Chronic Comorbidities and Receipt of Breast Cancer Screening in United States and Foreign-Born Women: Data from the National Health Interview Survey

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Abstract

Objective: Research is limited on how immigrant status affects provider recommendations and adherence to breast cancer screening among women with chronic conditions. This study examined whether chronic comorbidities are associated with breast cancer screening recommendations and adherence, as well as differences between foreign-born and United States-born women.

Materials and Methods: The study examined data from the 2013 and 2015 National Health Interview Survey on women 50–74 years of age ($N=12,425$). Chi-square analysis was used to assess relationships between chronic comorbidities (hypertension, diabetes, and obesity) and mammography screening recommendation and adherence (screened in the last 3 years). Multivariable binary logistic regression analysis examined the relationship between foreign-born status and mammography screening, adjusting for provider screening recommendation and chronic comorbidities.

Results: Obesity and hypertension were positively associated with mammography screening recommendation and adherence ($p<0.05$). United States-born women, compared with foreign-born women, had higher rates of obesity (28% vs. 24%, $p<0.001$) and hypertension (44% vs. 41%, $p<0.001$). Compared with normal-weight women, underweight women (odds ratio [OR]: 0.57, confidence interval [CI]: 0.39–0.82) were significantly less likely to report receiving mammograms. In stratified analyses, foreign-born underweight women (OR: 0.25, CI: 0.09–0.68) remained less likely to report receiving mammograms after controlling for years lived in the United States and citizenship status.

Conclusion: Public health intervention efforts must encourage mammography screening for both United States-born and foreign-born women, especially those diagnosed with chronic conditions.

Keywords: breast cancer, immigrant health, diabetes, hypertension, obesity, mammography screening

Introduction

EARLY DETECTION OF breast cancer through mammography screening can reduce mortality from this common cancer.¹ The risk of developing breast cancer increases with age, and regular biennial screening is recommended for all women between 50 and 74 years of age.² The United States population is aging, as is the rising number of immigrants. In the United States, one in eight of older adults are immigrants, and over half of foreign-born individuals are women.³ Understanding factors associated with receipt of mammography

screening among older women is pertinent for improving breast cancer prevention efforts. In addition to known sociodemographic factors (*e.g.*, higher socioeconomic status) and health access factors (*e.g.*, having health insurance and a usual source of care), physician recommendations of mammography are strongly related to screening adherence.^{4,5} Immigrants may fail to get screened because of lack of health insurance, low income, and limited health care access, but other factors such as cultural differences or lower education may prevent older immigrants from getting guideline-consistent screening.⁶

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Older adult women experience elevated risk of chronic conditions, including obesity, diabetes, and hypertension.⁷⁻⁹ These chronic conditions have been linked with increased breast cancer incidence: obesity and diabetes have strong associations with postmenopausal breast cancer.^{10,11} Immigrants living in the United States are at a lower risk of developing chronic conditions, compared with United States-born individuals, but are at higher risk for developing breast cancer.^{6,12,13} For example, a recent study revealed that while mammography rates increased significantly among foreign-born women between 2000 and 2008, they were lower than the rates for United States-born women.¹² To date, research on the impact of immigrant status on provider recommendations and breast cancer screening among women with chronic conditions is limited. Given the heightened risks for breast cancer associated with age, immigrant status, and chronic illness, this study examined whether chronic comorbidities are associated with breast cancer screening recommendation and adherence, and whether these relationships differ between foreign-born and United States-born women.

Methods

Study sample

This study analyzed data from the National Health Interview Survey (NHIS), an annual cross-sectional survey of nationally representative households of the United States civilian, noninstitutionalized population. The NHIS uses a complex multistage clustered sample design to conduct representative surveys on households across the United States. Information is collected through in-person interviews on different sociodemographic and health topics of household members, using family, person, and sample adult modules. A detailed description of the methods has been published previously.¹⁴ For this study, the 2013 and 2015 NHIS data were pooled because the survey for both years contained detailed cancer-related questions. In addition, combining the two sets of data improved the study's power to detect meaningful relationships among the relatively small immigrant sample. The final response rate for each year was 61.2% and 55.2%, respectively. Declining response rates of national level studies, including the NHIS, have been observed.¹⁵ This study was exempted from review by the Institutional Review Board of the University of Texas Medical Branch.

