Patterns of Use of Mammography among Women by Body Weight

Janaki Santhiveeran, PhD.
Professor
School Of Social Work
California State University, Long Beach
Long Beach, Ca. 90840, USA

This study explored disparities in mammography use in the prior two years among Californian women over the age of 40 across groups formed by Body Mass Index (BMI) and whether disparities are explained by sociodemographic factors, veteran status, and health care variables. Data for women from California were retrieved from 2015 California Health Interview Survey (CHIS). Nearly two-thirds of women had mammography screening in the prior 2 years and 26.7% had mammography screening over 2 years ago and 5.6% never had mammography screening. The logistic regression models were used to predict the likelihood of mammography use. Compared to nonveteran women, veteran women (OR =1.941) were more likely to have undergone mammography screening in the prior 2 years. Similarly, those who have had preventive care visit (OR = 2.833) had a greater likelihood of undergoing mammography screening in the prior 2 years than those who did not have preventive care visits. While having a disability (OR = .564) and public health insurance (OR = .243) were least likely adhere to mammography screening in the prior 2 years. Study findings highlight the need for targeted health care interventions to reach at risk population.

Introduction and Purpose

Breast cancer is a growing epidemic in the United States (U.S.), creating substantial challenges to our health care system. The American Cancer Society (ACS) estimates that there will be 252,710 cases of invasive breast diagnoses every year (Siegel, Miller, & Jemal, 2017).

According to American Cancer Society (ACS, 2017) estimates, there will be over 40,000 deaths associated with breast cancer in the U.S. alone (Siegel, Miller, & Jemal, 2017). Hence, it is not surprising that breast cancer is the most common type of cancer among women between the ages of 20 to 59 (Siegel, Miller, & Jemal, 2015). Prior research on nine different types of cancer using the Surveillance, Epidemiology, and End Results (SEER) validated a similar trend among veteran women when data from 1990 to 2004 were analyzed (Zhu et al., 2009). Some researchers have noted a higher incidence of breast cancer among veterans than nonveterans (Kangmin, et al., 2009). It is important to note that these two groups differed only in the incidence of breast cancer when that type of cancer was compared to lung, colorectal, and prostate cancers.nearly 10% of the incidences (27000/day) of breast cancer and deaths (4440/day) from breast cancer in the U.S. occur in California every year (American Cancer Society, 2017a).

Various organizations have drawn attention to cancer screening behaviors because they can be modified to prevent the occurrences of breast cancer. For instance, the United States Prevention Services Task Force (USPSTF) and the American Cancer Society (ACS) recommend that women between the ages of 50 and 69 should undergo a mammography every 1 to 2 years (Calvocoressi, et al., 2008; National Center for Health Promotion & Disease Prevention, 2007; US Prevention Services Task Force, 2007; Oeffinger, 2015). Mammography uses either a plain film or digital technologies to detect breast cancer during its asymptomatic stage (Nelson et al., 2009). If there is a concerning finding, women are usually referred for a breast Magnetic Resonance Imaging (MRI), an ultrasonography, or an invasive biopsy for further evaluation (Nelson et al., 2009).

Although several benefits such as early deduction of breast cancer to reduce preventable mortality are associated with mammography screening (Howlander, et al., 2016), only 60% to 70% of women between the ages of 40 to 65 have had a mammogram (Enewold, McGlynn, Shriver, & Zhu, 2012).

It is important to note that one-third of all deaths could be prevented if 100% of women undergo mammography screening (Mandelblatt, et al. 2013; Nelson et al., 2009). Consequently, understanding the use of mammography among women will shed light on how to prevent breast cancer. Existing research mainly focuses on factors associated with breast cancer (Siegel, Miller, & Jemal, 2017; Zhu et al, 2009). For example, obesity, a modifiable lifestyle factor, is widely studied as a cancer risk factor. There will be 3300 to 5700 fewer breast cancer deaths if obesity is eradicated by 2025 (Mandelblatt, et al. 2013).

