Saving Lives: Increasing Capacity In Breast Imaging

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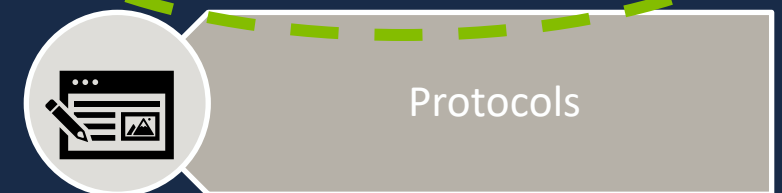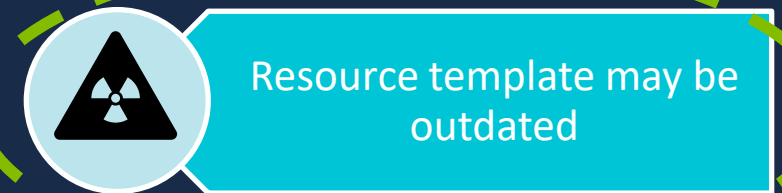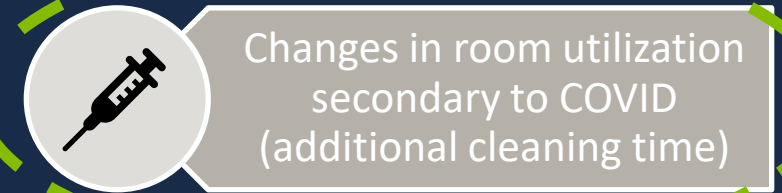RSNA 2024 Building Intelligent Connections Dec. 1-5

Introduction

- Breast cancer is the most common malignancy in American women. The most common way breast cancer is detected is by screening mammograms.

- Multiple national and international randomized clinical trials have shown screening mammograms decreases breast cancer mortality by 35%; observational studies have documented even higher mortality reduction.

- A screening mammogram is a non-invasive X-ray imaging study performed on asymptomatic women. Screening mammograms are indicated for average-risk asymptomatic women, starting at age 40 and every year thereafter.

- Abnormalities found at screening mammograms or symptomatic women require a diagnostic evaluation: additional mammographic view, sonography, or MRI, and may lead to a core biopsy for tissue diagnosis.

Problem statement:

Low capacity in the breast imaging center leads to backlogs, and patients either do not undergo recommended imaging or go to other facilities for their care.

Goal: Decrease backlog and increase capacity "Increase capacity by 10% over six months."

Focus on room utilization and templates.

Causes of low capacity in breast imaging*

- Increased number of breast surgeons (from 2 to 5)
- Changes in room utilization secondary to COVID (additional cleaning time)
- Ordering process
- Resource template may be outdated
- Protocols

*identified from fishbone diagram shown in A3 next slide

Title:	Saving Lives: Increasing capacity in Breast Imaging	Date/Revision(s):	9/01/2022-9/15/2023
Owner:	H. Ojeda-Fournier	Location:	Breast Imaging Division (multiple locations)
Team Members:	J Savoie, C Benavides, S Carmona, I Kalyan,		

1. Problem Statement:
What are you trying to solve or improve?
There is a backlog of patients to get screening mammograms.

2. Current Condition:
Where do things stand today?
10-20 days backlog for screening mammogram- variability per location
Screening mammograms scheduled at 20 min intervals to accommodate COVID protocols
Current capacity at KOP 195 screening mammograms/week
2 mammography units full time screening, 2 units diagnostic, 1 unit procedures (clip checks, localizations, stereotactic procedures)
Patients change into gown in the modality room- occupying room instead of moving to next patient
Technologist start and end procedures at variable times so it is difficult to assess data

