctor or nurse
- Heavy inflow requests at blood issue counter

Sr. No	Types of Error observed for Incomplete Blood Request Form
1	Indications not mentioned on form
2	Gamma irradiations not mentioned
3	Form Barcode without Sign-PRN
4	Doctor name not mentioned
5	Barcode not stucked on form
6	Date & Time not mentioned
7	Diagnosis Missing in the form
8	Doctor Signature Not mentioned
9	Age, Gender & Relatives number not mentioned
10	Required time not mentioned
11	phlebotomist sign and PRN missing
12	Blood Component not mentioned
13	Online Order not dispatched
14	HCA Sent without sample
15	Specimen barcode without Sign-PRN
16	Specimen sent without barcode

BLOOD ISSUE FORM



SWIMLANE DIAGRAM DEPICTING BLOOD ISSUE FORM PROCESS FLOW IN HOSPITAL

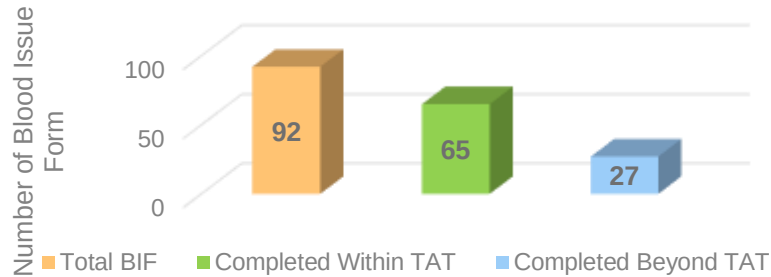


Analysis done for PRBC, SDP, RDP, Platelets and Granulocytes Blood Issue Form : sample size (N) = 92

1. Calculated number of Blood issue form requests which were within and beyond the benchmark TAT of 20 minutes.
2. Calculating average, maximum, minimum TAT by blood issue counter.



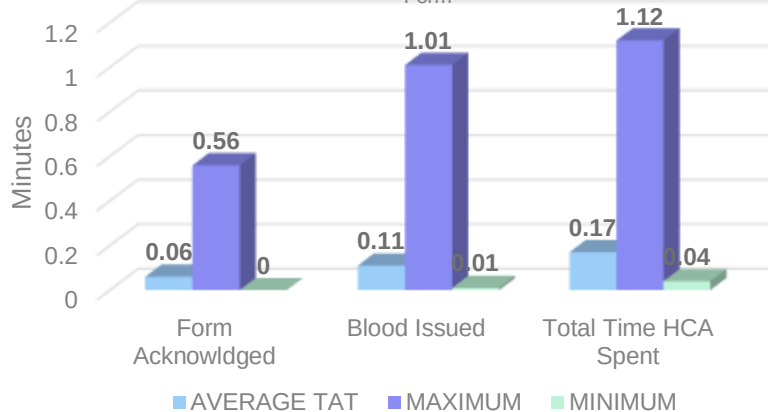
Issue Form within and beyond TAT



Interpretations:

- Graph represents number of Blood issue forms completed within standard TAT (20 minutes - component issue & aliquot bag)
- It's been observed 71% request (65) were completed within 20 minutes and 29% request (27) were completed beyond 20 minutes
- Observed delay caused due to following reasons:
 - Incomplete and Incorrect forms
 - Heavy inflow of requests
 - Protocol not followed or HCA unaware of protocol

Average, maximum, minimum TAT by blood issue counter for Blood Issue Form



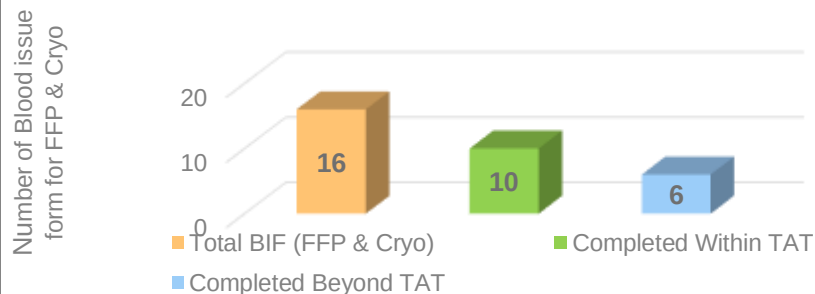
Interpretations:

