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Retrospective Review of Patients Presenting for Daytime, Evening, Weekday, and Weekend Breast Cancer Screening and Diagnostic Imaging Appointments.

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Abstract

Purpose: Disparate access to breast cancer imaging exists between subpopulations of American women. Our study investigated preferences among subpopulations for examination day and start times with the goal of ultimately improving these inequities.

Methods: Patient demographics for 304,029 consecutive breast imaging examinations during 01/01/2016-01/30/2022 were retrospectively compared. Statistical analysis included analysis of variance and a chi-squared test.

Results: Asians, African Americans, younger patients, and patients from wealthier zip codes were more commonly imaged on Fridays and Saturdays (Asians: 9.5% and 13.5% of Friday and Saturday appointments versus 7.7-8.6% for Monday-Thursdays, African Americans: 15.2% and 21.9% of Friday and Saturday appointments versus 13.1-13.9% for Monday-Thursdays, median age: 57 and 54 years for Friday and Saturday appointments versus 58-59 years for Monday-Thursdays, wealthier zip codes: 56.9% and 68.2% of Friday and Saturday appointments versus 55.0-56.9% for Monday-Thursdays) and in the late afternoon and evening (Asians: 10.2% and 11.2% of late-afternoon and evening appointments versus 8.3-8.5% for other times, African Americans: 14.7% and 15.2% of late-afternoon and evening appointments versus 13.5-14.3% for other times, median age: 57 and 52 years for late-afternoon and evening appointments versus 58 years for other times, wealthier zip codes: 59.7% and 57.0% of late afternoon and evening appointments versus 54.7-56.2% for other times) (all $p<0.001$). Similar trends were not seen for Hispanics.

Conclusions: Asian, African American, younger, and wealthier patients were more commonly imaged later in the day and on Fridays and Saturdays. Greater availability of these appointments could improve disparate access to breast cancer imaging.

Keywords: Health Equity; Breast Imaging; Health Disparity; Healthcare Access; Mammogram; Weekend.

Introduction

Breast cancer is the most common malignancy in women in the United States and represents the second leading cause of cancer-related death for American women [1]. Though it is not a preventable cancer, optimal population-based screening with mammography reduces mortality by up to 20-40% [2,3] however, not all subpopulations benefit equally. Non-Hispanic black, Asian-American/Pacific Islander, Native American, and Hispanic women are diagnosed younger and with more advanced malignancies than their Caucasian counterparts, and their breast cancer mortality follows this trend [4].

Contributing to these disparate outcomes is the fact that participation in an organized breast cancer screening program is also unequal, often related to limitations of access. A systematic review and meta-analysis by Ahmed et al in 2017 found that African Americans and Hispanics undergo screening mammography less routinely than Caucasians [5], while overall, women who live in rural or impoverished areas have significantly more limited access to breast imaging services [6]. Moreover, the 2020 covid-19 pandemic exacerbated underlying inequities within breast cancer imaging, and more vulnerable populations such as the uninsured, racial and ethnic minorities, those of lower socioeconomic status, and non-English speakers were slower to return to routine breast cancer screening [1,7,8]. Strategies to improve access for these patients are needed. Miles et al evaluated all screening and diagnostic imaging appointments at three academic breast imaging facilities (one urban medical Center and two satellite suburban imaging centers) during 2016-2017 and found that non-Caucasian and non-English speaking women were more commonly scheduled on Saturdays than on a weekday, implying a bias towards after-hours appointments for these subpopulations [9]. A prospective trial by Offman et al in 2013 found that the availability of, and ability to select, evening or weekend screening appointments increased attendance of breast cancer screening appointments [10].

These data led us to investigate the socioeconomic demographics of breast imaging patients at our institution based on examination day of the week and start time with the goal of identifying options to improve access to our imaging services. We hypothesized that certain subpopulations would show preferences for appointments outside of regular Monday-through-Friday business hours, and understanding these trends will hopefully allow us to improve access to our imaging services for all patients.

Materials and Methods

Study Sample and Measures

This HIPAA-compliant, retrospective chart review was approved by The University of [Name withheld for Anonymity] institutional review board. Informed consent was waived. Age, race, ethnicity, postal address, health insurance status, examination day of the week, and examination start time (classified as “early morning” 12-10 am, “late morning” 10 am-12 pm, “early afternoon” 12-3 pm, “late afternoon” 3-5 pm, and “evening” 5 pm-12 am) were recorded from the electronic medical record (Epic Systems, Verona, Wisconsin) for every consecutive patient who underwent mammography, breast ultrasound, or breast MRI at our institution between January 1, 2016 and January 31, 2022. Employment information was inaccurate within the medical record and thus unable to be included. The median income of residents within each patient’s postal zip code was recorded as above or below national median income from the 2020 United States census [11].

