Disparities in abnormal mammogram follow-up time for Asian women compared to non-Hispanic Whites and between Asian ethnic groups

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Abstract

Background—Delays in abnormal mammogram follow-up contribute to poor outcomes. We examined abnormal screening mammogram follow-up differences for non-Hispanic Whites (NHW) and Asian women.

Methods—Prospective cohort of NHW and Asian women with a Breast Imaging Reporting and Data System abnormal result of 0 or 3+ in the San Francisco Mammography Registry between 2000–2010. We performed Kaplan-Meier estimation for median-days to follow-up with a diagnostic radiologic test, and compared proportion with follow-up at 30, 60 and 90 days, and no follow-up at one-year for Asians overall (and Asian ethnic groups) and NHWs. We additionally assessed the relationship between race/ethnicity and time-to-follow-up with adjusted Cox proportional hazards models.

Results—Among Asian women, Vietnamese and Filipinas had the longest, and Japanese the shortest, median follow-up time (32, 28, 19 days, respectively) compared to NHWs (15 days). The proportion of women receiving follow-up at 30 days was lower for Asians vs NHWs (57% vs 77%, p<0.0001), and these disparities persisted at 60 and 90 days for all Asian ethnic groups except Japanese. Asians had a reduced hazard of follow-up compared with NHWs (aHR 0.70, 95% CI 0.69–0.72). Asians also had a higher rate than NHWs of no follow-up (15% vs 10%; p<0.001); among Asian ethnic groups, Filipinas had the highest percentage of women with no follow-up (18.1%).

Conclusion—Asian, particularly Filipina and Vietnamese, women were less likely than NHWs to receive timely follow-up after an abnormal screening mammogram. Research should disaggregate Asian ethnicity to better understand and address barriers to effective cancer prevention.

Keywords

Asian; ethnicity; abnormal mammogram; breast cancer; healthcare disparity

INTRODUCTION

Screening for breast cancer contributes to reduced morbidity and mortality from breast cancer when women receive appropriate follow-up and treatment[1]. Delay in breast cancer diagnosis because of a lack of evaluation of an abnormal screening mammogram may impact prognosis as it can be associated with larger tumor size, advanced disease stage, and poorer survival[2,3]. While there is no consensus on a clinical or research definition of timely follow-up, and prior studies use varying definitions, numerous studies have demonstrated that African American and Latina women are less likely than white women to receive appropriate follow-up after an abnormal mammogram result[4–9]. Fewer studies have included Asian women; those that have suggest a similar disparity in follow-up[6,10,11]; However, none of these have examined follow-up for distinct Asian populations.

Asians are one of the fastest growing immigrant groups in the United States; by 2060, the projected number of U.S. residents who will identify as Asian or Asian with another race will comprise 48.6 million persons, 11.7% of the total population, which represents a 143.1% increase from their population in 2014[12]. Despite this large and growing U.S. Asian population, many population-based breast cancer studies do not include Asians, and those that do report them as a single aggregated group[13–15]. Studies that disaggregate Asian Americans have demonstrated significant intragroup variation in breast cancer incidence and mortality. For example, breast cancer incidence rates differ markedly across distinct ethnic subpopulations of US Asian women with about three-folds difference between subgroups with the highest rate (Japanese:126 per 100000) and the lowest rate (Laotian: 44 per 100000)[16]. Additionally, US-born Chinese and Filipino women younger than 55 years have higher breast cancer incidence rates than NHW women of comparable age[17]

The San Francisco Mammography Registry (SFMR) provides a unique opportunity to study the relation between breast cancer screening and related outcomes in multiple Asian populations. The SFMR is a population-based registry that records breast imaging tests for women and contains information about a large number of Non-Hispanic white (NHW) and Asian women in the San Francisco Bay Area, a geographic region with a substantial diversity in the Asian ethnic groups living in the United States. The objective of this investigation was to compare follow-up after an abnormal mammogram result requiring diagnostic radiology among NHW and diverse Asian American ethnic women.

