# Use of Lean Six Sigma Methodology in the Breast Imaging Service to Improve Patient Flow


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## Background

With the total number of screening mammograms conducted in the United States reaching almost 40 million, it is estimated that 10% of those cases necessitate further workup to reach a diagnostic resolution on whether the lesion is cancerous or not, which is called time to resolution (TTR). The increasing demand for screening mammograms was reflected by the increase in the access time exceeding 6 months in our publicly funded tertiary referral breast imaging service. Breast imaging services often experience a significant degree of variability in patient flow, as the flow varies depending on whether the patient requires extensive testing or not, which adds to clinic inefficiency. The Lean Six Sigma Methodology (LSSM) was developed to give near-perfect services to huge operations by lowering the improbable occurrence. Hence, we applied LSSM in our breast imaging service to reduce TTR and improve patient flow, enhancing efficiency and patient outcomes. The primary aim of our study is to find the TTR of the screen-recalled cases (BI-RADS 0) of women attending screening mammography.

## Methods

This project is part of the performance improvement project initiated and approved by the institutional review board at our center. An electronic medical record integrated system was put in place to track the TTR from the time the screening study is input until diagnostic resolution is reached. A baseline audit was conducted from September 1st, 2017, till April 30th, 2018. A post-implementation audit was conducted from October 1st to December 30th, 2019. Multidisciplinary meetings, alongside a study of patient complaint data, were utilized to identify issues that were causing prolonged TTR leading to patient flow inefficiencies. . The resulting sources of variability were recognized and analyzed using an Ishikawa fishbone diagram to classify sources of variation. To address these root causes, possible solutions were proposed and implemented. A post-implementation audit was conducted, and the resulting TTR was compared to the baseline audit.