3. Target Condition: Increase capacity by 10% during a 6-month period
What outcome is required? Remember SMART

4. Gap Analysis:
What is the root cause(s) of the problem?
Increase in number of surgeons, change in room utilization secondary to COVID, resource templates outdated
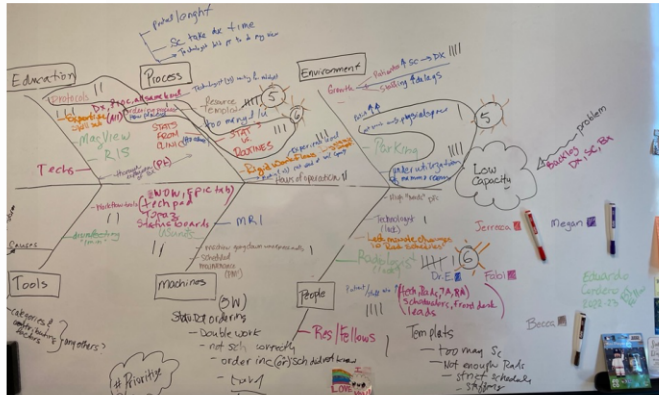
Fishbone diagram: Visualization tool for categorizing the potential causes of a problem.

5. Countermeasures Proposed:
How will your recommended countermeasures affect the root causes to achieve the target?

Screening capacity per room
(rooms am (1/2), rooms pm (3/4), rooms Friday pm (5))
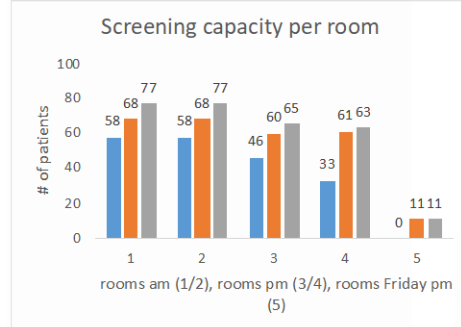
1. Review current screening templates and adjust to q15 min appointments
2. Test after one week (failed)
3. Standardize patient intake procedures, patients to use changing rooms all the time
4. Observe if the protocol is being followed
5. Standardize start and end exam in EPIC
6. Check projection against template
7. Perform across all sites

6. Plan:
What activities will be required for implementation and who will be responsible by when?
1. Projection of room capacity- Haydee
2. Data acquisition from Sectra PACS- Nada
3. Observational collection of data- Nada
4. Adjustment of templates- Cindy and Susana
5. Discussion during huddle of patient management (change in changing rooms only not in modality room)- Cindy
6. Checking on patient satisfaction- Joe
7. Compliance-Irina, Cindy
8. Data analysis- Haydee and Joe
9. Statistical analysis- Haydee

7. Results (Check) Next steps (Act):
What did you learn about the results of your experiment vs. the target? What are your next steps?
Number of screening studies during a 6-month period ↑ from 8018 to 9459: net ↑1441, ↑15.2%
1441 x $138.88/mmg = $200,126.08 over 6-months
1441 x $427.90/mmg = $616,603.90
- annual range: **$400,252.16 to $1,233,207.80**
Next steps: Decreasing implant studies from 30 minutes to 15
Decreasing screening studies further to 10 min→ this will increase capacity to do diagnostics studies
Shifting screeners to other times to increase diagnostic capacity (evenings, Saturdays)
Have hired two new faculty to be able to read volume and because upcoming retirements
Expanding HC and RB offering, can shift procedures to other sites to accommodate more at KOP
Preparing for HCOPP expansion and opening of Pacific Highlands site
Big opportunity: Work with scheduling to decrease re-work

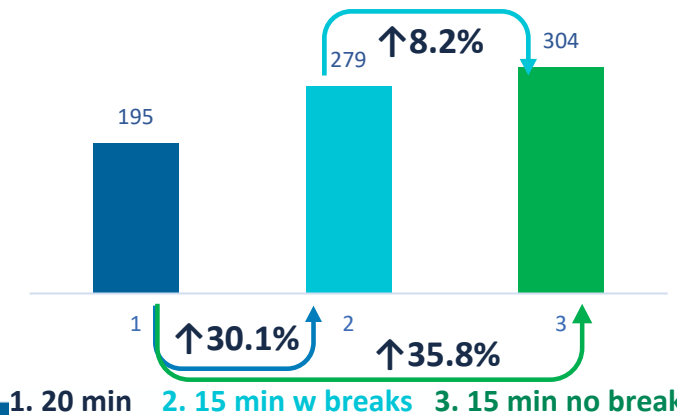### A3 Tool
A problem-solving and communication tool (named after the standard paper size), it originated in the Toyota Production System: Taiichi Ohno refused to read further than the first page of any written report! It has been adopted by many industries for its effectiveness in facilitating communication. Notice the use of visuals to communicate more efficiently.