METHODS

Study Sample

Our sample was obtained from the SFMR, which is a participating member in the National Cancer Institute's Breast Cancer Surveillance Consortium (http://breastscreening.cancer.gov). The registry includes participating radiology facilities that prospectively collect demographic and clinical data from women at the time of breast imaging and at each subsequent imaging visit. Our study sample included women with a Breast Imaging Reporting and Data System (BI-RADS) result indicating the need for further diagnostic imaging. This included women with imaging results reported as BI-RADS 0 (indeterminate, needs additional imaging) and 3+ (probably benign with a recommendation for immediate further diagnostic imaging) between 2000–2010, who did not opt out of participation in the SFMR. We selected all Asian and NHW women ages 40–80 at the 10 SFMR facilities with both substantial Asian and NHW populations (>5%); two SFMR facilities did not meet this population criteria (<5% NHWs in each) and were excluded. The remaining 10 facilities ranged from 9.3% to 43.6% Asians. For any given woman, we included only the first abnormal screening mammogram result in the SFMR.

Study Variables

Our independent variables are self-reported race (NHW and Asian) and Asian ethnicity. Asian ethnicity included Chinese, Japanese, Filipino, Vietnamese, Other Asian and Mixed Asian. "Other Asian" included Thai, Cambodian and other Southeast Asians that are represented in the SFMR in small numbers. Mixed-Asians are those who reported Asian race/ethnicity and at least one other race/ethnicity (NHW, Black, or Hispanic). We excluded women with a history of breast cancer because follow-up procedures for abnormal results likely differ between women without breast cancer and cancer survivors. Our study was approved by the UCSF Committee on Human Subjects.

We chose covariates measures based on clinical relevance, data availability, and published research. Patient demographic factors collected by the registry at the time of the index mammogram and obtained for analyses included self-reported age (decade), education (less than high school; high school graduate or GED; some college/technical school; college or post- college graduate), family history of breast cancer in a first degree relative (yes/no) and year of index abnormal mammogram (2000 to 2010).

Our primary outcome variable was time to follow-up. We defined follow-up as a diagnostic radiologic study (mammogram or ultrasound) done at any SFMR facility subsequent to the index abnormal mammogram. Our previous work has indicated that most women in the SFMR have radiologic follow-up for BI-RADS 0 or 3+ result within 60-days[18]. However, because there is not a clear clinical or research consensus on how best to define timely follow-up for these results[9] we examined multiple follow-up outcomes and compared them across groups: time-to-follow-up, proportion with follow-up at 30, 60, and 90 days, and proportion with no follow-up at 1-year. Together these outcomes contribute to our understanding of timely care and differences across groups. We chose these cutoffs based on the distribution of events in our data, and the documented clinical impact of a three-month

delay in diagnosis and treatment[3]. We examined follow-up up until 1-year to ensure that we were able to capture all possible additional follow-up after 90-days and before the next potential screening interval.

Statistical Analyses

Comparisons of demographic and clinical variables between NHWs and Asian women were performed using chi-square x^2 for categorical variables and t test for continuous variables. Similar analyses were conducted to assess differences among Asian subgroups (Asian-ethnic analyses). All reported P values are 2-sided, and statistical significance was defined as < 0.05. In the absence of competing risks, Kaplan-Meier analysis can be used to estimate the cumulative probability of an event over time. We calculated median days from index abnormal exam to radiologic follow-up, along with interquartile ranges (IQR) using the Kaplan-Meier method and compared groups using the log-rank test. The proportions of women who received follow-up by 30, 60 and 90 days were calculated by race and Asian ethnicity; group differences were assessed using chi-square test.

Multivariable adjusted cox proportional hazard models examined the hazard ratios (HRs) with 95% confidence interval (CI) of receipt of radiologic follow-up within 365 days of an index mammogram. The outcome of interest was time to follow-up calculated as number of days from the date of the index abnormal mammogram to the first known follow-up study. We censored the maximum follow-up time at 365 days for index mammograms because a mammogram subsequent to that may have been another screening mammogram rather than a follow-up to the index abnormal result. The proportional hazards assumption in the baseline covariates was verified by examining the scaled Schoenfeld residuals and diagnostic plots[19]. We stratified by mammography facility to account for variation in time to follow-up among facilities; with stratification, the proportional hazards assumption was not violated. Separate models were fitted comparing NHW and Asian women overall, and NHW and Asian women by Asian ethnic group; both models adjusted for age, education, family history of breast cancer, year of index mammogram, and mammography facility (as described above). An adjusted hazard ratio (aHR) <1.0 indicates the instantaneous 'risk' of achieving follow-up for the members of the comparison group is less compared to that for the reference group of NHWs. Data were analyzed with SAS V9.1 software (SAS institute, Cary, NC).

