Enhancing Patient Safety in Blood Specimen Collection the Impact of Implementing EGIS Electronic Collection Module (ECM)

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Mission Statement

To reduce the rate of *rejected laboratory specimens in the Emergency Department (ED).

*Rejected = mislabelled, unlabelled, or suspected to have been taken from the wrong patient.

Team Members

Name	Department	Role	Job Description
Dr Khong Zi-Shen	Emergency Medicine	Team Leader	Senior Resident
Dr Juliana Thay	Emergency Medicine	Team Member	Senior Consultant
Ms Liew Xingmei	Emergency Medicine	Team Member	Nurse Clinician I
Dr Chiu Li Qi	Emergency Medicine	Improvement Advisor, Project Supervisor	Senior Consultant
Ms Gloria Siew	Clinical Standards & Improvement	Collaborator	Manager
Mr Wong Tze Yin	Medical Laboratory Technology Service	Collaborator	Senior Medical Laboratory Scientist
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Background

From January to July 2022, an internal audit conducted unveiled 497 rejected specimens, equating to 2.2 errors per 1,000 collected specimens. Comparatively, the hospital's overall error rate stood at 1.1 errors per 1,000 specimens collected. Incident reports further revealed two cases of non-indicated blood transfusion and four instances of unnecessary electrolyte replacement. These errors not only caused increased patient distress due to repeated blood sampling but also led to higher healthcare costs.

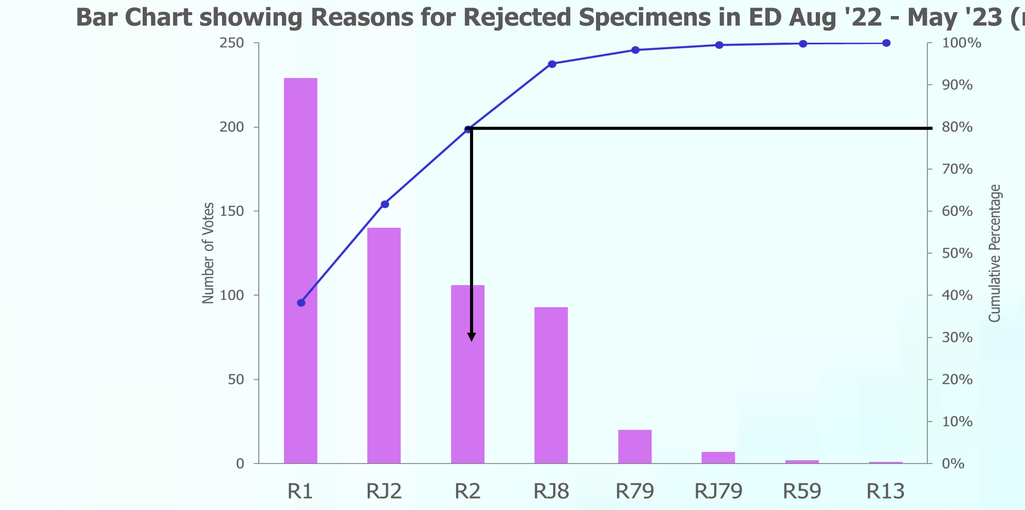
Methods

- Data regarding mislabelled specimens was obtained from the Department of Laboratory Medicine for the period January to August 2022.
- A sample of incident reports related to the mislabelled samples were extracted from the hospital's incident reporting system from April to August 2022.
- Results were analysed and presented in the form of a Statistical Process Chart.

Reasons for Blood Specimen Rejection

Code	Explanation	Interpretation
R1	Unlabelled specimen	Test not run. Specimen needs to be recollected.
R2	Discrepancy between specimen label and patient identifier	
R13	Form with no patient's particulars	
R59	Patient's ID tallies on request form and specimen tube but there is discrepancy in the blood group from the previous record.	Test has been processed. Specimen needs to be recollected.
RJ2 (microB)	Unlabelled specimen	Test not run. Specimen needs to be recollected.
RJ8	Mislabelled specimen	
RJ79	Patient's ID tallies on request form and specimen tube but there is a strong possibility that this specimen may not be from this patient.	Test has been processed. Specimen recollection is recommended as there is a strong possibility of error.