Methods

- Numerous analyses were performed, including time observations, reviewing data from the RIS (radiology information system), and reviewing PACS (picture achieving and communication systems) time stamps.

  - The observed data was reflective of actual room utilization and statistically significantly different from data extracted from RIS and PACS.

- A small group was convened to analyze the data, and a series of PDSA cycles were performed.

- Observation data showed that the median time of patient in the room to out of the room during a screening mammogram was 10 minutes. A modeling was performed by analyzing the templates showing an increase in capacity with various adjustments, which included standardizing allowing patients to use changing rooms (previously closed due to COVID and leading to procedure room underutilization) rather than changing in examination rooms.

- We also standardized technologists' procedures, such as the start and end times of exams in EPIC.

- The screening templates were adjusted to q15-minute intervals from the current 20 minutes. Tests after a week showed that we failed, and capacity decreased rather than increased. This failing (not a failure) motivated a second template review, adjustments, and data analysis round. After an additional observation period, further analysis showed increased capacity!

Templates/review group

Total expected increase in capacity per template modification

↑8.2%
195 · 279 · 304

1 ↑30.1% 2 ↑35.8% 3

1. 20 min   2. 15 min w breaks   3. 15 min no break

Observed vs. PACS data

- Series 1 (directly observed) vs. Series 2 (from PACS) demonstrates a statistically significant difference. Although time-consuming, observational data provides a more accurate and real-time reflection of clinical workflows and patient experiences.

Significant with high degree of confidence

Screening mammogram times

Observed data (blue) vs data from PACS (green)