Limited research exists on the factors associated with mammography screening (Bhanegaonkar, et al., 2012; Borrayo et al., 2009; Calvocoressi, et al., 2008; Enewold, McGlynn, Shriver, & Zhu, 2012; Hubbard, et al., 2016; Kung, Tsai, & Chiou, 2012; Ludman, 2010). Therefore, this study explored disparities in mammography use across groups formed by Body Mass Index (BMI) and whether disparities are explained by sociodemographic factors, veteran status, and health care variables.

Literature Review

Research explaining disparities in mammography screening are presented. Several researchers identified type of insurance as a main determining factor when it comes to breast cancer screening (Bhanegaonkar, et al., 2012; Breen, Cronin, & Meissner, 2007). Among women 40-65 years of age, differences were noted between women who had Medicaid or Medicare (60%) and private (70%) health insurance coverage (Breen, Cronin, & Meissner, 2007). Although the mammography screening rates among Medicaid recipients decreased over a 10-year period (1999-2008), 28% of those recipients did not have a screening (Bhanegaonkar, et al., 2012).

Prior research had noted how several factors, including education (Hubbard, et al., 2016), age (Borrayo et al., 2009; Calvocoressi, et al., 2008; Enewold, McGlynn, Shriver, & Zhu, 2012; Hubbard, et al., 2016), marital status (Borrayo et al., 2009; Ludman, 2010), and disability status (Kung, Tsai, & Chiou, 2012) are associated with mammography screening. Women (66-70 years) with a college degree were more likely to use mammography screening than women with only a high school education (Hubbard, et al., 2016), and much older women (71-75 years) were less adherent to undergoing mammography screening (Hubbard, et al., 2016).

Likewise, women above 60 were less likely to get a mammogram than women between the ages of 50 to 59 (Borrayo et al., 2009). In a rare study, the researchers found the less use of mammography among disabled women (Kung, Tsai, & Chiou, 2012).

Several researchers noted that Racial differences played a role in the likelihood of a woman undergoing cancer screening (Bhanegaonkar, et al., 2012; Borrayo et al., 2009; Calvocoressi, et al., 2008; Enewold, McGlynn, Shriver, & Zhu, 2012; Ludman, 2010). Non-Hispanic, White women are more likely to use mammography screening (Borrayo et al., 2009; Bhanegaonkar, et al., 2012; Ludman, 2010). Differences in mammography screening were also noted between Hispanic (42.3%) and White women (44.6%) (Borrayo et al., 2009). Yet another study found that Black, non-Hispanic women are more likely than non-Hispanic, White and Hispanic women to get a mammogram (Enewold, McGlynn, Shriver, & Zhu, 2012). Married, White, non-Hispanic women were more likely to use mammography screening than their Hispanic counterparts (Borrayo et al., 2009; Ludman, 2010). However, other researchers did not find a difference in mammography screening based on marital status (For e.g., Enewold, McGlynn, Shriver, & Zhu, 2012).

Researchers have documented mixed results regarding the use of mammography among the overweight and obese women (Atkin, et al., 2013; Banerjea, Findley, & Sambamoorthi, 2008; Borrayo et al., 2009; Littman et al., 2011). Only a small number (<12%) of obese women had undergone mammography screening within the past year (Atkin, et al., 2013; Littman, et al. 2011); however, Borrayo et al (2009) found that White women who were obese (BMI >30) were more likely to use mammography screening. Very few studies have analyzed mammography screening among veterans (Enewold, McGlynn, Shriver, & Zhu, 2012). Over half (61%) of all veteran women used mammography screening (Enewold, McGlynn, Shriver, & Zhu, 2012).

This study addresses the identified research gap by exploring the following hypotheses: 1) There is an association between BMI categories and mammography screening among the community sample of women in California; 2) There is an association between being a veteran, health care disparity (preventive care visit and insurance coverage), and sociodemographic variables (age, race, language spoken, education, marital status, poverty level, and disability status) in the use of mammography screening among the overall sample and groups stratified by BMI.

Research Method

Design and Data

The data for this retrospective study using a non-identifiable, community sample of women were retrieved from the California Health Interview Survey (CHIS) 2015 Adult Survey (California Health Interview Survey, 2015a). The CHIS is a community population-based survey of California households, using Computer assisted Telephone Survey (CATI) (California Health Interview Survey, 2015b). The CHIS is one of the databases that provide a community sample of California's women due to its use of random sampling procedure (California Health Interview Survey, 2015c). Although the CHIS Adult survey did not put forth any special effort in obtaining a sample of women veterans and women based on their BMI categories, the CHIS had a considerable number of veteran women and women based on their BMI categories.