Participants

The overall unweighted sample of women who participated in the NHIS survey was 37,718. This study included 13,536 women between the ages of 50 and 74 years, because recent mammography screening guidelines recommend that this age group receive a mammogram every 2 years. Participants excluded from the analysis included women who did not respond to questions regarding whether they had received mammography screening the last 2 years (623), or whether a physician had recommended that they receive mammography screening in the past 12 months (498); as well as those who did not respond to questions about any of the chronic conditions (863) or place of birth (3). Also, because of sample size limitations, women from race groups other than White, Hispanic, Black, or Asian were excluded (139). The final analytic sample included 12,425 women.

Measures

The main outcome variable was up-to-date mammography screening. Women were asked if they had ever had mammography screening, and how many years it has been since they were last screened. The variable for being up-to-date for mammography screening was dichotomized into whether or not participants had received mammography screening within the past 2 years. Participants were also asked whether a physician had recommended that they undergo mammography screening in the past 12 months, and this variable was dichotomized into whether or not a participant received a physician mammography screening recommendation.

Key independent variables included foreign-born status and chronic diseases (specifically obesity, hypertension, and diabetes). Foreign-born status was determined from participants' response to where they were born. Their responses were dichotomized into women born in the United States, and those born outside of the United States or a United States territory. Overweight and obese status was determined using body mass index (BMI) calculations (22).¹⁶ BMI was categorized into underweight (BMI <18.5), normal weight (BMI ≥18.5 and <25), overweight (BMI ≥25.0 and <30), obese (BMI ≥30 and <35), and severely obese (BMI ≥35). Diabetes was assessed according to participants' self-reported response to a question about whether they had ever been told by their physician that they had diabetes. A dichotomous variable for hypertension was created from participants' response to whether or not they had been told in at least two visits to a physician that they had hypertension.

Additionally, covariates were derived from questions on whether or not women had a usual source of health care, health insurance, or had ever been diagnosed with cancer. Each variable was dichotomized (yes or no). Self-rated health status was determined by asking how participants felt their health was in general, using a five-point Likert scale. Participants' responses were collapsed into the following categories for this study: excellent/very good, good, or fair/poor. Foreign-born women were asked how many years they had lived in the United States. Their responses were dichotomized as <10 years or ≥10 years. A dichotomized variable for citizenship status was created from a question on whether or not foreign-born women were United States citizens. Other sociodemographic characteristics included were age, education, race/ethnicity (non-Hispanic White, Hispanic, non-Hispanic black, and Asian), and household income (measure of federal poverty threshold; 0%–100% federal poverty level [FPL], <100%–200% FPL, <200%–300% FPL, and >300% FPL).

Statistical analyses

The SAS[®] statistical software version 9.4 (Cary, NC) was used to conduct all analyses. Data were weighted by following directions for using weights when pooling data from multiple NHIS survey years to account for complex sampling methods.¹⁴ Chi-square analysis was used to test the association between descriptive variables and foreign-born status. Bivariate associations between each key independent variable and the outcome variables were examined. *p*-Values were reported. Multivariable binary logistic regression was used to examine the association between foreign-born status and being up-to-date with mammography screening,

controlling for chronic conditions. In addition, physician mammography screening recommendation and the socio-demographic variables were included as covariates in the regression model. The estimates for all confounders were included in the tables to allow for examination of how each variable affects the observed associations and the outcome. Subsequent regression models were stratified by United States- or foreign-born status. The model developed for foreign-born women further adjusted for length of United States residency, and United States citizenship status. Forward and backward selection methods were used to determine the best model fit, and p -value of <0.05 were used to retain variables. As a result, previous cancer was excluded from the model. Odds ratios (ORs), and 95% confidence intervals (CIs) are reported for all regression models.