- Graph represents the average time of 6 minutes, maximum time of 56 minutes and immediate responsiveness at Blood issue counter to accept blood issue form.
- Graph represents the average time of 11 minutes, maximum time of 1 hour 1 minute and minimum time of 1 min at Blood issue counter to issue blood component
- Graph represents the average time of 17 minute, maximum time of 1 hour 12 minute and minimum time of 4 mins HCA had to spent at Blood issue counter
- Observed delay caused due to following reasons:
 - Incomplete and Incorrect forms
 - Heavy inflow of requests
 - Protocol not followed or HCA unaware of protocol

Analysis done for Fresh Frozen Plasma(FFP) & Cryoprecipitate (Cryo): Blood Issue Form : sample size (N) = 16

1. Calculated number of Blood issue form requests which were within and beyond the benchmark TAT of 45 minutes.
2. Calculating average, maximum, minimum TAT by blood issue counter for FFP and Cryo.

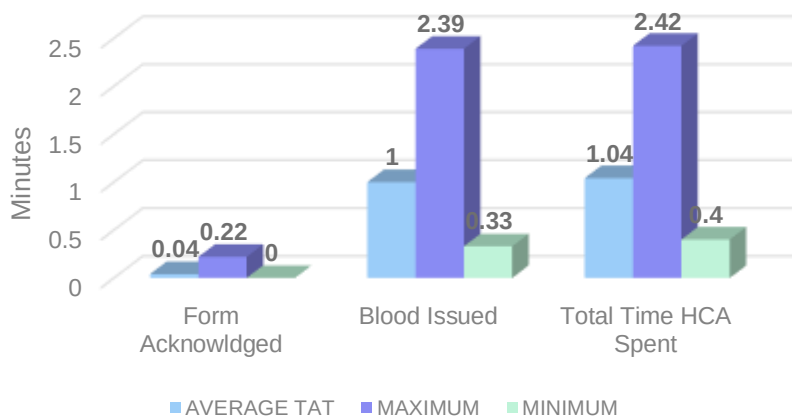
Blood Issue Form within and beyond TAT for FFP and Cryo



Interpretations:

- Graph represents number of Blood issue form requests completed within standard TAT (45 minutes)
- It's been observed 62% request (10) were completed within 45 minutes and 38% request (6) were completed beyond 45 minutes
- Observed delay caused due to following reasons:
 - Incomplete and Incorrect forms
 - Heavy inflow of requests
 - Protocol not followed or HCA unaware of protocol

Average, maximum, minimum TAT by blood issue counter for Blood Issue Form for FFP and Cryo