Variables

Data for the following variables were retrieved from the 2015 CHIS Adult Survey Questionnaire and the corresponding data file (California Health Interview Survey, 2015d).

Dependent Variable. Use of mammography screening in the prior 2 years was dichotomized (yes=1; no=0).). This variable was reinstated in 2015 CHIS (CHIS Adult Survey California Health Interview Survey, 2015c).

Independent Variables. Ever serve(d) in the US armed forces and had a preventive health care visit to a doctor were dichotomized into "yes" and "no". Health care insurance coverage is classified into "public", which included Medicare, Medicaid and "private", which included Employee-based insurance (EBI) and privately purchased insurances. The following sociodemographic variables were included: having had a college degree, being disabled, spoke only English, being white, non-Hispanic, and being married are dichotomized into "yes" and "no". Age is dichotomized by median into "younger" (<60) and "older" (>59). Poverty status is classified based on Federal Poverty Level (FPL) into "poor" (<300% FPL) and "not poor" (>299% FPL).

Women who had a BMI less than 25 were considered having a normal weight, women who had a BMI between 25-29.9 were considered having an overweight, and women who had a BMI greater than or equal to 30 were considered being an obese.

Sample

This research used two sets of criteria to identify women in California (CA),) using a non-probability, purposive sampling procedure: 1) females aged 40 years and above, and 2) females who lived in California (California Health Interview Survey, 2015c) at the time of the study. Women who identified themselves as veterans (26.4%) and a comparable sample of nonveteran women (73.6%) were selected. One-third (28.5%) of the women were obese (> 30 BMI), 32.2% of them were overweight (BMI 25 to 29.99), and 39.4% were normal weight (BMI < 24.99). Over half (54.6%) had a college degree including 30.7% with a BA or BS, 17.3% with an MA or MS, and 6.6% with a Ph.D. or equivalent. Less than half (45.3%) identified themselves as disabled due to physical, mental, or emotional condition. Over half of them (54.6%) were not married including 5% of them were living with a partner, 38.7% were divorced, separated or widowed, and 10.9% were never married. Half of them (48.7%) were less than 60 years of age and the rest (51.3%) were 60 and above. The majority (85.9%) spoke only English at home. Three-fourths (73.8%) identified themselves as White, non-Hispanics, 8.8% were Hispanics, 8.5% were African Americans, and 4.3% were Asians. The majority (85.8%) of the sample was in 300% Federal Poverty Level (FPL) and above, 6.1% were in 200-299% FPL, 5% were in 100-199% FPL, and 3.2% were in 0-99% FPL. The majority (59.5%) was employed or had a business and 40.5% were not employed or looking for a job.

Table 1: Descriptive Statistics, N=625

	f	%
Marital Status		
Married	284	45.4%
Living w/Partner	31	5.0%
Widow/Separated	242	38.7%
Never Married	68	10.9%
College Graduate [a]	341	54.6%
Age		
40-44 years	55	8.8%
45-49 years	58	9.3%
50-54 years	95	15.2%
55-59 years	96	15.4%
60-64 years	83	13.3%
65-69 years	80	12.8%
70 and above	158	25.4%
Female Veteran[a]	165	26.4%
Spoke English[a]	537	85.9%
Disabled[a]	283	45.3%
Poor, <300% FPL[a]	89	14.3%
Ethnicity		
Hispanic	55	8.8%
White, Non-Hispanic	461	73.8%
African American	53	8.5%
Other	56	8.9%
Preventive Care Visit[a]	533	85.3%
Health Insurance		
Medicaid/Medicare	279	44.6%
Private Insurance	329	52.6%
Uninsured	17	2.7%
BMI Categories		
BMI <25: Normal Weight	246	48.3%
BMI 25.0-29.00: Overweight	201	32.2%
BMI 30.0+: Obese	178	28.5%

Statistical Analyses

Data analyses were performed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics and chi-square analyses were performed. In addition, a multivariate logistic regression analysis was conducted to estimate adjusted odds ratios (ORs) with 95% confidence intervals (CIs) for associations between the independent variables, the covariates and the dependent variable, the use of mammography. An analysis was stratified by BMI categories and the level of significance was set at $p < .05$.