RESULTS

We identified 50,970 NHW and Asian women in the 10-year study period (2000–2010) who met our inclusion criteria. We excluded individuals with missing information on education (n=1249 or 2.5%) and family history (n=363 or 0.7%), leaving a final sample of 49,358. The majority (65%) clustered within three of 10 facilities with high screening mammography volumes (not shown). Table 1 shows 30% of the sample were Asians (n=14,818). The predominant Asian ethnic group represented was Chinese, making up 16.4% of total sample, followed by 6.8% Filipina, 2.4% Other Asian, 1.8% Japanese, 1.4% Mixed Asian and 1.1% Vietnamese. The mean age of all women was 53.9 years. On average, Asians were slightly younger than NHWs (52.9 versus 54.3 years, p<.00001). Japanese women were the oldest

among Asian ethnic groups (55.2 years) and Vietnamese and Other Asian women were the youngest (50 years). NHWs had statistically significantly higher proportion of college graduates than Asians (68.2% vs 43.8%). Among Asians, Japanese and Filipina women had the highest percentage of college graduates (60.4% and 57.9%, respectively) while Vietnamese women had the lowest percentage (18.2%). A higher proportion of NHWs reported a positive family history compared to Asians (17% vs 10%, p<.00001). About 12% of Japanese, Filipina and Other Asian women reported a positive family history, while only 5.2% of Vietnamese women did (p<.00001).

Table 2 shows the Kaplan-Meier median time to follow-up by race and Asian ethnicity as well as proportion of participants receiving follow-up for different time intervals. Overall, the median duration of follow-up from index mammogram to first follow-up was 18 days. Asian women overall had a substantially higher median follow-up time compared to NHWs (26 versus 15 days, p<.00001). Median follow-up time differed significantly by Asian ethnicity: Vietnamese women had the longest time, followed by Filipina and Chinese women, while Japanese women had the shortest time, approaching that for NHWs. Table 2 also displays the proportion of women who received follow-up within 30, 60, and 90 days by race and Asian ethnicity. At the 30-day follow-up interval, 76.9% of NHW women were recorded as having follow-up compared to 57.1% of Asian women overall ($p < .0001$). Among Vietnamese and Filipina woman, only half in each ethnic group received follow-up at 30 days (49.1% and 53%, respectively), and at 90 days follow-up rates remained lower for these groups than for all others. The overall prevalence of women in the sample who did not receive follow-up within one year after an index abnormal mammogram was 11.1% (n=5567). Asians had a higher proportion than NHWs of no follow-up (15% vs 10%, p-value<0.001), and among Asian ethnic groups, Filipinas had the highest proportion of no follow-up (18.1%).

Table 3 shows the results of the adjusted Cox proportional hazard modeling. Asians were significantly less likely to receive timely follow-up than NHWs (aHR=0.70, 95% CI 0.69–0.72). When comparing Asian ethnic groups to NHWs, while all groups were less likely to achieve follow-up, Filipina (aHR: 0.64, CI 0.61–0.66) and Vietnamese (aHR: 0.69, CI 0.63–0.76) women had the lowest hazard ratio of achieving follow-up, and Japanese women had the highest (aHR: 0.88, CI 0.83–0.95, p<0.0001).

DISCUSSION

Our findings indicate that Asian ethnicity was associated with delays in follow-up imaging after abnormal screening mammography with a higher proportion of Asians having no follow-up at one-year compared with NHWs. Our findings are consistent with prior studies examining differences in time to follow-up after an abnormal mammogram for other ethnic minorities[4,7,8]. Prior studies of abnormal follow-up which specifically included Asian women report mixed results with two studies finding delays for Asian women compared with NHWs and one finding no difference[6,10,11]. These studies differed in their definition of follow-up after abnormal mammogram. They also examined Asians as a single aggregated group, possibly masking the heterogeneity among Asians, which may in turn have impacted the findings.