## Results

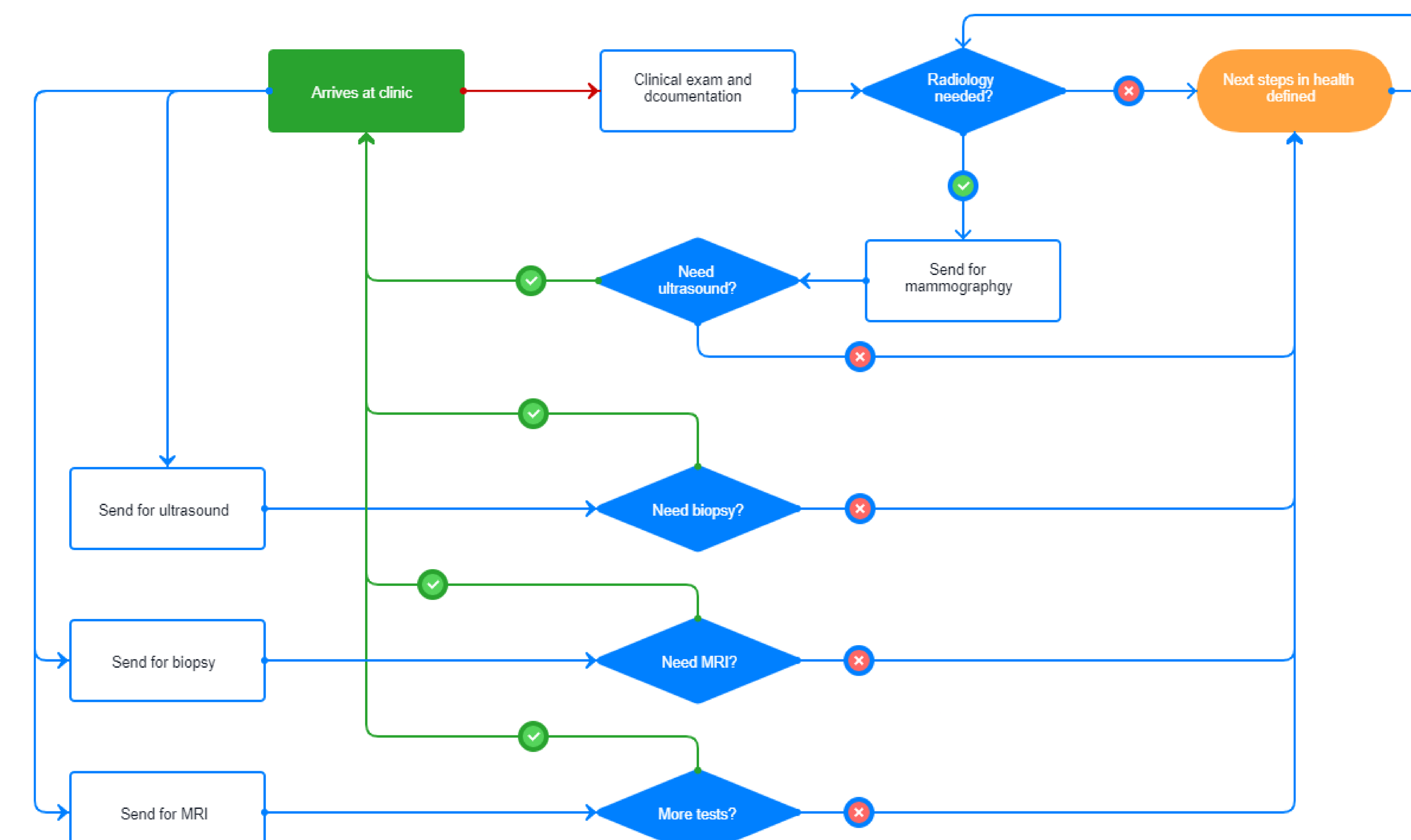


Figure 1. Pre-improvement patients flow to and from the breast imaging section. The green box represents the starting point for all patients. The red arrow is the starting direction for all patients from the clinic. The green arrows reflect the need to go back to the clinic before proceeding further.

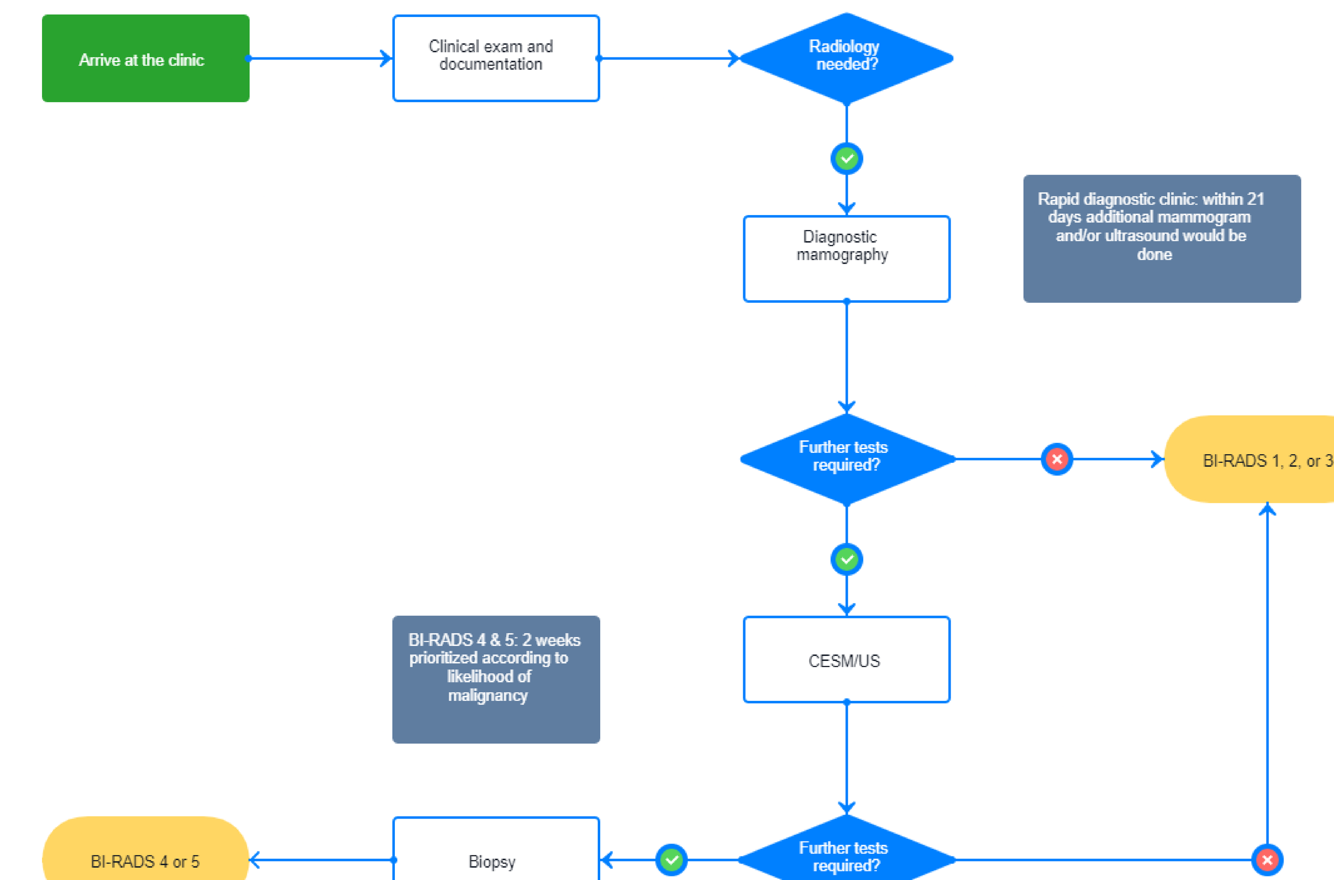


Figure 2. Post-improvement process map for the Rapid Diagnostic Clinic with recommended timeframe and metrics.