Results

Descriptive Results

The study sample consisted of 625 women from a community sample in California. The majority (85.3%) had a preventive care visit in the past year. Nearly, half (48%) had Employee-Based Insurance (EBI), 2.7% had no insurance, 7.6% had Medicaid and Medicare, 34.9% had Medicare and other insurance, and 2.1% had other public insurance (Table 1).

Mammography Screening by BMI Categories

Nearly two-thirds of women from California have undergone mammography screening within two years and 26.7% had undergone mammography screening over 2 years ago and 5.6% never had undergone mammography screening (Table 1).

Statistically significant differences were noted among BMI categories in mammography screening (χ^2 = 7.016; df=2; p<.030). Among 625 Californians (Table 2), 67.7% of them had undergone mammography screening within two years. Overweight and obese group (70.2%) has undergone mammography much more than normal weight group (63.1%) in the prior two years. Nearly one -fourth (23.2%) of overweight and obese women and one -third (32.1%) of normal weight women from California had undergone mammography screening over two years ago. Only 5.6% of overall sample and 6.6% of overweight and obese group and 4.1% of normal weight group did not have mammography screening. This study supported the first hypothesis.

Table 2: Mammography Screening by BMI Categories, N=625

	BMI Categories		
Mammography Screening	**Obese or overweight**	**Normal Weight**	**Overall**
	(n=379)	(n=246)	(n=625)
Within 2 Years	266 (70.2%)	157(63.8%)	423 (67.7%)
Over 2 Years Ago	88 (23.2%)	79(32.1%)	167 (26.7%)
Never	25(6.6%)	10(4.1%)	35(5.6%)

χ^2 (2) = 7.016; p < .030.

Logistic Regression Results

Results of the mammography screening among California women are presented here, with an emphasis on how the following variables: veteran status, health disparities, and sociodemographic characteristics predict the use of mammography screening. Table 3 presents the logistic regression results, which include odds ratios (ORs) and their corresponding confidence intervals (CIs) and the logistic regression model's chi-square for the overall sample and for the groups formed by BMI categories. This study partially supported the second hypothesis.

Overall Sample. For the overall sample (N=625), being a veteran (Wald χ^2 (1) = 6.536, p < .011), being disabled (Wald χ^2 (1)= 8.212, p < .004), having had a preventive care visit to a doctor (Wald χ^2 (1) = 16.832, p <.005), and having had a public health insurance (Wald χ^2 (1) = 38.734, p <.005) predicted the use of mammography screening in the prior 2 years (χ^2 =102.554; p<.005). After adjusting, the study established that being a veteran (OR =1.941) and having had a preventive care visit to a doctor (OR = 2.833) were more likely to have had mammography screening in the prior two years and being disabled (OR = .564) and having had a public health insurance (OR = .243) were less likely to have had mammography screening in the prior 2 years. Sociodemographic variables including being married, age, speaking English, being non-white, and being poor did not predict the use of mammography screening in the prior two years