	Welch's t test Tabular results	
1	Table Analyzed	Data 1
2		
3	Column B	Observed
4	vs.	vs.
5	Column A	PACS
6		
7	**Unpaired t test with Welch's correction**	
8	P value	<0.0001
9	P value summary	****
10	Significantly different (P < 0.05)?	Yes
11	One- or two-tailed P value?	Two-tailed
12	Welch-corrected t, df	t=10.11, df=40
13		
14	**How big is the difference?**	
15	Mean of column A	4.033
16	Mean of column B	10.00
17	Difference between means (B - A) ± SEM	5.967 ± 0.5901
18	95% confidence interval	4.774 to 7.159
19	R squared (eta squared)	0.7174
20		
21	**F test to compare variances**	
22	F, DFn, Dfd	4.944, 29, 29
23	P value	<0.0001
24	P value summary	****
25	Significantly different (P < 0.05)?	Yes
26		
27	**Data analyzed**	
28	Sample size, column A	30
29	Sample size, column B	30
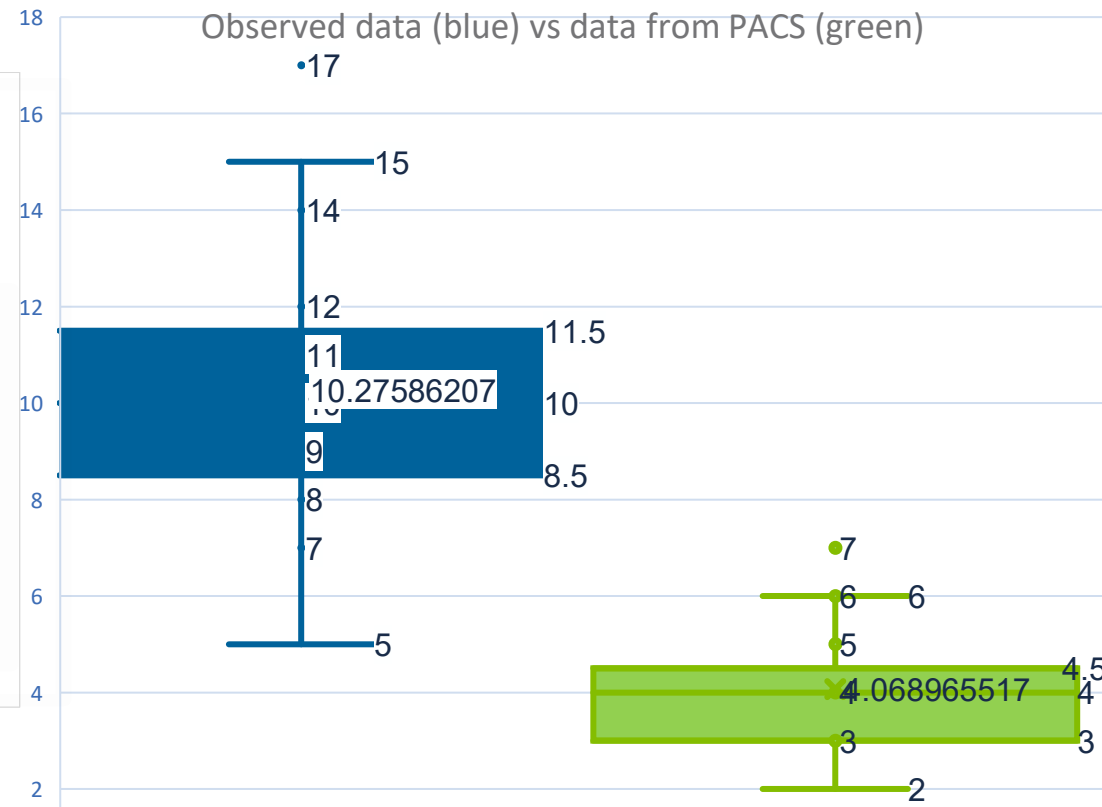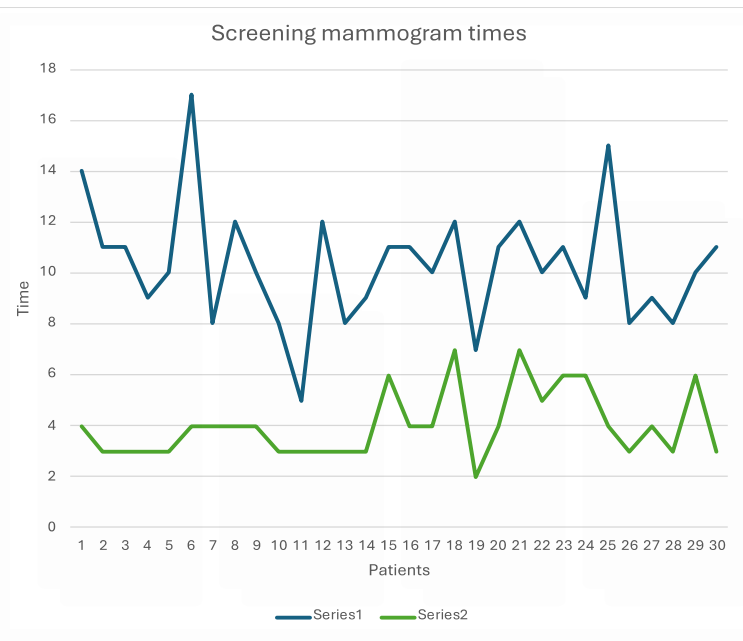
Room utilization