Results

Foreign-born women included 16% of all study participants, with the majority reporting Hispanic ethnicity, followed by non-Hispanic white and Asian ethnicity (Table 1). Overall, 27% of women were obese, 44% had hypertension, and 19% had diabetes. United States-born women, compared with foreign-born women, had higher rates of obesity (28% vs. 24%, $p < 0.0001$), hypertension (44% vs. 41%, $p < 0.0001$), and diabetes (18% vs. 21%, $p < 0.02$). Approximately 70% of all women had received a mammography screening recommendation from their provider in the past 12 months, and 74% of participants received a mammography screening within the past 2 years. Between United States-born and foreign-born women, the rate of provider recommendations of mammography screening (71% vs. 69%, $p < 0.12$) and adherence to screening (74% vs. 73%, $p < 0.37$) were not significantly different.

Among all study participants, obesity and hypertension were positively associated with receipt of a mammography screening recommendation, $p < 0.05$ (Table 2). A provider recommendation for mammography screening was higher for obese women than for normal-weight individuals (73% vs. 69%). A screening recommendation by a provider was also higher for hypertensive compared with nonhypertensive women (74% vs. 68%). Obesity and hypertension were both associated with increased adherence to mammography screening in the total sample ($p < 0.05$). Receipt of a mammography screening was lowest for underweight women compared with normal-weight women (56% vs. 73%). Mammography screening was, in addition, higher for hypertensive compared with nonhypertensive women (75% vs. 72%).

The independent effect of chronic conditions on the association between foreign-born status and receiving up-to-date mammography screening were evaluated for all women, after adjusting for provider mammography recommendation and sociodemographic variables (Table 3). Foreign birth was not significantly associated with adherence to mammography screening, and BMI was the only chronic condition associated with mammography screening. Compared with normal-weight women, underweight women (OR: 0.57, CI: 0.39–0.82) were significantly less likely to report having had a mammogram within the last 2 years. In analyses stratified by foreign-born status, United States-born underweight women (OR: 0.64, CI: 0.44–0.95) remained significantly less likely to report receiving mammograms than normal-weight United

States-born women. Similarly, among foreign-born women, underweight women (OR: 0.24, CI: 0.12–0.51) were significantly less likely to report receiving mammograms than normal-weight women, after controlling for years having lived in the United States with citizenship status. Foreign-born women who had lived in the United States for 10 years or more were more likely to have received mammograms than those who had lived in the United States <10 years (OR: 1.54, CI: 1.07–2.22). Compared with noncitizens, foreign-born United States citizens were also more likely to receive mammography screening (OR: 1.33, CI: 1.01–1.75).

Discussion

This study examined the association between chronic comorbidities and breast cancer screening recommendation and adherence, and also differences by foreign-birth status. Findings indicate that BMI and hypertension were associated with provider mammography screening recommendation and receipt of up-to-date mammography screening in both United States- and foreign-born women between ages 50 and 74 years. Whereas mammography screening was higher among hypertensive than nonhypertensive women, the positive association between hypertension and mammography screening was attenuated after adjusting for demographic and health access variables. Previous reports on the relationship between hypertension and mammography screening are mixed. Whereas some studies suggest no association, others indicate that hypertension is related to the increased likelihood of mammography screening.^{17–20} Notably, a recent study on the effect of cardiovascular disease on cancer screening recommendation found that women with hypertension were more likely to adhere to mammography screening guidelines, compared with those without hypertension.²⁰ It is likely that in seeking treatment to manage their hypertension, these women have regular interactions with their health care provider, which also increases their chances of receiving additional preventive care, including mammography.¹⁷

In contrast to findings from the present study, several studies have found that overweight and obese women have lower rates of mammography screening than normal-weight women.^{21,22} These studies suggested that overweight and obese women may avoid the health care system because of concerns about being stigmatized or embarrassed over their weight.²³ Although more than half of study participants in the present study were overweight, the sample was an older adult age group (≥ 50 years). Receipt of mammography screening among women in this age group is higher than women under 50 years of age. Results from the present study are consistent, however, with prior reports that underweight women are less likely to have received mammography screening.^{24–26} In studies of preventive care utilization, underweight women have often been excluded or their results unreported, possibly due to the small sample size of underweight individuals in these previous studies.^{24,27,28} Underweight women may fail to seek preventive care such as mammography because they experience higher morbidity and health problems than normal-weight women, and thus may prioritize treatment of those conditions over screening.²⁹