Table 3: Probability of Using Mammography Screening, N = 625

	Overall (n=625)					Overweight & Obese Group (n=379)					Normal Weight Group (n=246)				
	95% CI					95% CI					95% CI				
	lower	*upper*	*Wald* χ^2	*OR*	*Sig.*	*lower*	*upper*	*Wald* χ^2	*OR*	*Sig.*	*lower*	*upper*	*Wald* χ^2	*OR*	*Sig.*
Married[a]	.729	1.584	.132	1.074	.717	.459	1.253	1.169	.758	.280	.920	3.414	2.923	1.772	.087
College Grad[a]	.965	2.057	3.145	1.409	.076	.880	2.380	2.126	1.448	.145	.760	2.777	1.274	1.452	.259
< 60 years[a]	.445	1.151	1.906	.715	.167	.322	1.063	3.099	.585	.078	.480	2.507	.048	1.097	.827
Female Veteran[a]	1.167	3.229	6.536	1.941	.011	1.171	4.408	5.882	2.272	.015	.556	2.980	.348	1.287	.555
Spoke English[a]	.903	1.028	1.239	.964	.266	.882	1.053	.670	.964	.413	.894	1.099	.028	.991	.866
Disabled[a]	.381	.835	8.212	.564	.004	.367	1.020	3.548	.612	.060	.264	.955	4.417	.502	.036
Poor, <300% FPL[a]	.374	1.306	1.259	.699	.262	.238	1.221	2.196	.539	.138	.441	3.427	.157	1.230	.692
Non-White[a]	.629	1.570	.001	.994	.979	.564	1.794	.000	1.006	.984	.393	1.964	.100	.878	.752
Preventive Care Visit[a]	1.723	4.660	16.832	2.833	.000	1.743	6.646	12.869	3.404	.000	1.024	4.891	4.074	2.238	.044
Public Insurance[a]	.155	.379	38.734	.243	.000	.166	.522	17.477	.294	.000	.097	.421	18.202	.202	.000
Model χ^2 (10) = 102.554* **						**Model χ^2 (10) = 54.165*** **					**Model χ^2 (10) = 61.686*** **				
***p < .05; **p < .005; ***p < .0005**															
[a] Categorical variables: 1 = yes; 0 = no.															

Stratified by Body Weight. For the women who were overweight and obese (n=379), being a female veteran (Wald χ^2 (1) = 5.882, p < .015), having had a preventive care visit with a doctor (Wald χ^2 (1) = 12.869, p < .005), and having had a public health insurance (Wald χ^2 (1)= 17.477, p < .005) predicted the use of mammography screening in the prior 2 years (χ^2(10) = 54.165; p<.005). After adjusting, the study established that being a female veteran (OR =2.272) and having had a preventive care visit to a doctor (OR = 3.404) were more likely to have had mammography screening in the prior two years and having had a public health insurance (OR = .294) was less likely to have had mammography screening in the prior two years. For the women who had a normal weight (n=246), being disabled (Wald χ^2 (1)= 4.417, p < .036), having had a preventive care visit to a doctor (Wald χ^2 (1)= 4.074, p < .044), and having had a public health insurance (Wald χ^2 (1)= 18.202, p <.005) predicted the use of mammography screening in the prior 2 years (χ^2 (10) = 61.686; p<.005). After adjusting, the study established that women who had a preventive care visit to a doctor (OR= 2.238) were more likely to have had mammography screening in the prior two years and women who had disability (OR = .502) and had a public health insurance (OR = .202) were less likely to have had mammography screening in the prior two years.

Discussion

In a sample of 625 women from California, nearly two-thirds had undergone mammography screening in the prior two years, 26.7% had undergone mammography screening more than two years ago, and 5.6% had never undergone mammography screening. Logistic regression models were used to predict the likelihood of mammography use. Compared to nonveteran women, veteran women were more likely to have undergone mammography screening in the prior 2 years.

Similarly, those who have had preventive care visit had a greater likelihood of undergoing mammography screening in the prior 2 years than those who did not have preventive care visits. While having a disability and public health insurance were least likely adhere to mammography screening in the prior 2 years.

Similar to a prior study (Enewold, McGlynn, Shriver, & Zhu, 2012), veteran women from California were two times more likely to use mammography screening in the overall sample and the overweight and obese group. Higher use of mammography among veteran women in comparison to nonveteran women can be attributed to the availability of the Department of Defense's (DoD) TRICARE Prime plan for female veterans in addition to access to public and private health insurance plans (Harwood, Zhang, Dall, *Olaiya, & Fagan, 2009*). Further research is needed to ascertain the health care service usage of female veterans. This is an encouraging finding because early detection is a key to ameliorating the occurrence of breast cancer. However, this finding does not provide a reason for the higher rate of occurrence of breast cancer among veteran women (Zhu et al., 2009).

