The economic impact of screening mammogram image quality-related retakes and recalls: a modeling study from the facility perspective

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Background

- Breast cancer accounts for approximately 30% of all cancer cases in women.[1]
- Screening mammography plays a critical role in early breast cancer detection, thereby increasing the likelihood of survival.[2]
- Breast positioning is a key factor that impacts the quality of a mammography image, and improper imaging can lead to inconclusive results,[3] necessitating screening mammography retakes during the initial exam (same-day retake) or requiring a patient to return on a different day for additional imaging (technical recall).
- The aim of this study was to estimate the economic impact and efficiency implications of screening mammography image quality (IQ)-related same-day retakes, technical recalls, and other IQ improvement activities from the facility perspective.

Methods

- We constructed a modeling tool in Microsoft Office Excel.
- ***Inputs***
  - Model inputs and base case values are listed in Table 1.
  - Facility characteristics were estimated from market research data and published literature. The Merative MarketScan Commercial Claims Database was used to inform the estimated DBT screening mammogram reimbursement rate.
  - IQ-related components were grouped into three categories: same-day retakes, technical recalls, and other IQ improvement activities, such as monthly trainings.
  - Approximations of the rate of and time required for same-day retakes, technical recalls, and other IQ improvement activities were derived from internal market research data and assumptions.
- ***Base case analysis***
  - The number of same-day retakes and technical recalls, the time associated with all three IQ-related components, and the cost associated with all three IQ-related components were calculated.
  - In addition, the annual additional screening revenue opportunity was modeled by calculating the potential revenue associated with new screening mammograms that could be conducted from the room time spent on same-day retakes and technical recalls.
  - Improvement scenario analyses were performed to assess the impact of reductions in all three IQ-related components.

Table 1. Model Inputs

	Base Case Value
Facility characteristics	
Number of gantries[4]	3
Number of screening mammography exams per gantry per year[4]	5,000
Number of mammography technologists[4]	10
Screening mammography exam time slot[4]	15 min
Hourly cost of administrative staff[5]	$19
Hourly cost of operating a mammography room[4]	$200
Hourly cost of mammography technologist[6]	$43
Hourly cost of breast radiologist[7]	$166
Reimbursement for a DBT screening mammography exam[8]	$241.15
Same-day retakes	
Percentage of screening mammography exams that require retake on the same day due to poor image quality[9]	6%
Average administrative staff time needed for a same-day retake[4]	0 min
Average room time needed for a same-day retake[4]	1 min
Average radiologist time needed for a same-day retake[4]	0 min
Technical recalls	
Percentage of screening mammography exams that require technical recall (different day retake) due to poor image quality[9]	3%
Average administrative staff time needed for a technical recall[4]	5 min
Average room time needed for a technical recall[4]	15 min
Average radiologist time needed for a technical recall[4]	5 min
Other image quality improvement activities	
Average time spent on other IQ improvement activities per month[9]	2 hours

- ***Sensitivity analysis***
  - A sensitivity analysis evaluated the impact of key inputs on (1) annual cost and (2) annual additional screening revenue opportunity of all three IQ components combined.

Results

- ***Base case analysis***
  - Under the base case scenario, the number of same-day retakes and technical recalls per year was 1,350 (Table 2). The amount of time spent on all three IQ-related components was 443 hours, for a total annual cost of $42,758. The annual additional screening revenue opportunity based on the room time associated with same-day retakes and technical recalls was $122,987.
  - Modeling improvement scenarios of 15% to 25% reductions in same-day retake rate, technical recall rate, and time spent on other IQ improvement activities results in 203 to 338 avoided same-day retakes and technical recalls per year, time savings of 66 to 111 hours per year, and cost savings of $6,414 to $10,689 per year (Table 3; Figure 1). These scenarios result in the potential for $18,448 to $30,747 in additional annual screening revenue if the room time associated with the avoided retakes and recalls was utilized to conduct new screening exams.

Table 3. Improvement scenarios: modeling a 15% to 25% reduction in same-day retake rate, technical recall rate, and time spent on other IQ improvement activities

	15% reduction	*20% reduction*	*25% reduction*
Same-day retakes			
# of same-day retakes avoided per year	135	180	225
Time saved per year	2 hours	3 hours	4 hours
Annual cost savings from reduction in same-day retakes	$450	$600	$750
Potential annual additional screening revenue	$2,170	$2,894	$3,617
Technical recalls			
# of technical recalls avoided per year	68	90	113
Time saved per year	28 hours	38 hours	47 hours
Annual cost savings from reduction in technical recalls	$4,416	$5,888	$7,359
Potential annual additional screening revenue	$16,278	$21,704	$27,129
Other image quality improvement activities			
Time saved per year	36 hours	48 hours	60 hours
Annual cost savings from reduction in other IQ activities	$1,548	$2,064	$2,580
For all three components combined			
# of same-day retakes & technical recalls avoided per year	203	270	338
Time saved per year	66 hours	89 hours	111 hours
Annual cost savings	$6,414	$8,552	$10,689
Potential annual additional screening revenue	$18,448	$24,597	$30,747

