Enhancing Patient Safety: Preventing Specimen Collection, Labelling, and Transport Errors

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Background

Specimen collection, labelling, and transport errors represent a persistent and preventable patient safety risk across acute care settings. These errors can lead to serious downstream consequences, including delays in diagnosis, inappropriate or delayed treatment, repeat testing, and avoidable patient harm. At Humber River Health (HRH), the organizational commitment to delivering safe, equitable, and innovative care has driven a focused effort to better understand and address these risks.

In response to recurring specimen-related safety events reported through the internal incident reporting system, the Quality and Patient Safety (QPS) team initiated a comprehensive review of current specimen-related practices across the organization. This work aimed to move beyond focusing on individual errors and instead examine system-level contributors across the full specimen journey, from order entry and collection to labelling, transport, and laboratory processing.

Purpose

The primary aim of this initiative was to proactively prevent specimen-related safety incidents by identifying, analyzing, and mitigating high-risk failure points within the specimen handling process.

Specific objectives included:

- Identifying common types and trends in specimen-related errors
- Understanding contributing human and system factors
- Standardizing processes across departments where possible
- Enhancing reliability in patient identification, labelling accuracy, and specimen transport pathways
- Supporting a culture of safety through interdisciplinary collaboration and shared learning

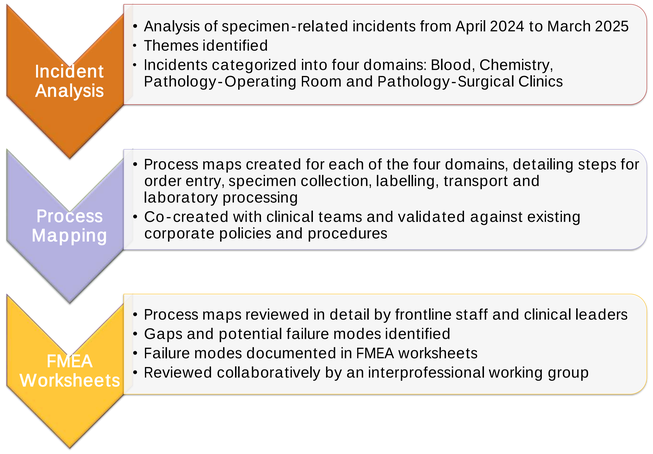

Figure 1. Flowchart detailing the steps and sub-steps undertaken as part of the specimen safety initiative.

Methods

A mixed-methods quality improvement approach was used to examine specimen-related risks. Incident data from April 2024 to March 2025 were analyzed to identify patterns in error types, timing, and clinical areas involved.

A hospital-wide Failure Mode and Effects Analysis (FMEA) was conducted, involving multidisciplinary stakeholders from nursing, laboratory services, pathology, and clinical programs.

The process included:

- Development of detailed, step-by-step process maps (4 total) outlining the full specimen workflow
- Identification of potential failure modes at each stage of the process
- Assessment of risk severity, frequency, and detectability using FMEA scoring methodology
- Validation of workflows with key stakeholders and against existing organizational policies and procedures
- Iterative refinement of findings and preliminary action planning through engagement with frontline staff and clinical leaders

This structured approach enabled a comprehensive evaluation of both technical and human factors influencing specimen safety.

Results

Analysis of reported incidents demonstrated that the most common specimen-related errors involved incorrect patient identification, mismatched tubes and labels, and misrouted specimens. High-risk test categories included Complete Blood Count (CBC), Chemistry, Pathology, and Group & Screen.

Errors were more frequently reported during day shifts, suggesting potential workflow pressures or process variability during peak operational hours, without implying causality. The most prominent themes identified were "Wrong Patient" and "Mislabelled Specimen."

Incidents were further categorized into four key domains: Blood, Chemistry, Pathology – Operating Room, and Pathology – Surgical Clinics.

Through collaborative process mapping, multiple system vulnerabilities were identified, including inconsistencies in labelling practices, communication gaps during handoffs, and variability in transport processes. The FMEA process highlighted both known and previously unrecognized failure points, providing a structured foundation for targeted improvement strategies.

References

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2. Roseen, E. J., Natrakul, A., Kim, B., & Broder-Fingert, S. (2024). *Process mapping with failure mode and effects analysis to identify determinants of implementation in healthcare settings: A guide. Implementation Science Communications, 5*, 110. https://doi.org/10.1186/s43058-024-00642-4

Next Steps

The next phase of this initiative focuses on translating identified risks into actionable system improvements.

Key activities include:

- Finalizing and prioritizing intervention strategies based on FMEA findings
- Standardizing specimen collection and labelling protocols across clinical areas
- Piloting redesigned workflows in high-risk areas to assess feasibility and effectiveness
- Establishing metrics and monitoring systems to evaluate the impact of interventions over time

Ongoing evaluation will be critical to ensure sustained improvements and to support continuous quality improvement efforts.

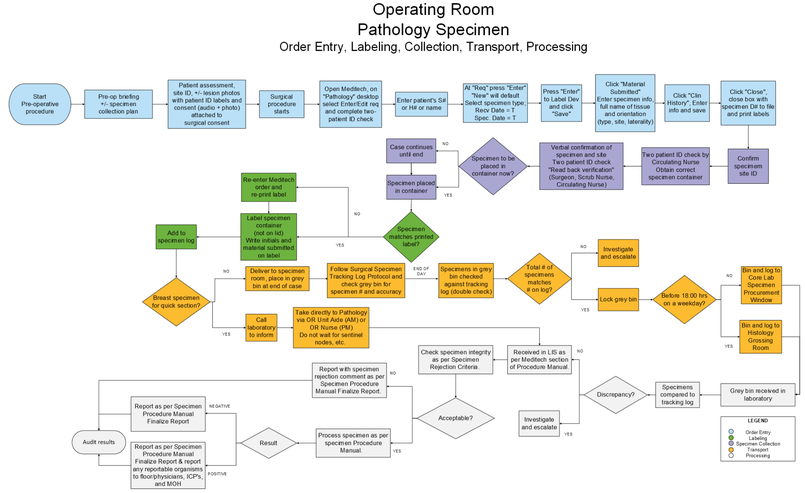

Figure 2. Process map of the specimen order, collection, labelling, and delivery process in the Operating Room.

Lessons Learned

This initiative reinforced the value of using structured quality improvement methodologies, such as process mapping and FMEA, to better understand complex clinical workflows. Engaging frontline staff and interdisciplinary teams was essential in identifying practical challenges and uncovering hidden failure modes that may not be evident through incident reports alone.

Additionally, the work highlighted that specimen-related errors are often system-driven rather than solely attributable to individual performance. Standardization, clear communication, and alignment with existing policies are key to reducing variability and improving reliability.

Overall, process mapping proved to be a powerful tool for fostering shared understanding, promoting collaboration, and driving meaningful, system-level change in patient safety.