This is the first study, to our knowledge, to examine follow-up outcomes after an abnormal mammogram by Asian ethnic group. We found wide variation in follow-up proportions among Asian American groups; however they all had lower proportion of follow-up compared to NHW, varying from 12% to 36% lower, with Filipinas and Vietnamese women having the lowest proportion. Only Japanese women catch up to white women by 90-days after the abnormal exam. Notably, except for Japanese women, all Asian ethnic groups have high proportion of no follow-up at one-year, ranging from 12.8% to 18.1%.

There are several potential explanations for the observed lower rate of follow-up. Asian subgroups vary widely with regard to socioeconomic status (SES), regular access to a healthcare provider, and acculturation, including limited English proficiency (LEP), all of which may influence follow-up behavior after an abnormal mammogram result. Women from lower socioeconomic backgrounds often do not have access to early detection and are less likely to have timely and complete follow-up after an abnormal screening test[9]. Differential patterns of immigration and acculturation result in certain groups, such as Vietnamese Americans, to be more likely to lack health coverage, have LEP and lower SES than other groups, such as Japanese Americans[20]. In a previous study by our group, we found that having LEP is associated with receiving care at a mammography facility with longer follow-up times. Even at facilities with short follow-up times, women with LEP were more likely to have delays in follow-up than English speakers[18]. Communication factors including a woman's understanding of follow-up care is associated with receipt of adequate follow-up of an abnormal mammogram result[21]. Language barriers can impede comprehension of the clinical care process and affect timely adherence to recommendations. Karliner and colleagues found that Asian, particularly Chinese-speaking, women did not fully understand their physicians' reports of their mammograms[22]. A more recent analysis by Pérez-Stable of a multi-ethnic sample of women showed that those who did not fully understand their abnormal mammogram results were more likely to experience delays in follow-up care after an abnormal result[6]. Although the use of professional interpreters has been shown to enhance communication and outcomes for patients with LEP[23], many providers report getting by without their use[24,25]. Furthermore, mammography result notification letters are written in English and at levels too difficult for many patients to understand[22,26].

Additionally, other healthcare delivery and communication issues not directly related to a language barrier might affect women's follow-up behavior. For example, primary care is associated with better follow-up outcomes; however, disadvantaged Asian groups have been found to be less likely to have a regular primary care provider[5,20]. Additionally, Asians report lack of trust with their health care provider, low satisfaction in their health care, and perceived discrimination or disrespect by providers[27–29], all of which may increase risk of not receiving timely follow-up after an abnormal mammogram. The specific communication and healthcare delivery experiences of Asian women during the diagnostic mammography process, the extent they differ by Asian ethnicity and English language proficiency, and how they may influence follow-up after abnormal mammogram is unknown.

While cultural barriers to mammography among different Asian ethnic groups include lack of prevention orientation, cultural beliefs and stigma about breast cancer and screening, and

modesty and embarrassment are known to reduce screening mammography for these groups[30–32], it is unknown if these same factors affect follow- up. Other patient-related factors previously explored for women in general are psychosocial barriers, including fear of pain associated with follow-up exams, cancer fatalism, anxiety waiting for diagnostic results, and coping strategies[33–35]. For example, some Asian groups perceive a diagnosis of cancer as a "death sentence"[36]. Future studies designed specifically to understand factors associated with follow-up behaviors among diverse Asian women with abnormal mammogram results should incorporate cultural, psychosocial and potentially protective factors, patient differences and similarities among different Asian ethnic groups, and how those factors influence follow-up outcomes.

System-related barriers including delayed notification of results, scheduling delays, and difficulty in obtaining an appointment have been found to be salient factors in the follow-up of breast abnormalities for women in general[37,38]. Difficulties navigating the healthcare system, such as scheduling problems, contribute to women's delayed follow-up[9]. Furthermore, geographic proximity of the breast cancer services and mammography facilities involved in follow-up care can impact timely care, particularly among disadvantaged Asians[39]. Organizational processes such as information systems including mail and phone reminder systems for patient and providers, availability of interpreter services and patient navigator programs enhance follow-up care, especially among Asians and women with LEP[40]. Although in our analysis the findings were adjusted for mammography facility, it may be that more disadvantaged Asian women are receiving care at mammography facilities with more barriers; the impact of these system-level factors on these disparities in care deserves further study.