While the present study found that immigrant women were just as likely as United States-born women to receive up-to-date mammography screening, several studies have suggested

TABLE 1. DISTRIBUTION OF BREAST CANCER SCREENING AMONG WOMEN ≥50–74 YEARS OF AGE INCLUDED IN THE NATIONAL HEALTH INTERVIEW SURVEY, 2013 AND 2015

<i>Personal characteristics</i>	<i>N = 12,425 N (%)</i>	<i>United States-born n = 10,420, % (95% CI)</i>	<i>Foreign-born n = 2,005, % (95% CI)</i>
Age			
≥50	5,917 (47.8)	47.3 (46.0–48.6)	50.5 (47.9–53.1)
51–60	4,983 (39.9)	40.3 (39.2–41.4)	37.8 (35.3–40.4)
≥61	1,525 (12.3)	12.4 (11.7–13.2)	11.7 (10.0–13.4)
Race/Ethnicity			
Non-Hispanic white	8,297 (74.3)	81.8 (80.9–82.8)	27.4 (24.7–30.1)
Hispanic	1,557 (9.2)	3.9 (3.5–4.3)	42.4 (39.9–9)
Non-Hispanic black	1,981 (12.6)	13.5 (12.6–14.3)	7.4 (5.9–8.9)
Asian	592 (3.8)	0.8 (0.6–0.9)	22.8 (21.3–25.2)
Education level			
No high school degree	1,699 (11.9)	9.6 (8.9–10.3)	27.1 (24.6–29.5)
High school degree	3,250 (26.1)	26.8 (25.8–27.9)	21.5 (19.3–23.7)
Some college/Associate college degree or higher	7,431 (62.0)	63.6 (62.4–64.8)	51.4 (48.7–54.2)
Poverty level			
0–100% FPL	1,766 (12.4)	11.2 (10.4–11.9)	20.4 (18.4–22.5)
>100%–200% FPL	2,377 (18.0)	17.4 (16.5–18.3)	21.2 (19.0–23.3)
>200%–300% FPL	2,027 (16.1)	15.1 (15.1–16.8)	16.7 (14.8–18.6)
>300% FPL	6,255 (53.6)	55.4 (54.1–56.8)	41.7 (39.0–44.4)
Marital status			
Married	5,593 (46.3)	45.3 (44.1–46.6)	52.1 (49.6–54.6)
Living with partner	6,446 (51.0)	51.8 (50.6–53.0)	45.8 (43.2–48.3)
Other (not married)	349 (2.8)	2.9 (2.5–3.2)	2.1 (1.3–2.9)
Usual source of care			
Yes	11,844 (95.7)	96.0 (95.6–96.5)	93.6 (92.4–94.7)
No	580 (4.3)	4.0 (3.5–4.4)	6.4 (5.3–7.6)
Health insurance			
Yes	11,554 (93.9)	94.7 (94.2–95.3)	88.7 (87.2–90.3)
No	847 (6.09)	5.27 (4.7–5.8)	11.3 (9.7–12.8)
Self-rated health status			
Excellent/very good	6,120 (51.1)	52.6 (39.0–44.2)	41.6 (39.0–44.2)
Good	3,724 (29.3)	28.5 (27.5–29.5)	34.3 (32.0–36.5)
Fair/poor	2,578 (19.6)	18.9 (18.0–19.8)	24.1 (22.0–26.2)
Ever diagnosed with cancer			
Yes	1,843 (15.7)	16.8 (15.8–17.7)	8.8 (6.3–8.8)
No	10,576 (84.3)	83.2 (82.3–84.2)	91.2 (89.6–92.7)
Years in the United States			
United States born	10,420 (86.3)	NA (NA)	NA (NA)
≤10 years	118 (0.7)	NA (NA)	6.6 (5.5–7.6)
>10 years	1,867 (13.0)	NA (NA)	93.4 (92.4–94.5)
United States citizenship			
United States born	10,420 (83.9)	NA (NA)	NA (NA)
Yes	1,454 (11.7)	NA (NA)	72.3 (70.3–74.3)
No	548 (4.4)	NA (NA)	27.7 (25.7–29.7)
BMI			
Under weight	221 (1.7)	1.7 (1.4–2.0)	1.7 (1.1–2.4)
Normal weight	4,036 (33.5)	32.7 (31.6–33.8)	38.0 (35.6–40.5)
Overweight	3,834 (31.2)	30.6 (29.7–31.8)	33.7 (31.2–36.2)
Obese	3,546 (27.4)	28.0 (26.9–29.0)	23.7 (21.5–25.8)
Severe obesity	788 (6.3)	6.8 (6.2–7.4)	2.9 (2.0–3.7)
Hypertension			
Yes	5,557 (43.5)	44.0 (42.7–45.2)	40.7 (38.2–43.2)
No	6,868 (56.5)	56.0 (54.7–57.2)	59.3 (56.8–61.8)
Diabetes			
Yes	2,428 (18.6)	18.1 (15.8–17.3)	21.5 (19.2–23.7)
No	9,997 (81.4)	81.9 (81.0–82.7)	78.5 (76.3–80.8)