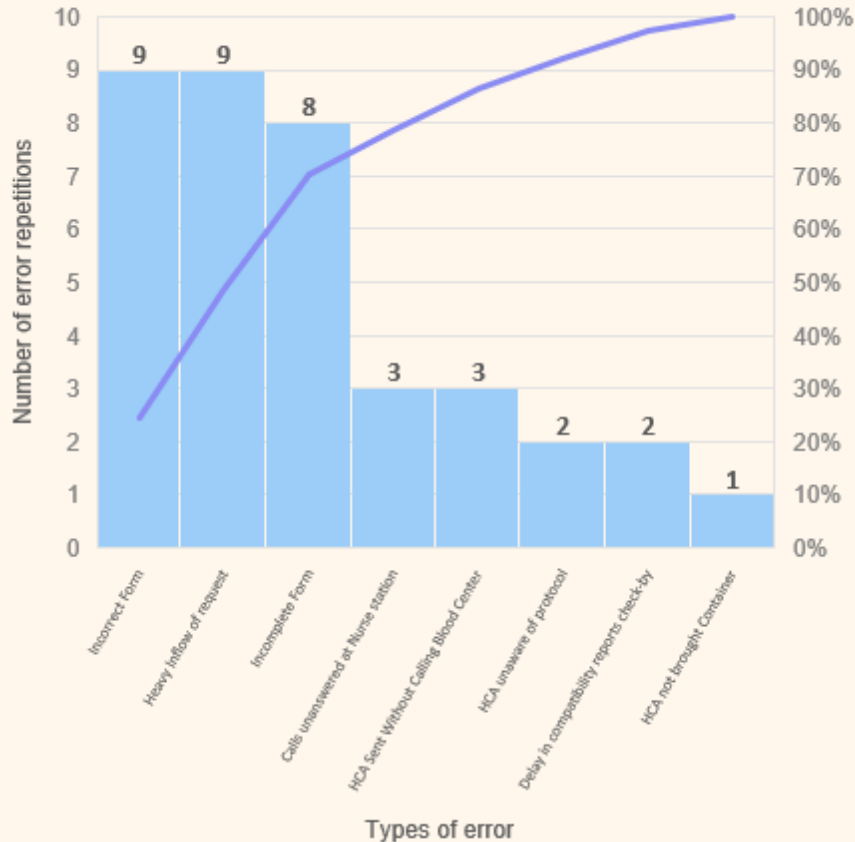
Interpretations:

- Graph represents the average time of 6 minutes, maximum time of 56 minutes and immediate responsiveness at Blood issue counter to accept blood issue form.
- Graph represents the average time of 11 minutes, maximum time of 1 hour 1 minutes and minimum time of 1 min at Blood issue counter to issue blood component
- Graph represents the average time of 17 minutes, maximum time of 1 hour 12 minutes and minimum time of 4 minutes HCA had to spent at Blood issue counter
- Observed delay caused due to following reasons:
 - Incomplete and Incorrect forms
 - Heavy inflow of requests
 - Protocol not followed or HCA unaware of protocol
 - Calls not answered at nurse station

- **Pareto Analysis** was done to calculate the frequency or occurrence of errors for different categories.
- Sample size (N) = 108.