- Patient in the room-to-patient out of the room was variabile depending on tech (some techs changing patients in modality room vs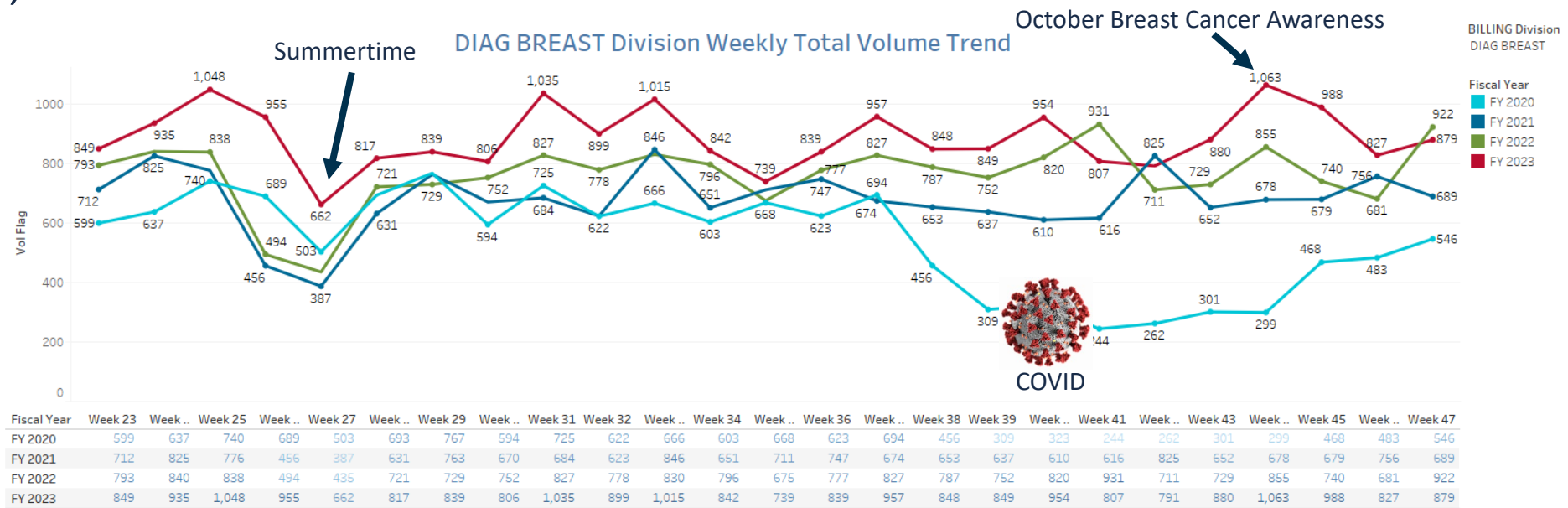. changing in changing room) and the start/end time in the EMR was not consistent. Variability with standardized: Patients changing outside of room and start/end time of procedure consistently documented.

- The observation before and after the intervention showed a statistically significant decrease in room utilization.

1	Table Analyzed	Data 1
2		
3	Column B	After
4	vs.	vs.
5	Column A	Before
6		
7	**Mann Whitney test**	
8	P value	0.0027
9	Exact or approximate P value?	Exact
10	P value summary	**
11	Significantly different (P < 0.05)?	Yes
12	One- or two-tailed P value?	Two-tailed
13	Sum of ranks in column A,B	1248 , 405.5
14	Mann-Whitney U	195.5
15		
16	**Difference between medians**	
17	Median of column A	11.00, n=37
18	Median of column B	8.000, n=20
19	Difference: Actual	-3.000
20	Difference: Hodges-Lehmann	-2.000