(continued)

TABLE 1. (CONTINUED)

<i>Personal characteristics</i>	<i>N = 12,425 N (%)</i>	<i>United States-born n = 10,420, % (95% CI)</i>	<i>Foreign-born n = 2,005, % (95% CI)</i>
Mammography screening recommendation			
Yes	8,697 (70.6)	70.9 (69.8–72.1)	68.8 (66.4–71.3)
No	3,728 (29.4)	29.1 (27.9–30.2)	31.2 (28.7–33.6)
Mammography screening			
Yes	9,115 (73.9)	74.0 (73.0–75.0)	72.9 (70.3–74.2)
No	3,310 (26.1)	26.0 (25.0–27.0)	27.1 (24.9–29.2)

Values are unweighted sample sizes, and all percentages and 95% CI were weighted; NA, not applicable; Bivariate associations have a *p* value <0.0001, except for “Mammography screening recommendation” and “Mammography screening”; “Diabetes” association with “Place of birth” had a *p* value of 0.02.

FPL, Federal poverty level, based on the department of Health and Human Services (HHS) poverty guidelines.

Weight: Based on BMI measure, underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9) and obese (>30).

BMI, body mass index; CI, confidence interval.

that immigrant women were less likely to receive up-to-date mammography screening than United States-born women.^{13,30,31} For example, one study found that after adjusting for sociodemographics, health services, and health behavior, foreign-born women from different racial/ethnic groups (White, Hispanic and other) were significantly less likely to have received a mammogram in the past 3 years.³⁰ It is also worth noting that some research that found that foreign-born women had a lower likelihood of receiving mammography screening revealed that this relationship was nonsignificant after adjusting for factors, including sociodemographic, socioeconomic status, and health access factor, including health insurance, and usual source-of-care factors.^{32,33}

Findings from the current study may reflect the contribution of health policy measures designed to increase screening among immigrants to a narrowing gap in screening between United States- and foreign-born women. Recent examination of national level trends in mammography screening indicated that increases in mammography use among immigrants have helped them catch up to the screening rates of United States-born women.^{12,34} Initiatives, including the National Breast and Cervical Cancer Early Detection Program have focused on providing screening services to underserved populations, including immigrant women across the United States.³⁵ In addition, cancer centers and safety net health centers across

the United States have provided health education and preventive care services, including screening to underserved populations, such as foreign-born individuals.³⁶

This study found that among foreign-born women, an increased number of years lived in the United States, and also being a United States citizen, was positively associated with mammography screening. This result is supported by previous literature.^{31,32,37} A recent study using combined data from the 2000 to 2011 NHIS surveys examined whether citizenship and years of residence in the United States had an interactive association with mammography screening.³⁷ The authors found that compared with United States-born citizens, both immigrant citizens and noncitizens who have resided in the United States for 5 years or more were more likely to have received up-to-date mammography cancer screening. In contrast, immigrant noncitizens who had lived in the United States for <5 years were less likely to have been screened. It is highly likely that acculturation plays a strong role in adopting health behaviors of the adopted country. For example, the present study found that well over 90% of the foreign-born women had lived in the United States for more than 10 years, and almost two-thirds of them were United States citizens. Having lived in the United States for that long, these women would likely have better knowledge of, access to, and comfort in interacting