Pareto Analysis for Blood Issue Form



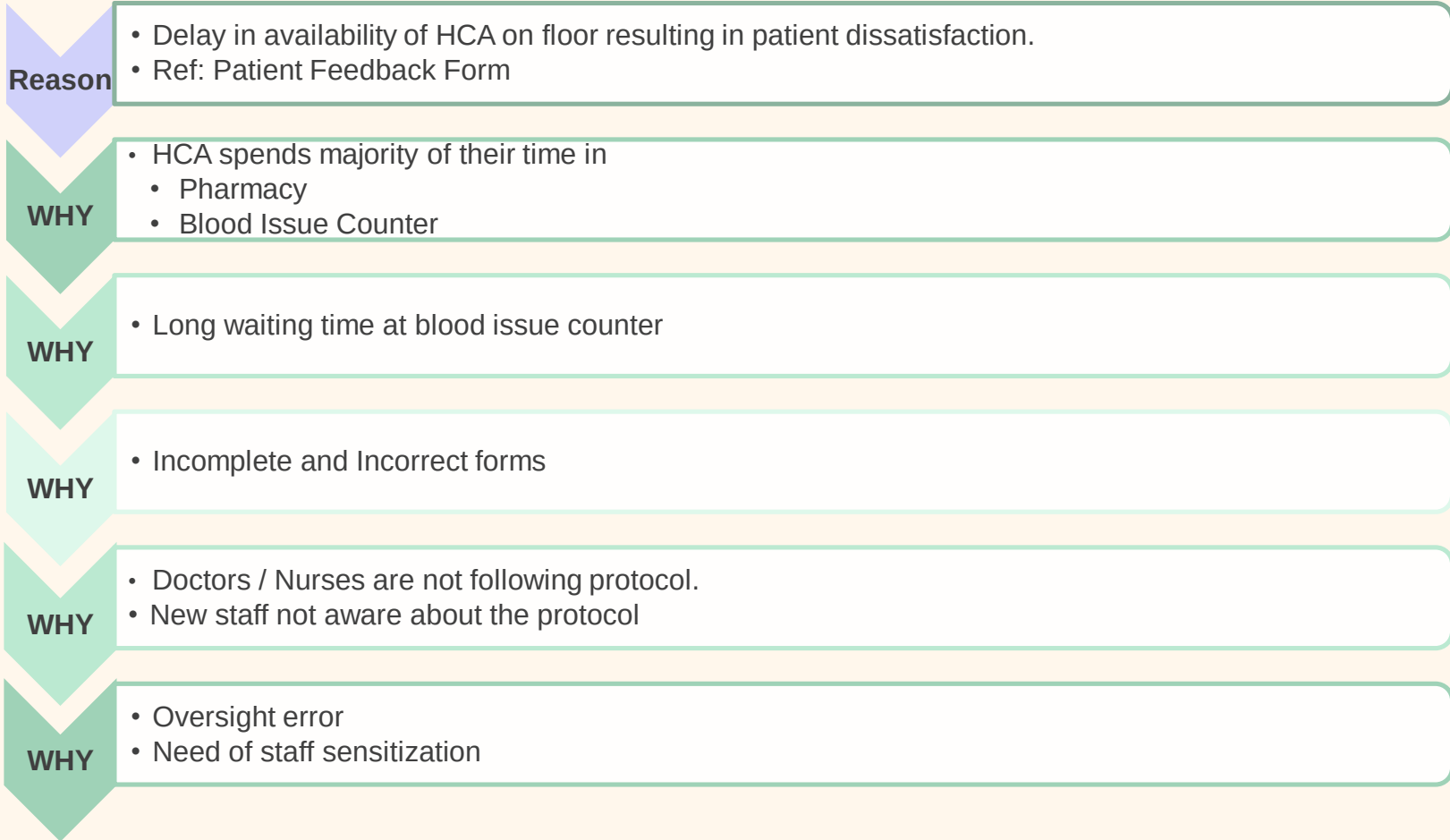
Interpretations:

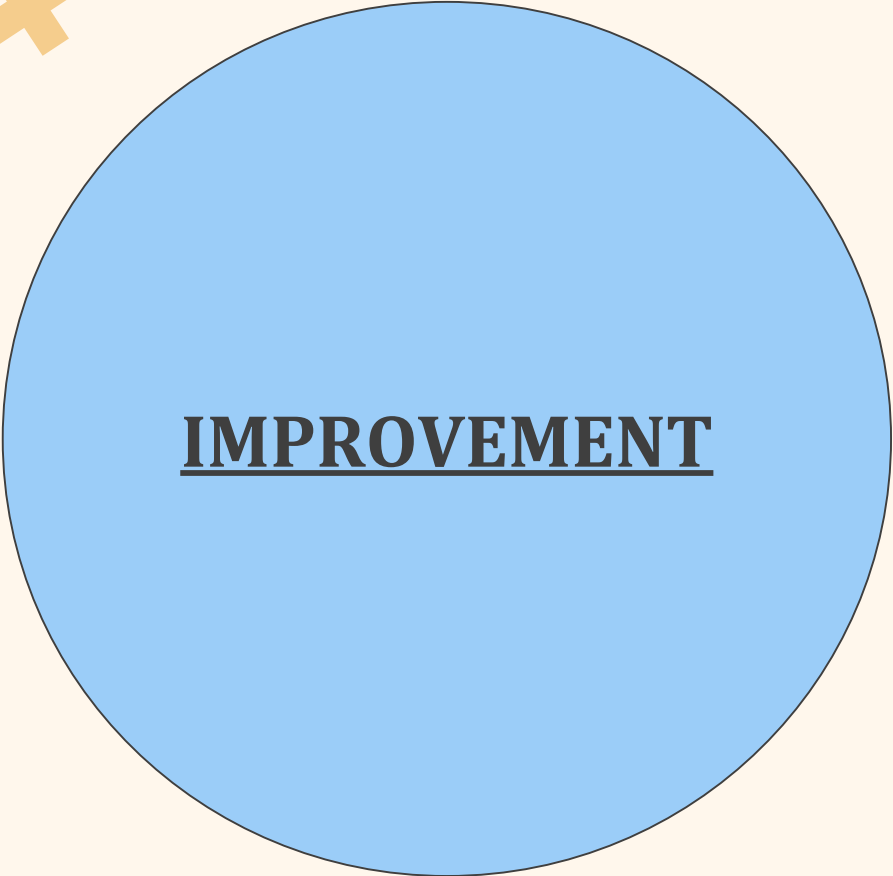
Pareto Analysis reveals that 80% of the variation in blood Issue form is due to