The results reported here show that predictors of mammography across groups formed by BMI categories are different from the predictors based on other variables, although some factors, such as a health care disparity, emerged as a powerful variable by ascertaining that California women who had public health insurance were less likely to have mammography screening among the overall sample, the overweight and obese group, and the normal weight group. This is in line with the results reported by prior studies (Bhanegaonkar, et al., 2012; Breen, Cronin, & Meissner, 2007), which found low use of mammography screening among women who were covered by Medicaid or Medicare. Disabled women from California were less likely to use mammography screening than women who were not disabled among the overall sample and the normal weight group. This finding is similar to the results reported in a prior study that used an international sample although the possible role of age is unclear in that study (Kung, Tsai, & Chiou, 2012). Contrary to prior studies (Borrayo et al., 2009; Hubbard, et al., 2016), possible role of age is unclear. Despite several researchers concluded racial differences in mammography screening (Bhanegaonkar, et al., 2012; Borrayo et al., 2009; Calvocoressi, et al., 2008; Enewold, McGlynn, Shriver, & Zhu, 2012; Ludman, 2010), race was not a significant predictor in this study. This finding might be due to less variation in the racial makeup of the sample of women from California. Similar to Enewold, McGlynn, Shriver, & Zhu (2012), this study is consistent in reporting a lack of association between marital status and mammography screening. The results have important implications for hospitals and health care policy targeting four groups, California women who are obese or overweight, who have public health insurance, who are veterans, and who are disabled. The study results will also be relevant to medical social work and health care professionals. First, the study results will empower VAMCs and hospitals in California to take a fresh look at their outreach efforts, preventive health interventions across BMI categories, and obesity management strategies and guidelines (Ryan & Kahan, 2018). Further exploration will confirm the efforts put forth by VAMCs, if any, to increase the compliance of obese women by designing outreach efforts and public health educational interventions to be held by hospital social workers to achieve an optimal use of mammography screening among women with a high BMI. There is a need to develop outreach efforts combined with educational initiatives, as discussed by several authors (For e.g., Davis, et al., 2014), to reach and engage Californians who are covered by Medicaid, Medicare or other public health insurances and who are disabled to enhance their use of mammography screening to be in line with their peers. Second, the study results will empower the Council on Social Work Education (CSWE) and schools of social work to infuse the curriculum, on topics relevant to integrated health to improve patient self-efficacy using mindfulness counseling (Whitebird et al., 2018) to prepare social workers to serve women with diverse needs and risks in preventive health care settings. Such curriculum will offer personally responsive emotional support (Morgan et al., 2017) as mentioned in the disease management literature. Third, the study results will help health care professionals to develop an integrated model focusing on the intellectual capital of women to bring about the desired changes in breast cancer screening, with the goal of achieving 100% mammography screening rate among women aged above 40 years. Focusing on the patient resiliency and the cognitive processing will strengthen positivity and self-efficacy (Tabernero, 2017) in preventive care management.

Strengths, Limitations, and Future Research

The strengths of this research are its use of the 2015 California Health Interview Survey Data, which boasts a robust data to examine cancer-screening behavior. Next, the CHIS offered a large community sample including various types of groups based on veteran status and BMI. Other strengths are that the sample's use of mammography screening was recent, within a two-year period, which might have minimized the reporting error of the dependent variable.

The simple nature of these variables addressing current cancer screening behavior might have prevented a misinterpretation of the variables by the study participants. The use of multivariate and bivariate analyses offered important interpretations that are comparable to prior research.

Despite the use of a large database, some limitations can be noted. First, the main concern of this study is its use of modifiable risk factors such as health disparity and lifestyle variables that have been measured through self-reporting, which is exposed to recall bias. Second, a disparity in the number of veteran and non-veteran women to some extent might have affected the study results, which -- on the other hand – could be limited because only a third of the study sample was veteran women. Third, this study considered the use of mammogram screening in the prior two years as the most important phenomena in the breast cancer prevention, but it may not be the only phenomenon when it comes to breast cancer screening. The use of mammography screening in the prior two years was not essentially at a VAMC, as the study used a community sample. The reports of the community sample were not verified using the hospital data. Using hospital data might have addressed these limitations, as it might have given access to several health disparity and health condition variables. Exploration of these variables in the future will help the researchers explain the complex phenomenon of mammography screening. Fourth, the study limited its analysis by stratifying the results according to BMI categories. Preferably, a future research study correlating various BMI variables might highlight the power of BMI in determining the mammography screening. Obesity could be deterring mammography screening, as obesity is a chronic disease whose incidence is accelerating rapidly in the U.S., leading to health inequalities (Pozza & Isidori, 2018) and escalating health care costs (Biener, Cawley, & Meyerhoefer, 2017). Finally, it is feasible that other factors that are not studied in this study might partly explain mammography usage.