TABLE 2. ASSOCIATION BETWEEN CHRONIC CONDITIONS MAMMOGRAPHY SCREENING RECOMMENDATION AND ADHERENCE

	<i>Mammography screening recommendation</i>	<i>Mammography screening</i>
Weight		
Underweight	62.32 (54.59–70.05)*	56.14 (48.14–64.14)***
Normal weight	69.15 (67.19–71.11)	73.28 (71.58–74.98)
Overweight	70.45 (68.71–72.19)	74.69 (73.10–76.27)
Obese	72.73 (70.73–74.74)	75.13 (73.36–76.90)
Severely Obese	72.46 (68.77–76.15)	72.40 (68.84–75.96)
Hypertension		
Yes	73.60 (72.18–75.01)***	75.11 (73.73–76.48)*
No	68.34 (66.91–69.76)	72.93 (71.61–74.24)
Diabetes		
Yes	72.62 (70.40–74.84)	73.33 (71.18–75.47)
No	70.17 (68.97–71.37) [†]	74.00 (72.99–75.01)

p* ≤ 0.05, **p* ≤ 0.001; [†]*p* = 0.07.

TABLE 3. LOGISTIC REGRESSION ODDS RATIOS OF THE ASSOCIATION OF CHRONIC CONDITIONS AND PLACE OF BIRTH WITH MAMMOGRAPHY SCREENING, STRATIFIED BY PLACE OF BIRTH

	<i>Received mammography in past 2 years</i>		
	<i>Total</i>	<i>United States-born</i>	<i>Foreign-born^a</i>
Foreign-born			
No	Ref	—	—
Yes	1.11 (0.91–1.35)	—	—
Mammography recommendation			
No	Ref	Ref	Ref
Yes	6.38 (5.72–7.12)***	6.38 (5.67–7.20)***	6.38 (5.07–8.03)***
Weight			
Normal weight	Ref	Ref	Ref
Underweight	0.57 (0.39–0.82)**	0.64 (0.44–0.95)**	0.24 (0.12–0.51)**
Overweight	1.11 (0.97–1.27)	1.09 (0.93–1.27)	1.16 (0.86–1.55)
Obese	1.13 (0.97–1.32)	1.11 (0.94–1.32)	1.20 (0.85–1.68)
Severely obese	1.11 (0.89–1.39)	1.10 (0.86–1.40)	1.27 (0.65–2.51)
Hypertension			
No	Ref	Ref	Ref
Yes	1.10 (0.96–1.25)	1.13 (0.98–1.29)	0.92 (0.69–1.23)
Diabetes			
No	Ref	Ref	Ref
Yes	1.01 (0.87–1.18)	1.01 (0.86–1.20)	1.03 (0.79–1.36)
Years lived in the United States			
≤10 years	—	—	Ref
>10 years	—	—	1.54 (1.07–2.22)*
Citizen			
Yes	—	—	Ref
No	—	—	1.33 (1.01–1.75)*

All models adjusted for age, race, education, household income, marriage, health insurance, self-rated health status, usual source of care, and ever had cancer.

^aModel included only foreign-born individuals and additionally controlled for years lived in the United States and citizenship status.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

with the health care system.^{31,34} Having United States citizenship also drastically improves their health care access and quality of care received—for example, by acquiring public/private health insurance. Taken together, this may also explain why there was no difference in mammography use between foreign-born women and United States-born women.