Statistical Analysis

Summary statistics for patient demographics, examination start time, and examination day include frequencies, percentages, and medians. Age was compared using analysis of variance, and categorical variables were compared using a chi-squared test. The statistical tests were conducted at the patient examination level, assuming independence. All tests were two-sided, and statistical significance was defined at a p-value of 0.05 or less. The statistical analysis was conducted using R (version 4.3.1, R Development Core Team).

Results

Our study included 304,029 consecutive imaging examinations, and the corresponding patient demographics based on examination day and start time are detailed within Table 1. A few important results deserve specific mention.

Appointments for Asians comprised 9.5% and 13.5% of Friday and Saturday appointments, respectively (versus 7.7-8.6% for Monday-Thursdays, $p<0.001$), while African Americans comprised 15.2% and 21.9% of Friday and Saturday appointments, respectively (versus 13.1-13.9% for Monday-Thursdays, $p<0.001$). The median age for Friday and Saturday appointments was 57 and 54 years, respectively (versus 58-59 years for Monday-Thursdays, $p<0.001$). Patients residing within a zip code with a median income above the 2020 U.S. national average comprised 56.9% and 68.2% of Friday and Saturday appointments, respectively (versus 55.0-56.9% for Monday-Thursdays, $p<0.001$). These trends were not observed for Hispanics, though similar trends were seen for examination start times.

Specifically, appointments for Asians comprised 10.2% and 11.2% of late afternoon and evening appointments, respectively (versus 8.3-8.5% for other start times, $p<0.001$), while African Americans comprised 14.7% and 15.2% of late afternoon and evening appointments, respectively (versus 13.5-14.3% for other

start times, p<0.001). The median age for late afternoon and evening appointments was 57 and 52 years, respectively (versus 58 years for other start times, p<0.001). Patients residing within a zip code with a median income above the 2020 U.S. national average comprised 59.7% and 57.0% of late afternoon and evening appointments, respectively (versus 54.7-56.2% for other start times, p<0.001). Again, these trends were not observed for Hispanic women.

Finally, self-pay patient appointments were more common on Saturdays and in the evening (2.0% of Saturday appointments versus 1.7% for Monday-Fridays, p<0.001; 3.1% of evening appointments versus 1.6-1.9% for other start times, p=0.001).

Appointment Day	**Monday (N=59928)**	**Tuesday (N=63900)**	**Wednesday (N=62859)**	**Thursday (N=62703)**	**Friday (N=53092)**	**Saturday (N=1547)**	**p value**
Income*							**< 0.001**
Above National Median	31733 (55.04%)	34377 (55.61%)	34465 (56.89%)	33868 (56.11%)	29184 (56.85%)	1038 (68.15%)	
Below National Median	25921 (44.96%)	27438 (44.39%)	26117 (43.11%)	26494 (43.89%)	22147 (43.15%)	485 (31.85%)	
Age							**< 0.001**
Median (Range)	58.00 (13.00, 100.00)	59.00 (12.00, 98.00)	58.00 (14.00, 100.00)	58.00 (13.00, 100.00)	57.00 (11.00, 99.00)	54.00 (22.00, 86.00)	
Race*							**< 0.001**
American Indian or Alaska Native	147 (0.29%)	155 (0.28%)	157 (0.29%)	146 (0.27%)	173 (0.38%)	10 (0.75%)	
Asian	4335 (8.44%)	4259 (7.71%)	4622 (8.57%)	4450 (8.29%)	4355 (9.51%)	179 (13.49%)	
Black or African American	6707 (13.06%)	7577 (13.71%)	7428 (13.77%)	7455 (13.90%)	6949 (15.18%)	290 (21.85%)	
Native Hawaiian or Other Pacific Islander	59 (0.11%)	67 (0.12%)	55 (0.10%)	59 (0.11%)	46 (0.10%)	0 (0.00%)	
Two or more races	238 (0.46%)	283 (0.51%)	290 (0.54%)	282 (0.53%)	263 (0.57%)	11 (0.83%)	
White or Caucasian	39881 (77.64%)	42931 (77.67%)	41406 (76.74%)	41260 (76.90%)	33995 (74.26%)	837 (63.07%)	
Ethnicity*							**< 0.001**
Hispanic or Latino	11836 (20.19%)	11769 (18.82%)	11539 (18.74%)	11800 (19.25%)	9939 (19.16%)	250 (16.67%)	
Not Hispanic or Latino	46787 (79.81%)	50766 (81.18%)	50032 (81.26%)	49484 (80.75%)	41929 (80.84%)	1250 (83.33%)	
Insurance Status							**< 0.001**
Insured	55257 (98.31%)	58843 (98.51%)	57046 (98.11%)	57261 (98.32%)	49061 (98.31%)	1498 (98.04%)	