Our study has some limitations. First, our use of existing data restricted us to those variables available; we were unable to assess some potentially relevant factors, including breast symptoms and prior mammograms, as well as acculturation, language, and length of time in US, that may mediate the relationship between Asian ethnicity and receipt of follow-up care. Another study limitation is that our population lives only in northern California potentially limiting generalizability to Asians living in other geographic areas; however, it is the diversity and relatively high population concentration of Asian ethnic groups living in northern California which allowed us to conduct this study. Finally, while we were able to adjust for educational attainment, we were unable to examine other SES factors which might vary among Asian ethnic groups and influence receipt of timely follow-up.

Despite these limitations, our study has several strengths. We used a population-based registry of women undergoing mammography with a representative sample of women receiving screening mammography in community practice. These data represent the largest available screening mammography data among Asian women. The study sample consisted of a large proportion of Asian Americans (30%) and representative sample of 6 different Asian groups, allowing statistically valid conclusions regarding group comparisons.

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CONCLUSION

Overall, these findings indicate disparities in follow-up after an abnormal mammogram requiring radiologic follow-up for Asian women compared to NHW. Our findings have implications for future research. First, this work emphasizes the substantial differences in follow-up care across different Asian ethnic groups, and reinforces the need for disaggregation of ethnicity in population health studies. Second, heterogeneous findings across Asian ethnic groups underscore the importance of further research in the correlates of follow-up for Asian women, including patient, provider and system-level characteristics. Future investigations, particularly among high-risk Asian ethnic groups, are needed to understand the breast cancer care experience of Asian women, to identify and develop culturally and linguistically appropriate strategies to improve timely follow-up for these populations.

Acknowledgments

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Asian, particularly Filipina and Vietnamese, women were less likely than NHW to receive timely follow-up after an abnormal screening mammogram. Research should disaggregate Asian ethnicity to better understand and address barriers to effective cancer prevention.

Table 1

Sample demographics and clinical characteristics (n=49358), 2000–2010

	Total (n=49358)		NHW (n=34540)		Asian Women (n=14818)		p*	Chinese (n=8121)		Japanese (n=915)		Filipina (n=3374)		Vietnamese (n=534)		Other Asian (n=696)		Mixed (n=1178)		p**
	n	%	n	%	n	%		n	%	n	%	n	%	n	%	n	%	n	%	
Age (Years)							<.0001													<.0001
40–49	17630	35.7%	11926	34.5%	5704	38.5%		3135	38.6%	311	34.0%	1147	34.0%	243	45.5%	355	51.0%	513	43.5%	
50–59	15010	30.4%	10391	30.1%	4619	31.2%		2687	33.1%	254	27.8%	1010	29.9%	180	33.7%	176	25.3%	312	26.5%	
60–69	8554	17.3%	6256	18.1%	2298	15.5%		1154	14.2%	157	17.2%	648	19.2%	62	11.6%	82	11.8%	195	16.6%	
70–80	8164	16.5%	5967	17.3%	2197	14.8%		1145	14.1%	193	21.1%	569	16.9%	49	9.2%	83	11.9%	158	13.4%	
Education							<.0001													<.0001
Some High School	3006	6.1%	401	1.2%	2605	17.6%		1842	22.7%	10	1.1%	254	7.5%	228	42.7%	94	13.5%	177	15.0%	
High School Graduate	5237	10.6%	2476	7.2%	2761	18.6%		1796	22.1%	107	11.7%	388	11.5%	133	24.9%	83	11.9%	254	21.6%	
Some College	11007	22.3%	8038	23.3%	2969	20.0%		1501	18.5%	245	26.8%	780	23.1%	76	14.2%	180	25.9%	187	15.9%	
College Graduate +	30108	61.0%	23625	68.4%	6483	43.8%		2982	36.7%	553	60.4%	1952	57.9%	97	18.2%	339	48.7%	560	47.5%	
Family History of BC							<.0001													<.0001
Yes	7385	14.7%	5912	17.1%	1473	9.9%		745	9.2%	113	12.4%	409	12.1%	28	5.2%	84	12.1%	94	8.0%	
No	41973	85.0%	28628	82.9%	13345	90.1%		7376	90.8%	802	87.7%	2965	87.9%	506	94.8%	612	87.9%	1084	92.0%	