Pareto Chart of Rejected Specimens

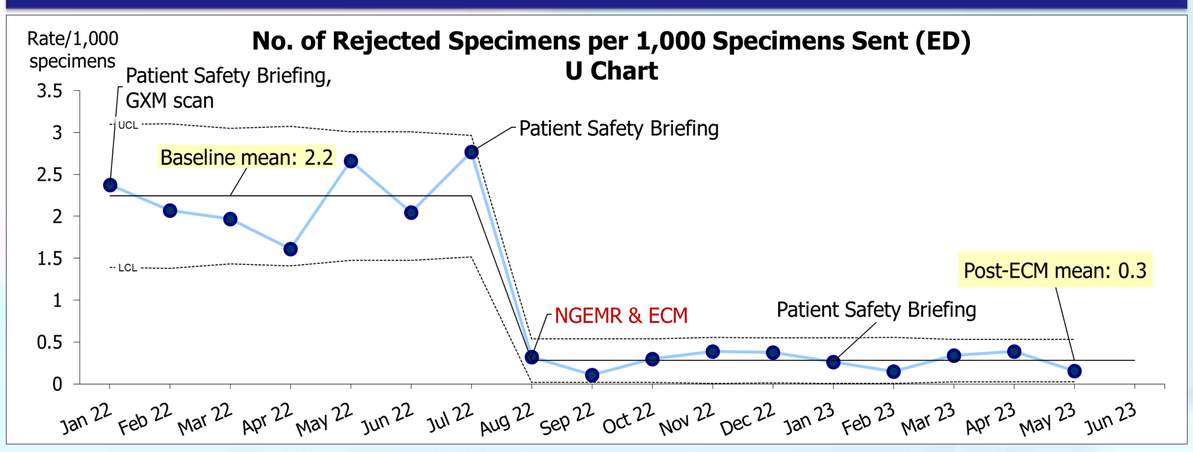


80% of specimens were rejected due to being mislabelled (R2) or unlabelled (R1/RJ2)

Interventions

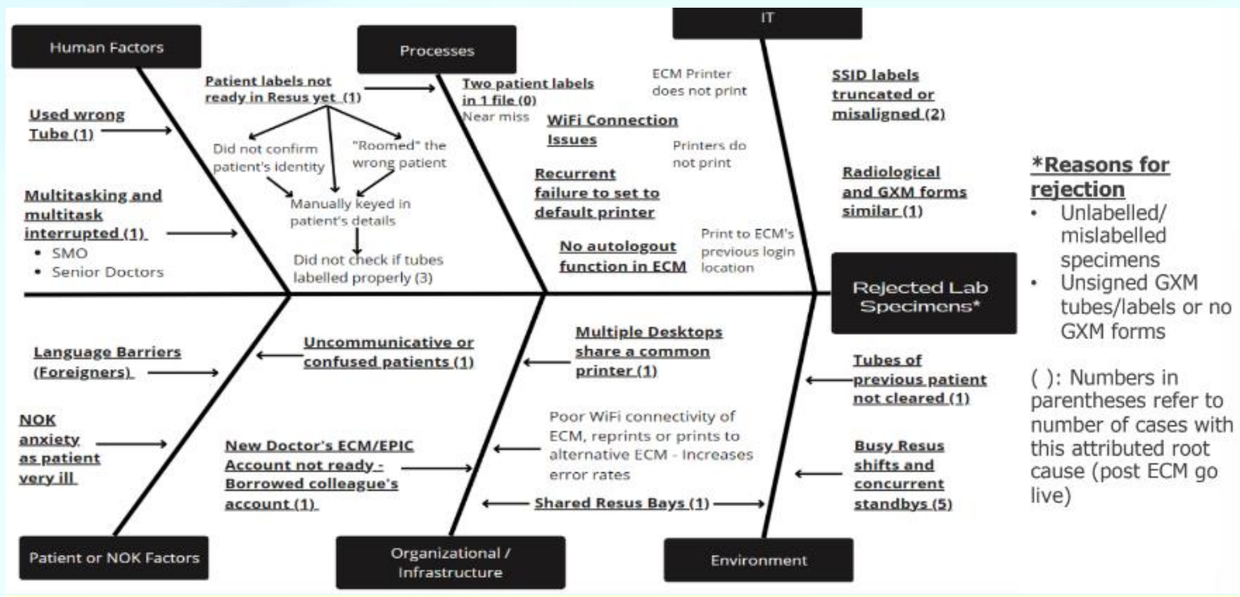
1. Biannual ED patient safety briefings scheduled in January and July, the first month of posting for all junior doctors, and regular nursing roll calls. Focusing on the common root causes of errors during specimen collection and highlights the importance of the usage of two patient identifiers during specimen collection, labelling and despatch.
2. Barcode scanning of patient label on blood tube and GXM form to confirm same patient details before despatching the specimen.
3. Introduction of the Electronic Collection Module (ECM) by EGIS Technology Inc. In August 2022.
   - ECM reduces error rates by automating specimen collection processes and implementing safeguards such as electronic order entry and barcode scanning.
   - These features ensure accurate patient and specimen identification and minimises risk of human error.
   - Real-time data collection also allows for immediate error detection and correction.
   - Overall, these built-in safety measures standardise procedures and mitigate the potential for mistakes. This was in comparison to the previous collection method in the ED where patient identification for specimen collection and the labelling of specimens depended solely on the healthcare worker's compliance to the usage of two patient identifiers and double-checking of specimens before despatch.