Conclusion

A health care disparity of this nature will help the profession to strengthen its focus on preventive health, specifically mammography screening. Identifying groups with distinct patterns of preventive medical care use adds vital information to existing risk-assessment models and resiliency-based preventive care management similar to disease management (Morgan et al., 2017). However, the findings can be generalized only to women with similar demographic characteristics. In conclusion, the model, combining veteran status and modifiable and non-modifiable risk factors, is valuable in stratifying women who are less likely to undergo mammography screening, which can be applied to individualizing patient self-efficacy and mindfulness health counseling, developing a customized plan for preventive care management, and offering individualized screening recommendations.

References

American Cancer Society (2017a). California at a Glance 2017. Available at https://cancerstatisticscenter.cancer.org/#/cancer-site/Breast

Atkin, E., Madhavan, S., LeMasters, T., et al. (2013). Are obese women more likely to participate in a mobile mammography program? *Journal of Community Health, 38*(2), 338-348.

Bhanegaonkar, A., Madhavan, S. S., Khanna, R., & Remick, S. C. (2012). Declining Mammography Screening in a State Medicaid Fee-For-Service Program: 1999-2008. *Journal of Women's Health, 21*(8), 821-829.

Biener, A., Cawley, J., & Meyerhoefer, C. (2017). The high and rising costs of obesity to the US health care system. *Journal of General Internal Medicine, 32*, S6-S8.

Borrayo, E. A., Hines, L., Byers, T., Risendal, B., Slattery, M. L., Sweeney, C., & Giuliano, A. (2009). Characteristics associated with mammography screening among both Hispanic and Non-Hispanic White women. *Journal of Women's Health, 18*(10), 1585-1894.

Breen, N., Cronin, K., & Meissner, H. I (2007). Reported drop in mammography: Is this cause for concern? Cancer, 109, 2405-2409.

California Health Interview Survey (2015a). 2015 Methodology Report Series: Report 1- Sample Design. Los Angeles, CA: UCLA Center for Health Policy Research. Available at: http://healthpolicy.ucla.edu/chis/design/Documents/chis-2015-short-methodology-report-1_sampling_2017-08-17.pdf

California Health Interview Survey (2015b). 2015 Methodology Report Series: Report 2- Data Collection. Los Angeles, CA: UCLA Center for Health Policy Research. Available at: http://healthpolicy.ucla.edu/chis/design/Documents/chis-2015-short-methodology-report-2_data-collection_2017-08-17.pdf

California Health Interview Survey (2015c). What is new and notable in 2015. Los Angeles, CA: UCLA Center for Health Policy Research. Available at: http://healthpolicy.ucla.edu/chis/design/Documents/whats-new-chis-2015.pdf

California Health Interview Survey (2015d). CHIS 2015 Adult Questionnaire, Los Angeles, CA: UCLA Center for Health Policy Research. Available athttp://healthpolicy.ucla.edu/chis/design/Documents/_CHIS2015AdultQuestionnaire.pdf

Calvocoressi, L., Sun, A., Kasl, S. V., Claus, E. B., & Jones, B. A. (2008). Mammography Screening of Women in their 40s, *Cancer, 112*(3), 473-480.

Davis, T., Rademaker, A., Bennett, C., Wolf, M., Carias, E., Reynolds, C., Liu, D., & Arnold, C. (2014). Improving Mammography Screening Among the Medically Underserved. *Journal of General Internal Medicine, 29*(4), 628-635.

Enewold, L., McGlynn, K. A., Shriver, C., Zhu, K. (2012). Mammography Screening by Race/Ethnicity among U.S. Servicewomen, 2009-2010. *Military Medicine, 177*(12), 1513-1518.

Kung, P., Tsai, W-C., & Chiou, S-J. (2012). The assessment of the likelihood of mammography usage with relevant factors among women with disabilities. *Research in Developmental Disabilities, 33*(1), 136-143.