Times observed **before** and **after** intervention

Variation in time before and after
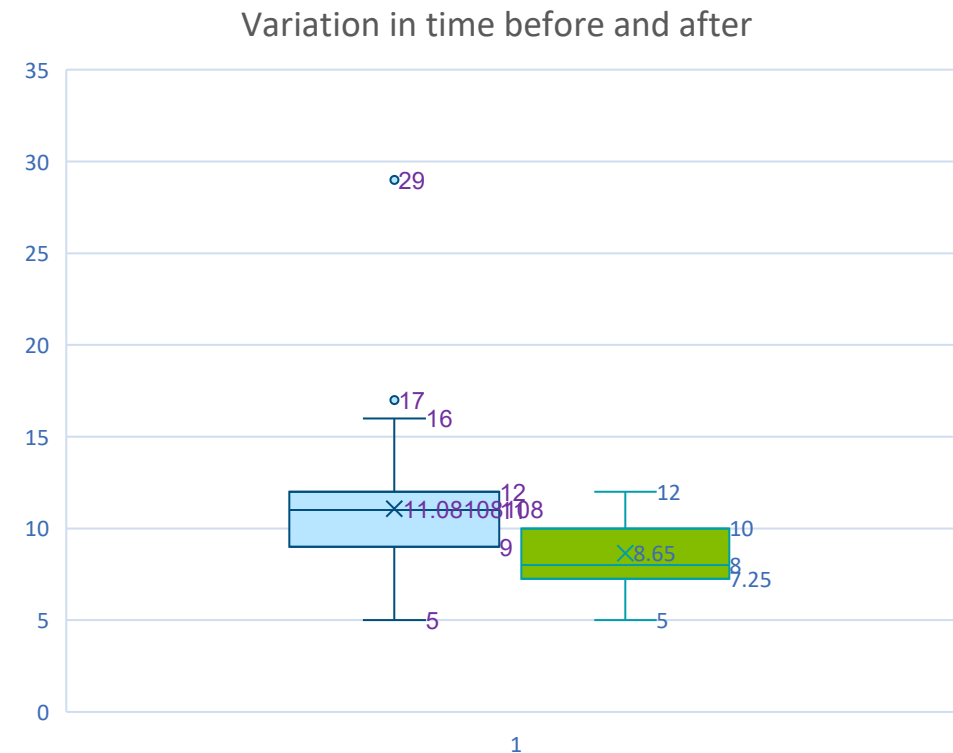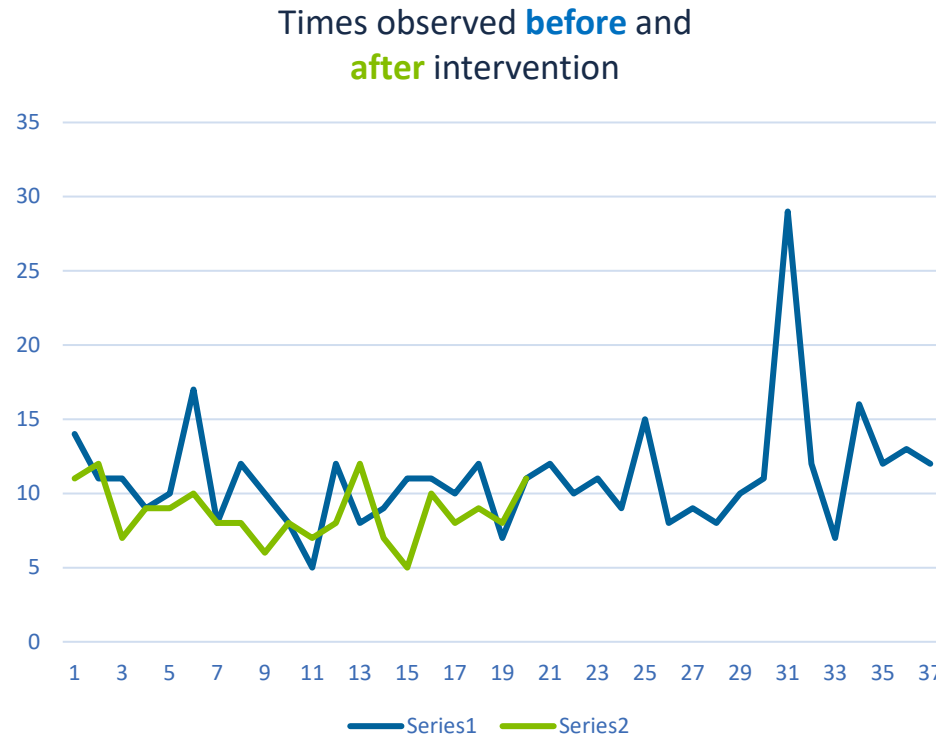
Results

- We compared historical data for screening mammograms to current data for a matched period rather than the previous six months. This was done because we had shown visits fluctuating over the year (surge during October breast cancer awareness month or lows during summer vacations: see graph below).

- Comparing January to June of 2022 to 2023 showed a net increase of 1441 screening studies, representing a 15.2% increase (we had targeted a 10% increase in volume). Net increase and percent change were recorded. This increase translates to an estimated $400,252.16 to $1,233,207.80 of additional revenue.