Figure 1. Potential economic impact of improvement scenarios

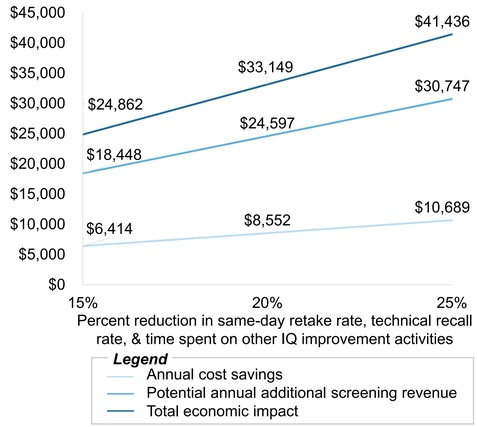


Table 2. Base case analysis results

	Base Case
Number of screening mammograms per year	15,000
Same-day retakes	
# of same-day retakes per year	900
Admin staff time spent on same-day retakes per year	0 hours
Room time for same-day retakes per year	15 hours
Radiologist time spent on same-day retakes per year	0 hours
Total time spent on same-day retakes per year	15 hours
Annual cost of same-day retakes	$3,000
Annual additional screening revenue opportunity	$14,469
Technical recalls	
# of technical recalls per year	450
Admin staff time spent on technical recalls per year	38 hours
Room time for technical recalls per year	113 hours
Radiologist time spent on technical recalls per year	38 hours
Total time spent on technical recalls per year	188 hours
Annual cost of technical recalls	$29,438
Annual additional screening revenue opportunity	$108,518
Other image quality improvement activities	
Time spent on other IQ improvement activities per year	240 hours
Annual cost of other IQ improvement activities	$10,320
For all three components combined	
# of same-day retakes & technical recalls per year	1,350
Time spent on all three components per year	443 hours
Annual cost of all three components	$42,758
Annual additional screening revenue opportunity	$122,987

- ***Sensitivity analysis***
  - A sensitivity analysis evaluated the impact of key inputs on the annual cost and annual additional potential screening revenue opportunity of all three IQ components combined (Table 4, Figures 2-3).
  - The number of gantries, hourly cost of operating a mammography room, percentage of screening exams that require technical recall, and average time spent on other IQ improvement activities had the greatest impact on annual cost (Figure 2).
  - The number of gantries, percentage of screening exams that require technical recall, average room time needed to conduct a technical recall, and screening mammography exam time slot had the largest influence on annual additional revenue opportunity (Figure 3).

Table 4. Values for sensitivity analyses for annual cost and annual additional screening revenue opportunity for all three components combined

Variable	Min	Base Case	Max
Facility characteristics			
Number of gantries	1	3	5
Screening mammography exam time slot	12 min	15 min	20 min
Hourly cost of operating a mammography room	$100	$200	$300
Same-day retakes			
% of screening exams that require retake on the same day due to poor image quality	3%	6%	10%
Average room time needed to conduct a same-day retake	0.5 min	1 min	2 min
Technical recalls (different-day retakes)			
% of screening exams that require technical recall due to poor image quality	1%	3%	5%
Average room time needed to conduct a technical recall	12 min	15 min	20 min
Additional image quality improvement activities			
Average time spent on other IQ improvement activities per month	0 hours	2 hours	4 hours

Figure 2. Sensitivity analysis: Annual cost of all three components combined

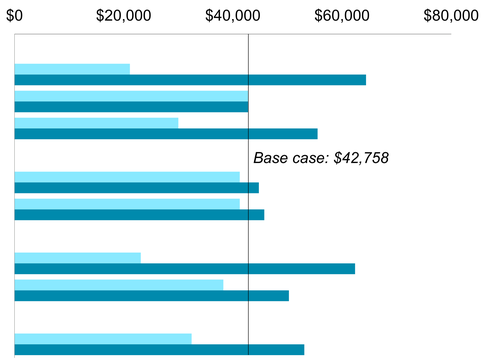
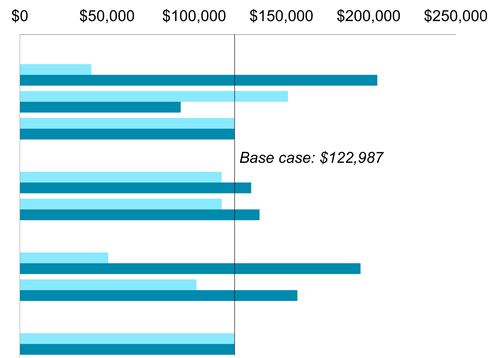


Figure 3. Sensitivity analysis: Annual additional screening revenue opportunity for all three components combined



Conclusions

- The impact of screening mammography same-day retakes and technical recalls on facility economics and efficiency is non-negligible.
- Improvements in ease of positioning and image quality on mammography systems may reduce the rates of same-day retakes and technical recalls, resulting in efficiency gains and cost savings for facilities.

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