Self-pay	951 (1.69%)	893 (1.49%)	1100 (1.89%)	976 (1.68%)	843 (1.69%)	30 (1.96%)	
Examination Start Time	Early Morning (N=62989)	Late Morning (N=111723)	Early Afternoon (N=101578)	Late Afternoon (N=26643)	Evening (N=1096)		p value
Income*							**< 0.001**
Above National Median	33054 (54.65%)	60591 (56.13%)	55104 (56.16%)	15329 (59.70%)	587 (56.99%)		
Below National Median	27434 (45.35%)	47364 (43.87%)	43012 (43.84%)	10349 (40.30%)	443 (43.01%)		
Age							**< 0.001**
Median (Range)	58.00 (12.00, 100.00)	58.00 (13.00, 100.00)	58.00 (11.00, 100.00)	57.00 (15.00, 98.00)	52.00 (18.00, 86.00)		
Race*							**< 0.001**
American Indian or Alaska Native	163 (0.30%)	265 (0.28%)	269 (0.31%)	87 (0.36%)	4 (0.40%)		
Asian	4659 (8.45%)	7892 (8.27%)	7095 (8.27%)	2443 (10.18%)	111 (11.23%)		
Black or African American	7897 (14.32%)	13299 (13.94%)	11544 (13.45%)	3516 (14.65%)	150 (15.18%)		
Native Hawaiian or Other Pacific Islander	67 (0.12%)	105 (0.11%)	91 (0.11%)	21 (0.09%)	2 (0.20%)		
Two or more races	282 (0.51%)	472 (0.49%)	459 (0.53%)	147 (0.61%)	7 (0.71%)		
White or Caucasian	42072 (76.30%)	73355 (76.90%)	66376 (77.33%)	17793 (74.12%)	714 (72.27%)		
Ethnicity*							**< 0.001**
Hispanic or Latino	11618 (18.81%)	21468 (19.67%)	20052 (20.18%)	3805 (14.62%)	190 (17.56%)		
Not Hispanic or Latino	50150 (81.19%)	87664 (80.33%)	79317 (79.82%)	22225 (85.38%)	892 (82.44%)		
Insurance Status							**0.001**
Insured	58991 (98.12%)	101864 (98.39%)	91184 (98.33%)	25894 (98.43%)	1033 (96.90%)		
Self-pay	1131 (1.88%)	1662 (1.61%)	1553 (1.67%)	414 (1.57%)	33 (3.10%)		

*Excludes unknowns
Boldface indicates statistical significance ($p<0.05$)

Table 1: Socioeconomic demographics of breast cancer imaging patients by examination day and start time.

Discussion

This review of over 300,000 breast imaging procedures indicates that the demographics of breast imaging patients differ based on examination day and start time. Asian, African American, younger, and patients who reside within wealthier zip codes were more commonly scheduled later in the day and on Fridays or Saturdays, while self-pay patients were more commonly scheduled in the evening or on Saturdays. Though it cannot be known with certainty, we believe that the fact that younger patients and patients residing within wealthier zip codes were scheduled afterhours indirectly suggests that these patients were employed and thus preferred appointments outside of regular business hours. The benefit of non-traditional imaging appointment times for working patients has been previously confirmed in the literature [12]. Moreover, we believe that the trends for race and insurance are not coincidental but rather are based on patient necessity or preference, and other authors agree. Miles et al evaluated over 60,000 mammogram appointments between January 1, 2016 and December 31, 2017 and found that racial/ethnic minorities and non-native English speakers preferred Saturday screening mammogram appointments.9 Even among a non-American patient population, evening or weekend screening appointments resulted in increased compliance with breast cancer screening.10 These findings are important to consider when generating clinical and imaging scheduling templates because greater availability of Friday, Saturday, and later afternoon-evening appointments could improve disparities in outcomes and access to breast health services.

A few study limitations must be acknowledged. First, the single-institution, retrospective design limits generalizability, and we did not include Sunday imaging appointments because they are not offered at our institution. Employment information within the medical record was very unreliable, and that datapoint would have been a valuable addition herein. Also, our statistical analysis indicated significant trends for every patient demographic (not unexpected when analysing over 300,000 data points for each demographic variable), and statistical significance might not always indicate clinically relevant or important results.

Conclusions

The demographics of breast imaging patients are dissimilar based on examination day and start time should be considered when creating or modifying clinical and imaging schedules. Afterhour's appointment availability may alleviate some of the inequities of access to breast health services. Further study should include multi-institutional analyses and other screening examinations such as low-dose CT for lung cancer screening.

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Ethical Guidelines: This study was approved by the institutional review board from The University of [Name withheld for Anonymity], IRB ID 2022-0009. Informed consent was waived. Study complied with the United States Health Insurance Portability and Accountability Act of 1996.

Conflict Of Interest: The authors disclose no conflicts of interest, related or unrelated to this work.

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