*
p-value of chi-square and t-test analyses comparing non-Hispanic white (NHW) and Asian women

**
p-value of chi-square and t-test analyses comparing Asian ethnic group

Table 2

Median days to follow-up and proportion receiving follow-up at 30, 60, and 90 days

| | Total Sample (n=49358) | | | | Asian-Ethnicity(n=14818) | | | | | | |
	Total (n=49358)	NHW (n=34540)	Asian Women (n=14818)	p*	Chinese (n=8121)	Japanese (n=915)	Filipina (n=3374)	Vietnamese (n=534)	Other Asian (n=696)	Mixed (n=1178)	p**
Median days to follow-up, days (IQR)	18 9–35	15 8–29	26 14–56	<.0001	27 15–54	19 10–34	28 15–76	32 15–76	23 13–54	23 13–55	<.0001
Follow-up time 30 days, n (%)	35023 71.0%	26558 76.9%	8465 57.1%	<.0001	4638 57.1%	657 71.8%	1787 53.0%	262 49.1%	422 60.6%	699 59.3%	128
Follow-up time 60 days,, n (%)	41184 83.4%	29931 86.7%	11253 75.9%	<.0001	6230 76.7%	784 85.7%	2421 71.8%	379 71.0%	536 77.0%	903 76.7%	94.8
Follow-up time 90 days,, n (%)	42185 85.5%	30373 87.9%	11812 79.7%	<.0001	6534 80.5%	798 87.2%	2565 76.0%	411 77.0%	571 82.0%	933 79.2%	70.6
No follow-up, n (%)	5567 11.3%	3319 9.6%	2248 15.2%	<.0001	1191 14.7%	94 10.3%	609 18.1%	77 14.4%	89 12.8%	188 16.0%	45.2

Note: median days to follow-up (censored at 365 days); IQR=interquartile range

*
p-value of log-rank test and chi-square analyses comparing non-Hispanic white (NHW) and Asian women

**
p-value of log-rank test and chi-square analyses comparing Asian ethnic group

Table 3

Adjusted hazard ratios of follow-up for Asians overall compared with NHW and for 6 Asian ethnic groups compared with NHW (n=49358)

	aHR	95% CI	p	aHR	95% CI	P
Total Asian vs NHW						
Asian	0.70	0.69- 0.72	<.0001			
NHW	1.00	Ref.				
Asian Ethnicity vs NHW						
Chinese				0.71	0.69–0.73	<.0001
Japanese				0.88	0.83–0.95	0.0004
Filipina				0.64	0.61- 0.66	<.0001
Vietnamese				0.69	0.63–0.76	<.0001
Other Asian				0.72	0.66–0.78	<.0001
Mixed				0.71	0.70- 0.76	<.0001
NHW				1.00	Ref.	
Age						
40–49	1.07	1.05- 1.10	<.0001	1.07	1.05- 1.10	<.0001
50–59	1.00	Ref.		1.00	Ref.	
60–69	1.02	0.99-1.05	0.1991	1.02	0.99–1.05	0.1662
70+	1.05	1.02-1.08	0.0027	1.05	1.02–1.08	0.0029
Education						
Some High School	0.75	0.72- 0.78	<.0001	0.75	0.71–0.78	<.0001
High School Graduate	0.86	0.83–0.89	<.0001	0.86	0.83–0.89	<.0001
Some College	0.99	0.971 1.017	0.613	0.99	0.97–1.02	0.5700
College Graduate +	1.00	Ref.		1.00	Ref.	
Family History of BC						
Yes	1.05	1.02- 1.07	0.0012	1.05	1.02- 1.07	0.0005
No	1.00	Ref.		1.00	Ref.	

Models were adjusted for year of index mammogram which was statistically significant.

NHW=non-Hispanic White

Ref.=Reference category