This study had several strengths. Study participants were a representative sample of the United States adult population and included a substantial proportion of foreign-born, allowing for a broad understanding of breast cancer screening adherence for immigrants from different origins. Furthermore, examination of the NHIS data enabled consideration of a multitude of variables, including time lived in the United States and how chronic conditions play a role in the adherence to screening guidelines. However, some limitations of this study include the use self-report data, which are subject to recall bias. Also, because the NHIS is based on a cross-sectional study design, it is impossible to draw causal inferences from statistically significant results. Some foreign-born groups may have been excluded from this study, as the language requirement for study participants were English and Spanish. Limited language fluency may also have affected accuracy in participants' response to questionnaires. The sample size of immigrants, even after combining 2013 and 2015 NHIS

data, was not adequate for examining differences among immigrants by countries of origin. Moreover, certain immigrant groups, such as undocumented immigrants and refugees, were not identifiable in the NHIS data. It is also important to note that mammography screening recommendations are not consistent across professional organizations. The American Cancer Society recommends yearly screening for women between 45 and 54 years, whereas the United States Preventive Services Task Force (USPSTF) and the American Academy of Family Physicians recommend biennial screening for women between 50 and 74 years.³⁸ The study's design reflects the latter set of recommendations.

Conclusion

It remains imperative to address the cancer preventive care needs of both United States-born and foreign-born women by encouraging mammography screening, particularly among those diagnosed with chronic conditions. The study's findings also highlight the need for health care professionals to be cognizant of unique barriers experienced by immigrants who seek preventive care, such as treatment for chronic conditions. Public health intervention efforts to increase mammography screening rates among immigrant women should target recent immigrants to the United States and those that are underweight.

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Author Disclosure Statement

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References

- Nelson HD, Fu R, Cantor A, Pappas M, Daeges M, Humphrey L. Effectiveness of breast cancer screening: Systematic review and meta-analysis to update the 2009 U.S. preventive services task force recommendation. *Ann Intern Med* 2016;164:244–255.
- Siu AL. Screening for breast cancer: U.S. preventive services task force recommendation statement. *Ann Intern Med* 2016;164:279–296.
- Lopez G, Radford J. Statistical portrait of the foreign-born population in the United States, 2015. Washington, DC: Pew Research Center, 2017.
- White A, Thompson TD, White MC, et al. Cancer screening test use—United States, 2015. *MMWR Morb Mortal Wkly Rep* 2017;66:201–206.
- Plourde N, Brown HK, Vigod S, Cobigo V. Contextual factors associated with uptake of breast and cervical cancer screening: A systematic review of the literature. *Women Health* 2016;56:906–925.
- Singh GK, Rodriguez-Lainz A, Kogan MD. Immigrant health inequalities in the United States: Use of eight major national data systems. *Scientific World J* 2013;2013:512313.
- Mathus-Vliegen EM. Obesity and the elderly. *J Clin Gastroenterol* 2012;46:533–544.
- Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. *Diabetes care* 2012;35:2650–2664.
- Nwankwo T, Yoon SS, Burt V, Gu Q. Hypertension among adults in the United States: National Health and Nutrition Examination Survey, 2011–2012. *NCHS Data Brief* 2013:1–8.
- Liao S, Li J, Wei W, et al. Association between diabetes mellitus and breast cancer risk: A meta-analysis of the literature. *Asian Pac J Cancer Prev* 2011;12:1061–1065.
- La Vecchia C, Giordano SH, Hortobagyi GN, Chabner B. Overweight, obesity, diabetes, and risk of breast cancer: Interlocking pieces of the puzzle. *Oncologist* 2011;16:726–729.
- Yao N, Hillemeier MM. Disparities in mammography rate among immigrant and native-born women in the U.S.: Progress and challenges. *J Immigr Minor Health* 2014;16:613–621.
- Billmeier TM, Dallo FJ. Nativity status and mammography use: Results from the 2005 National Health Interview Survey. *J Immigr Minor Health* 2011;13:883–890.
- Centers for Disease Control National Center for Health Statistics. National Health Interview Survey (NHIS): Questionnaires, datasets, and related documentation 2013–2015. Atlanta, GA: Centers for Disease Control and Prevention, 2016.
- Czajka JL, Beyler A. Declining response rates in federal surveys: Trends and implications (background paper). Mathematica Policy Research 2016. <https://www.mathematica-mpr.com/our-publications-and-findings/publications/declining-response-rates-in-federal-surveys-trends-and-implications-background-paper> Accessed December 18, 2018.
- Moyer VA. Screening for and management of obesity in adults: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med* 2012;157:373–378.
- Liu BY, O'Malley J, Mori M, et al. The association of type and number of chronic diseases with breast, cervical, and colorectal cancer screening. *J Am Board Fam Med* 2014;27:669–681.
- Talley CH, Williams KP. Impact of age and comorbidity on cervical and breast cancer literacy of African Americans, Latina, and Arab women. *Nurs Clin North Am* 2015;50:545–563.
- Heflin MT, Oddone EZ, Pieper CF, Burchett BM, Cohen HJ. The effect of comorbid illness on receipt of cancer screening by older people. *J Am Geriatr Soc* 2002;50:1651–1658.
- Guo F, Hirth JM, Berenson AB. Effects of cardiovascular disease on compliance with cervical and breast cancer screening recommendations among adult women. *J Womens Health (Larchmt)* 2015;24:641–647.
- Fagan HB, Wender R, Myers RE, Petrelli N. Obesity and cancer screening according to race and gender. *J Obes* 2011;2011:218250.
- Maruthur NM, Bolen S, Brancati FL, Clark JM. Obesity and mammography: A systematic review and meta-analysis. *J Gen Intern Med* 2009;24:665–677.
- Aldrich T, Hackley B. The impact of obesity on gynecologic cancer screening: An integrative literature review. *J Midwifery Womens Health* 2010;55:344–356.
- Banerjee R, Findley PA, Sambamoorthi U. Disparities in preventive care by body mass index categories among women. *Women Health* 2008;47:1–17.
- Zhu K, Wu H, Jatoi I, Potter J, Shriver C. Body mass index and use of mammography screening in the United States. *Prev Med* 2006;42:381–385.
- Fontaine KR, Heo M, Allison DB. Body weight and cancer screening among women. *J Womens Health Gend Based Med* 2001;10:463–470.
- Wee CC, Phillips RS, McCarthy EP. BMI and cervical cancer screening among white, African-American, and Hispanic women in the United States. *Obes Res* 2005;13:1275–1280.
- Wee CC, McCarthy EP, Davis RB, Phillips RS. Screening for cervical and breast cancer: Is obesity an unrecognized barrier to preventive care? *Ann Intern Med* 2000;132:697–704.
- Hellmann SS, Njor SH, Lynge E, et al. Body mass index and participation in organized mammographic screening: A prospective cohort study. *BMC Cancer* 2015;15:294.
- McDonald JT, Neily J. Race, immigrant status, and cancer among women in the United States. *J Immigr Minor Health* 2011;13:27–35.
- De Alba I, Hubbell FA, McMullin JM, Sweningson JM, Saitz R. Impact of U.S. citizenship status on cancer screening among immigrant women. *J Gen Intern Med* 2005;20:290–296.
- Echeverria SE, Carrasquillo O. The roles of citizenship status, acculturation, and health insurance in breast and cervical cancer screening among immigrant women. *Med Care* 2006;44:788–792.