- Incorrect forms written by doctor or nurse
- Heavy inflow requests at blood issue counter
- Incomplete forms written by doctor or nurse.

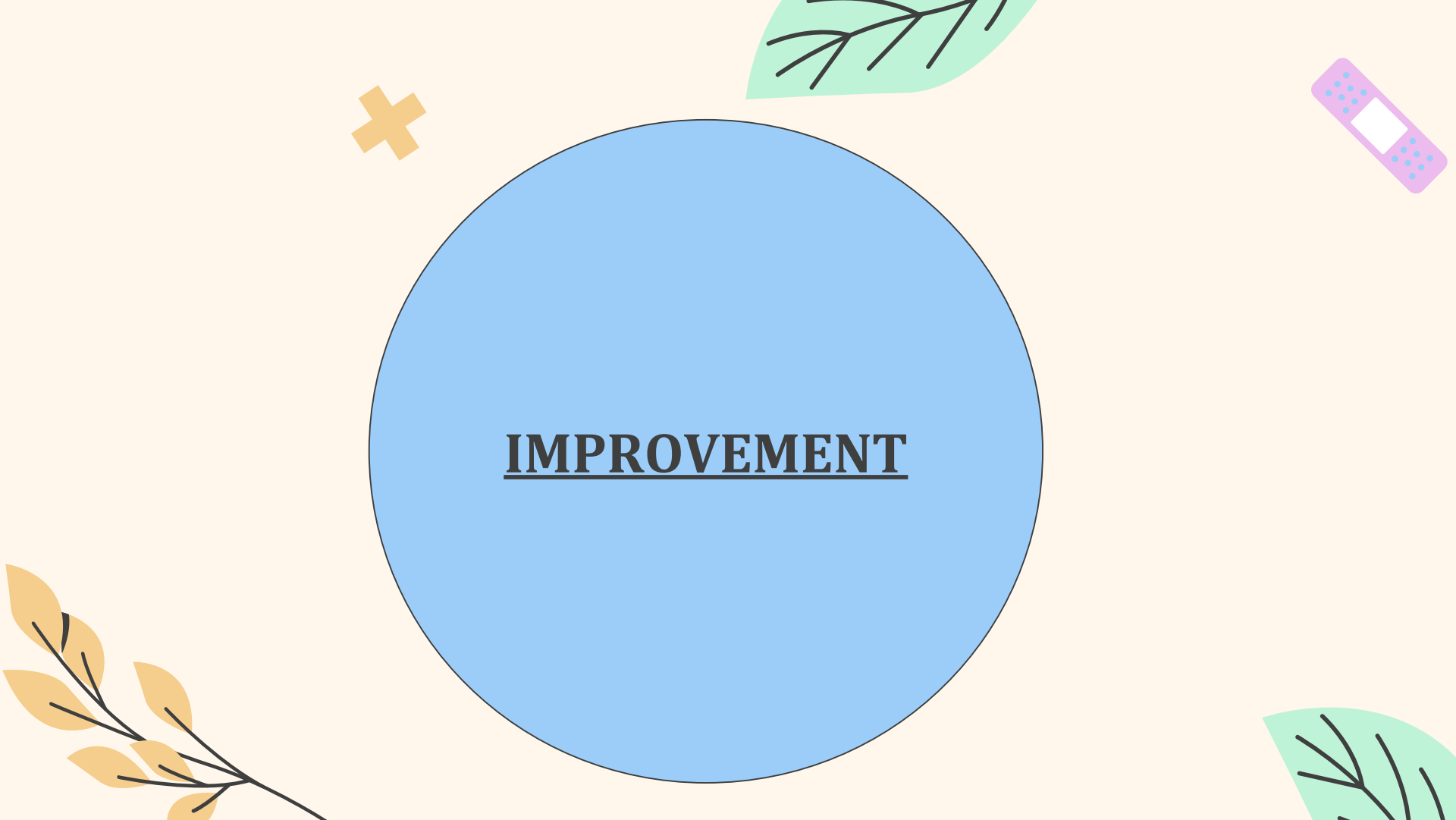
Sr No.	Types of Error observed for Incorrect BIF Form
1	Wrong Date mentioned
2	Wrong Blood Component mentioned
3	Wrong Blood Volume mentioned
4	Wrong Bar Code stuck
5	Wrong order details mentioned
6	Wrong Blood Group mentioned
7	Wrong Gender mentioned
8	Wrong required time mentioned
9	Form Overwriting
10	Wrong Patient UHID mentioned