- During the baseline audit of 8 months, 589 cases of mammographic recalls (BI-RADS 0) were recruited. The average TTR for this group was 86.3 days.
- To reflect the required change in the mindset to adopt a patient-centric approach instead of the traditional exam/modality-focused one, there will be proposed improvement plans. Due to the lack of funding received for this project, some gaps, like staff shortages, were not able to be addressed.
- During the post-implementation period of 3 months, 370 cases of mammographic recalls (BI-RADS 0) were made. The average TTR for this group was 36.0 days.
- After applying LSSM, we managed to significantly reduce our TTR by at least 58% ($P < 0.01$).

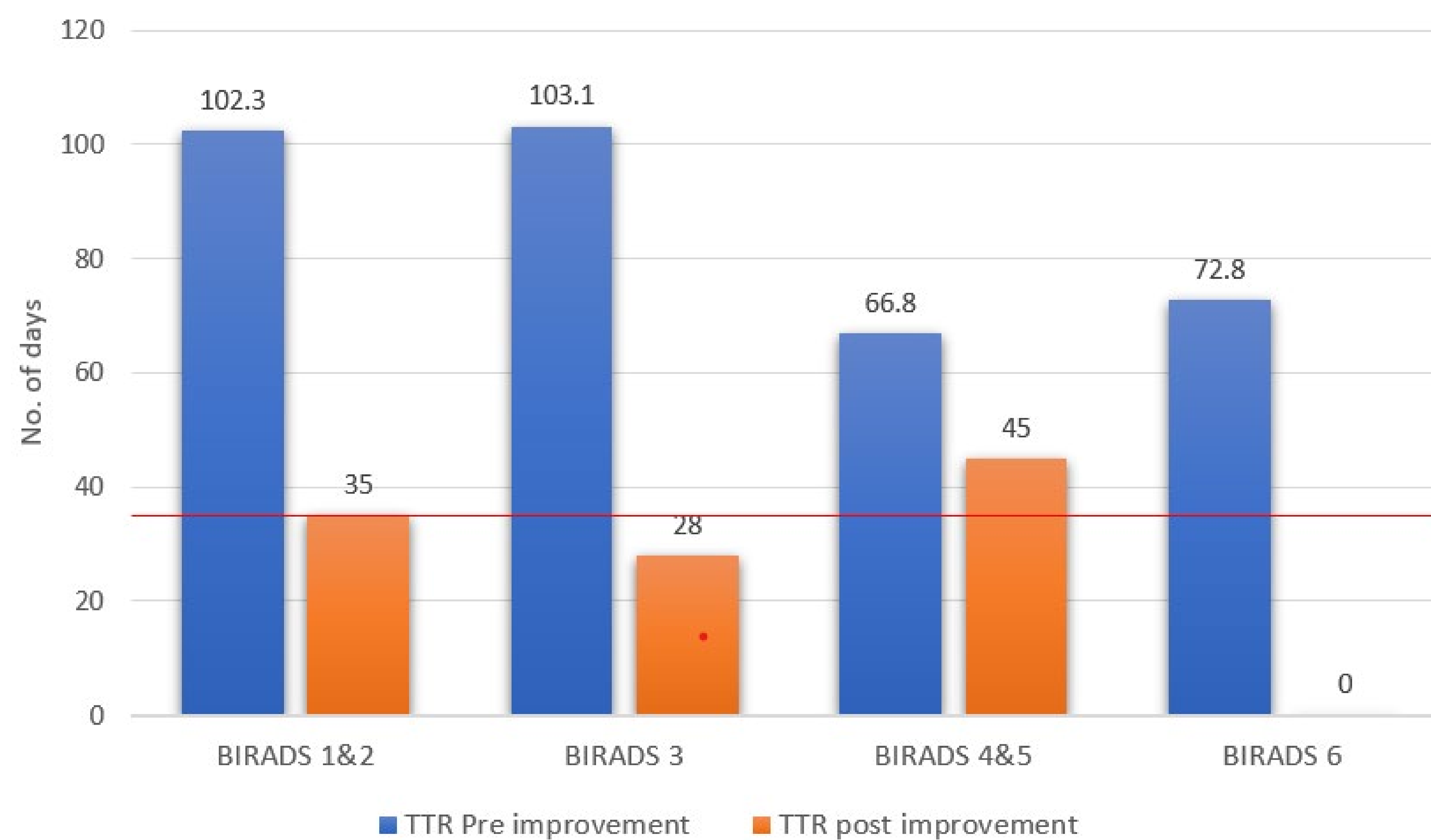


Figure 3. TTR pre- and post- improvement. The red line indicates the target TTR of 35 days. The category outcome (BI-RADS) is post-diagnostic evaluation of screening recalls (BI-RADS 0).