DIAG BREAST Division Weekly Total Volume Trend

October Breast Cancer Awareness
Summertime
COVID

BILLING Division
DIAG BREAST

Fiscal Year
FY 2020
FY 2021
FY 2022
FY 2023

| Fiscal Year	Week 23	Week ..	Week 25	Week ..	Week 27	Week ..	Week 29	Week ..	Week 31	Week 32	Week ..	Week 34	Week ..	Week 36	Week ..	Week 38	Week 39	Week ..	Week 41	Week ..	Week 43	Week ..	Week 45	Week ..	Week 47
FY 2020	599	637	740	689	503	693	767	594	725	622	666	603	668	623	694	456	309	323	244	262	301	299	468	483	546
FY 2021	712	825	776	456	387	631	763	670	684	623	846	651	711	747	674	653	637	610	616	825	652	678	679	756	689
FY 2022	793	840	838	494	435	721	729	752	827	778	830	796	675	777	827	787	752	820	931	711	729	855	740	681	922
FY 2023	849	935	1,048	955	662	817	839	806	1,035	899	1,015	842	739	839	957	848	849	954	807	791	880	1,063	988	827	879

Discussion

- Observational data, derived from direct time studies of room utilization, provides a more accurate and real-time reflection of clinical workflows and patient experiences.

  - This data type captures the actual duration of patient encounters within imaging rooms, accounting for real-life variances such as patient preparation, technologist interactions, and unforeseen delays.

- Data acquired from PACS and RIS relies heavily on timestamps that may not accurately represent imaging procedures' true start and end times.

- This is an ongoing quality improvement project. After further data analysis, a second decrease in the screening time to 12 minutes (current 15) will be undertaken to increase capacity further. Additional attention is being paid to the increase in diagnostic volume, with interventions being planned.

  - Further capacity will be added by offering evening and weekend screening appointments.

patient time at room	
Average 'TIME'	
Average of TIME	
	10.3
MEDIAN	
	10
N	
	30
MODE	
	11
RANGE	
5-17 MIN	

The histogram shows the median time to complete a DBT screening mammogram is 10 minutes with a range rom 5-17 min. The current intervention of 15 minutes has been successful. Further intervention decreasing screening time to 12 minutes is being planned (5/room/hr).

Time to obtain mammogram
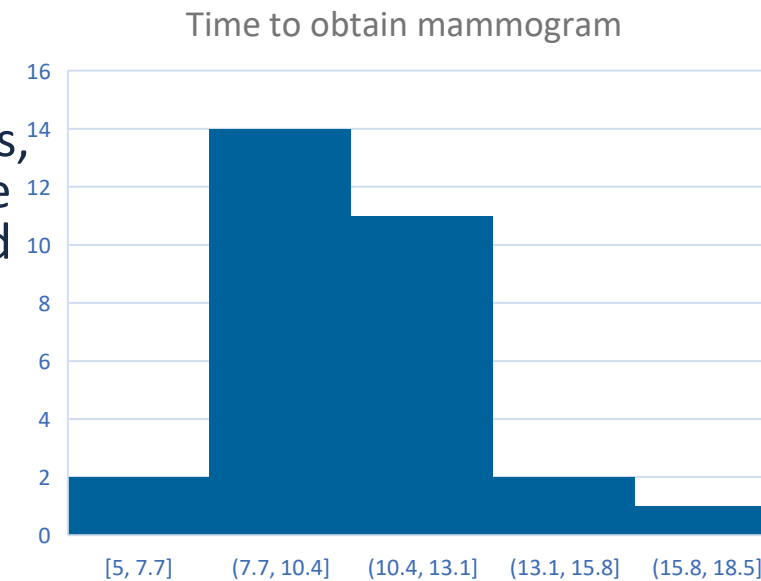
Conclusion

Time period	Number of screening studies	Net increase	% change
1/1/2022- 6/30/2022 historical	8018		
1/1/2023-6/30/2023 after	9459	1441	↑15.2

- Improvements in capacity—demonstrated by a 15.2% increase in screening volume—highlight the critical role of accurate, real-time data in driving effective quality improvement initiatives (above)

- Critical to consider patient satisfaction-review of NRC data showed no change in patient experience before and after the interventions (right)

1441 x $778 = $1,121,098
1441 x $427.90 = $616,603.90
BUT... patients have insurance
~$138.88 = net impact **$200,126.08/6 mo.**
annual range: **$400,252.16 to $1,233,207.80**

Saving Lives: Priceless

Patient Satisfaction