WHY-WHY or 5-WHY Analysis





IMPROVEMENT



- The results of the analyse phase are applied in the improve phase. Consideration was given to improvements, and brainstorming was done to find solutions to the problem statements that were among the most controllable reasons of delay.
- To discuss the factors found during the analysis phase meeting was conducted including all the stakeholders responsible for errors and delay in delivery system are as follows
 - Head Of Blood Centre
 - Blood Technician Supervisor
 - Head Clinical Quality
 - Clinical Administration Managers Team
 - Head of Nursing Administration
 - Deputy General Managers Nurses
 - General Manager Nurses
 - HCA Supervisor

PROBLEM STATEMENT 1: Delay due to Incorrect and Incomplete documentation

- **Staff Responsible:** Clinical Admin Managers, Junior Medical Staff
- **Recommendation:** Clinical Administration team needs to take training sessions to provide better understanding on existing protocols for blood and blood components, regular monitoring and inform all Junior medical staff to not involve nurses for writing and online requisition of BRF and BIF.

PROBLEM STATEMENT 2: Delay due to Incorrect and Incomplete documentation

- **Staff Responsible:** Nurse Managers and Nurses
- **Recommendation:** Nurse managers are informed about the type of errors-delayed online order dispatch, filling of BRF, BIF and asked to provide training sessions for better understanding on existing protocols for blood and blood components, regular monitoring. Nursing staff on the floor to be updated with observation and immediate corrective action to be taken.

PROBLEM STATEMENT 3: Delay due to heavy inflow of requests at blood issue counter

- **Staff Responsible:** Blood center or Blood issue counter
- **Recommendation:** Blood center head was asked to prioritize of HCAs by Blood Centre or blood issue counter who are coming with Blood issue form for FFP and cryoprecipitate components as it requires thawing of 30-35 minutes before issue.

PROBLEM STATEMENT 4: Lack of regulation of Standard Operating Procedures (SOPs) need to be followed by nurses for blood request or blood issue.

- **Staff Responsible:** Nurse Managers and Nurses
- **Recommendation:** Nurse Managers were asked to provide regular session for provide better understanding of SOPs, also asked to design an induction programme with the help of blood center for new joining staff. The sessions should include brief about protocols for sample collection, barcodes used for different type of components request and issue, to provide sign-PRN on form and sample, type of container required for PRBC, FFP and to send HCA to blood issue counter after calling.

PROBLEM STATEMENT 5: Delay as HCAs are not aware about protocols.

- **Staff Responsible:** HCA Supervisor and HCA staff
- **Recommendation:** Training sessions to HCAs for coming forward in line in case of Blood request form and Blood issue form with FFP and cryo component.