33. Goel MS, Wee CC, McCarthy EP, Davis RB, Ngo-Metzger Q, Phillips RS. Racial and ethnic disparities in cancer screening: The importance of foreign birth as a barrier to care. *J Gen Intern Med* 2003;18:1028–1035.
34. Reyes AM, Miranda PY. Trends in cancer screening by citizenship and health insurance, 2000–2010. *J Immigr Minor Health* 2015;17:644–651.
35. Center for Disease Control and Prevention. National breast and cervical cancer early detection program (NBCCEDP), 2012. Available at: <http://cdc.gov/cancer/nbccedp/legislation/law.htm> Accessed August 20, 2017.
36. American Cancer Society Cancer Action Network. Federally qualified health centers improve access to help save lives, 2017. Available at: <https://acscan.org/sites/default/files/FINAL%20Community%20Health%20Centers%20FS%2008.23.17.pdf> Accessed August 20, 2017.
37. Miranda PY, Yao N, Snipes SA, BeLue R, Lengerich E, Hillemeier MM. Citizenship, length of stay, and screening for breast, cervical, and colorectal cancer in women, 2000–2010. *Cancer Causes Control* 2017;28:589–598.
38. Smith RA, Andrews KS, Brooks D, et al. Cancer screening in the United States, 2017: A review of current American Cancer Society guidelines and current issues in cancer screening. *CA Cancer J Clin* 2017;67:100–121.

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