Results



Between January 2022 to July 2022, there were 497 rejected specimens (71 errors per month). In contrast, between August 2022 to May 2023, there were 101 rejected specimens (10 errors per month). The specimen rejection rate was 2.2 rejections per 1,000 specimens collected versus 0.3 rejections per 1,000 specimens collected, reflecting an 87% reduction in error rate. ECM proved to be the strongest and most sustainable intervention introduced.

Cause and Effect Diagram for Rejected Specimens Post Intervention



Total Number of Errors: 17 (some errors have >1 root cause)

The most common root causes were the sharing of a busy resuscitation area with concurrent standbys, the use of shared printers and sharing the responsibility of specimen collection between multiple personnel (i.e. three different persons are involved in blood extraction, specimen collection on ECM and despatching the samples for one patient).

Cost Savings

Baseline

Month	R1	R2	R13	R59	R79	RJ2	RJ79	RJ8
Jan 22	25	13	0	0	2	13	12	1
Feb 22	20	5	0	0	0	18	13	0
Mar 22	22	9	0	0	0	16	14	0
Apr 22	16	10	0	0	0	13	8	0
May 22	29	14	0	1	0	27	20	0
Jun 22	31	16	0	0	2	16	5	0
Jul 22	35	26	0	0	0	26	19	0
Average/Month	25.4	13.3	0.0	0.1	0.6	18.4	13.0	0.1

Post-intervention

Month	R1	R2	R13	R59	R79	RJ2	RJ79	RJ8
Aug 22	6	2	0	0	0	1	0	3
Sep 22	2	0	0	0	0	2	0	0
Oct 22	4	3	1	0	0	3	0	0
Nov 22	8	2	0	0	1	2	0	0
Dec 22	3	2	0	0	5	0	1	2
Jan 23	8	0	0	0	0	1	0	0
Feb 23	3	0	0	0	0	1	0	1
Mar 23	10	0	0	0	3	0	0	0
Apr 23	4	3	0	1	5	1	1	0
May 23	3	1	0	0	2	0	0	0
Average/Month	5.1	1.3	0.1	0.1	1.6	1.1	0.2	0.6
Difference/Month	**20.3**	**12.0**	**-0.1**	**0.0**	**-1.0**	**17.3**	**12.8**	**-0.5**

Numbers are too small and not included into calculation.

Item	Unit Cost
Nursing (SN) manpower	1.09/min
Medical Officer manpower	$ 1.41/min
Time take to repeat one specimen	15 minutes
Consumables (Alcohol swab, gauze, needle, Elastoplast) with 1 lavender and 1 light green tube	$ 0.47/collection
Total cost for 1 aerobic and 1 anaerobic blood C/S set	$ 89.25

	Assumptions	Calculation
R1+R2	Specimen not run. New specimen taken by SN	= [(20.3 + 12.0) x 1.09 x 15] + [(20.3 + 12.0) x 0.47] = $543.53
RJ2	Specimen not run. New specimen taken by MO	= (17.3 x 1.41 x 15) + (17.3 x 0.47) = $374.64
RJ79	Specimen taken and processed. New specimen taken by MO	= 89.25 x 12.8 = $1142.4
Conservative estimate of cost savings per month	= $2060.57	
Conservative estimate of cost savings per annum	= $24,726.84	

Assumptions

1. Repeat specimens that are not GXM/blood cultures are all done by nurses.
2. GXM samples and blood cultures are done by doctors, specifically, medical officers (conservative estimate).
3. Repeat specimens assumed to be the lavender and light green tube as these are most commonly sent as a set in ED.
4. For specimens which have already been processed, the full cost (un-subsidized) is included; assumption of RJ79 to consist of blood culture set.

Conclusion

The ECM was the strongest and most sustainable intervention which reduced specimen rejection rates. However, it was not infallible. Proposed solutions to further reduce errors need to consider a holistic approach encompassing human factors, improvement of the IT infrastructure and a spirit of continuous improvement.