CONTROL

To control the reason of delay result of barcode errors, wrong barcode for wrong component. This template/poster was circulated for all floor wings with service codes for Online order of Blood Component for doctors and nurse.

Sl.No	Component Request	Service Codes	Main Group	Sub Group	Service Description
1	PRBC	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Leuko Reduced Concentrate of Human Red Blood Cells (LR RBC)-NAT
2	Gamma Irradiated PRBC	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Leuko Reduced Concentrate of Human Red Blood Cells (LR RBC)-NAT
3	SDP	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Gamma Irradiation- Packed Red Cell Cons
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges- Single Donor Platelet (SDP)- LR-NAT
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Gamma Irradiation- Single Donor Platelet
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Bacterial Screening-SDP
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Platelet Additive Solution

Sl.No	Component Request	Service Codes	Main Group	Sub Group	Service Description
4	Packed Platelet	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Platelet Concentrate (PLT) (PC)
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Gamma Irradiation-Platelet Concentrate
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Bacterial Screening-PC
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Platelet Additive Solution
5	Platelet Concentrate	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Platelet Concentrate (PLT) (PC)
6	Fresh Frozen Plasma	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Fresh Frozen Plasma (FFP)-NAT
7	Gamma Irradiation of Fresh Frozen Plasma	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Fresh Frozen Plasma (FFP)-NAT
		LUFTN000000	Laboratory Medicine	Transfusion Medicine	Gamma Irradiation- Fresh Frozen Plasma
8	Cryoprecipitate	LUFTN000000	Laboratory Medicine	Transfusion Medicine	Processing Charges - Cryoprecipitate Anti-Hemophilic Factor (CRYO)-NA

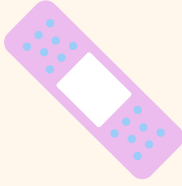
CONCLUSION

The study was conducted at a multi-specialty hospital to optimize turnaround time of the blood component delivery system using the Six Sigma DMAIC technique. The first five phases of DMAIC (Define, Measure, Analysis, Improve, Control) were successfully completed, and various tools such as process mapping, pareto analysis and why-why analysis were employed. The six-sigma approach was used with an aim to improve the efficiency of the delivery process of blood components. The findings of this study have important implications for patient care and healthcare efficiency. By reducing these, hospital can ensure timely access to blood components, leading to improved patient outcomes and satisfaction. The study provides valuable insights for healthcare administrators to identify areas for improvement and optimize the blood component delivery system.



REFERENCES

1. Sokovic M, Pavletic D, Pipan KK. Quality improvement methodologies–PDCA cycle, RADAR matrix, DMAIC and DFSS. Journal of achievements in materials and manufacturing engineering. 2010 Nov 1;43(1):476-83.
2. Storage and Transportation of Blood and components [Internet]. Gov.In. [cited May 28, 2023] Available from: <http://nbtc.naco.gov.in/assets/resources/training/8.pdf>
3. Hijji B, Parahoo K, Hussein MM, Barr O. Knowledge of blood transfusion among nurses. Journal of clinical nursing. 2013 Sep;22(17-18):2536-50.
4. Dzik WH, Corwin H, Goodnough LT, Higgins M, Kaplan H, Murphy M, Ness P, Shulman IA, Yomtovian R. Patient safety and blood transfusion: new solutions. Transfusion Medicine Reviews. 2003 Jul 1;17(3):169-80.
5. Nybo, M., Cadamuro, J., Cornes, M. P., Gómez Rioja, R., & Grankvist, K. (2019). Sample transportation - an overview. Diagnosis (Berlin, Germany), 6(1), 39–43. Available From: <https://doi.org/10.1515/dx-2018-0051>
6. Hijji B, Parahoo K, Hussein MM, Barr O. Knowledge of blood transfusion among nurses. Journal of clinical nursing. 2013 Sep;22(17-18):2536-50.



Thank You