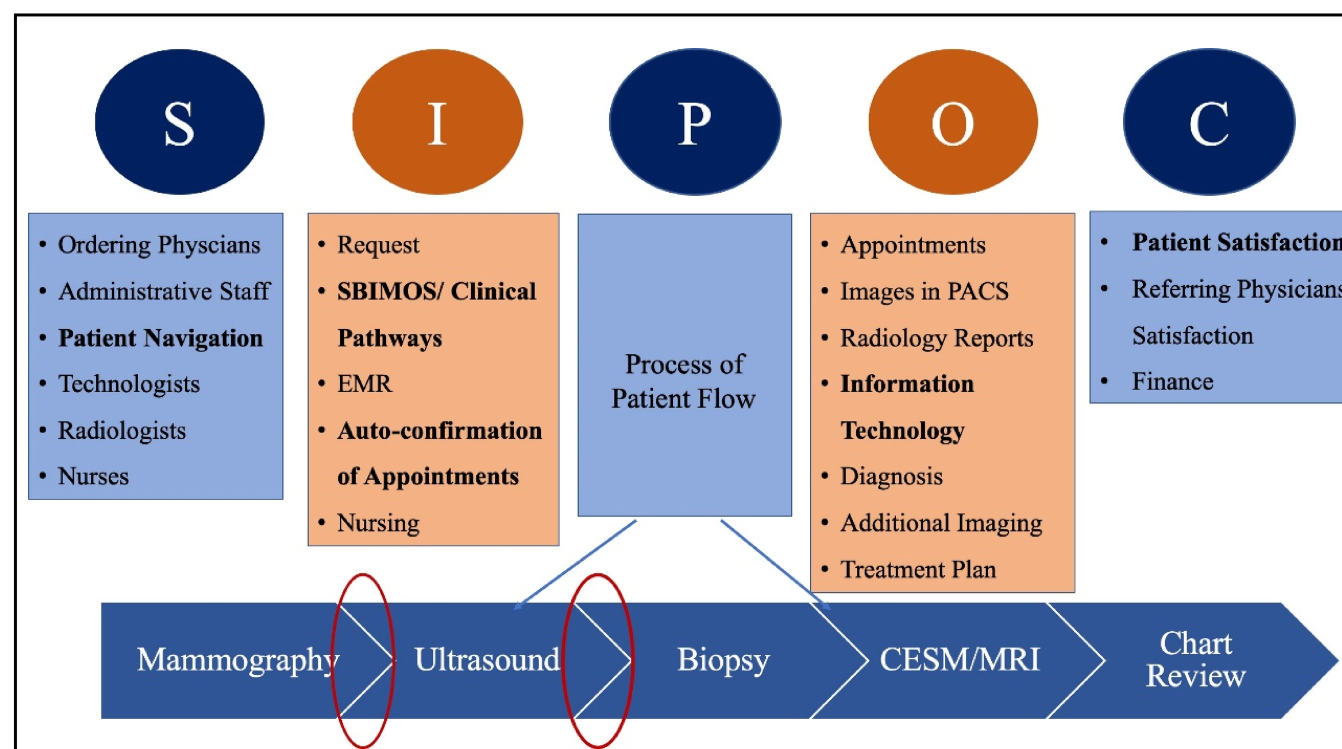


Figure 4. SIPOC model. Suggested strategies for further improvement. The text in bold is highlighted as a potential target for the next step in continuous improvement. Red Circles highlight areas of high impact regarding time delays and the improvement plans were directed at in our study. Abbreviations: CESM, contrast-enhanced spectral mammography; EMR, electronic medical record; PACS, picture archiving and communication system; SBIMOS, Standardized Breast Imaging Medical Order Sets.

## Conclusion

With the application of LSSM in our publicly funded tertiary referral breast imaging service, we managed to reduce our TTR by 58%, moving closer to our target. This was mainly related to the effect of training the coordinators to capture the screening recalls and schedule the recommended examinations. Moreover, there was an observed increase in the numbers of same-day nonscheduled targeted US generated and performed by the radiologist due to their commitment to embracing patient-centered care. These changes should be there to stay, incorporated into our culture, to facilitate continuous improvement and cost reduction.

As the need for healthcare resources grows in the future, LSSM may play an increasingly essential role in enhancing healthcare service delivery.