Harwood, H. J., Zhang, Y., Dall, T. M., *Olaiya, S. T., & Fagan, N. K. (2009).* Economic implications of reduced binge drinking among the military health system's TRICARE prime plan beneficiaries. *Military Medicine, 174*, pp. 728-736.

Howlander N, Noone AM, Krapcho M, et al. (2016). SEER Cancer Statistics Review, 1975–2013. Bethesda, MD: National Cancer Institute.

Hubbard., R. A., O'Meara, E. S., Henderson, L. M., Hill, D., Braithwaite, D., Haas, J. S., Lee, C. I., Sprague, B. L., Alford-Teaster, J., Tosteson, A. N. A., Wernli, K. J., Onega, T., & O'Meara, E. S. (2016). Multilevel factors associated with long-term adherence to screening mammography in older women in the U.S. *Preventive Medicine, 89*, 169-177.

Littman, A. J., Koepsell, T. D., Forsberg, C. W., Boyko, E. J., & Yancy, W. S. (2011). Preventive care in relation to obesity: An analysis of a large, national survey. *American Journal of Preventive Medicine,* 415, 465-472.

Ludman, E. J. Ichikawa, L. E., Simon, G. E., Rohde, P., Arterburn, D., Operskalski, B. H., & Jeffery, R. W. (2010). Breast and cervical cancer screening: Specific effects of depression and obesity. *American Journal of Preventive Medicine, 38*(3), 303-310.

Mandelblatt, J., van Ravesteyn, N., Schechtern, C., Chang, Y., Huang, A-T., Near, A. M., Koning, H. d., & Jemal, A. (2013). Which strategies reduce breast cancer mortality most? *Collaborative modeling of optimal screening, treatment, and obesity prevention. Cancer, 119* (14), 2541-2548. http://onlinelibrary.wiley.com/doi/10.1002/cncr.28087/full

Morgan, H. M., Entwistle, V. A., Cribb, A., Christmas, S., Owens, J., Skea, Z. C., & Watt, I. S. (2017). We need to talk about purpose: a critical interpretive synthesis of health and social care professionals' approaches to self-management support for people with long-term conditions. *Health Expectations, 20*(2), 243-259.

National Center for Health Promotion & Disease Prevention (NCP) (2007). Department of Veterans Affairs Preventive services included within National Performance Measures FY 2007. http://www.prevention.va.gov/docs/FY2007PreventiveServicesPMFY07.doc

Nelson, H. D., Tyne, K., Naik, A., Bougatsos, C., Chan, B. K., Humphrey, L. (2009). Screening for Breast Cancer: An update for the U. S. Preventive Services Task Force. *Annals of Internal Medicine. 151*(10), 727-737.

Oeffinger, K., et al. (2015). Breast Cancer Screening for Women at Average Risk: 2015 Guideline Update from the American Cancer Society. *JAMA: Journal of the American Medical Association, 314*(15), 1566-1614.

Pozza, C., & Isidori, A. M. (2018). What's Behind the Obesity Epidemic. In *Imaging in Bariatric Surgery* (pp. 1-8). Springer, Cham.

Ryan, D. H., & Kahan, S. (2018). Guideline Recommendations for Obesity Management. *Medical Clinics of North America*, *102*(1), 49-63.

Siegel R. L., Miller K. D., & Jemal A (2017). *Cancer statistics, 2017. CA: A Cancer Journal for Clinicians, 67*, 7-30.

Tabernero, C. (2017). Comparative Study of Positivity and Self-Efficacy for the Regulation of Negative Emotions in Persons with and without Cardiovascular Disease. *EC Psychology and Psychiatry*, *4*, 247-263.

U.S. Preventive Services Task Force (2007). Screening for breast cancer: recommendations and rationale. http://www.ahrq.gov/clinic/3rduspstf/breastcancer/brcanrr.htm .

Zhu, K., Devesa, S. S., Wu, H., Zahm, S. H., Jatoi, I., Anderson, W. F., Peoples, G. E., Maxwell, L. G., Granger, E., Potter, J. F., and McGlynn, K. A. (2009). Cancer incidence in the U. S. Millitary Population Rates from the SEER Program. Cancer Epidemiology, Biomarkers and Prevention, 18(6), 1740 –1745.