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Association between employer-based health promotion programs and adherence to breast cancer screening in Texas

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ABSTRACT

Breast cancer is the most common cancer diagnosed among women in Texas. Although adherence to recommended screening mammogram guidelines enables early detection and reduces breast cancer risks, screening mammogram adherence is low in Texas. With the rising percentage of women in the workforce, employer-based health promotion programs could be an effective measure in increasing mammogram adherence, thereby reducing breast cancer risk in Texas. Although employer-based health programs are common in the state, little is known about their effectiveness in increasing screening mammogram adherence among age-eligible employed females. The study survey was administered using Qualtrics and the study participants were representative of the Texas population. The study population included 318 females from Texas who were 50–74 years old. Among those who had access to employer-based health promotion programs, 65.4 % were adherent and 34.6 % were non-adherent to the guidelines. Population-weighted survey logistic regression analysis showed no significant association between access to employer-based health promotion programs and mammogram adherence for employed women (AOR: 0.85 [0.15–4.79], p-value = 0.86). However, access to healthcare coverage (AOR: 7.58 [2.89–19.88], p-value < 0.001), those who disagree with the fatalistic belief that everything causes cancer (AOR: 2.99 [1.45–6.19], p-value < 0.001), and those who perceive cancer screening important (AOR: 12.36 [2.26–67.47], p < 0.05) were found as significant determinants of mammogram adherence among females in Texas. The study concluded that access to employer-based health promotion programs alone was insufficient to improve breast cancer screening. The employers and the insurance companies, with support from the government, should develop a comprehensive program that addresses all structural and psychosocial barriers to employee breast cancer screening adherence.

1. Introduction

Breast cancer is the second most commonly diagnosed cancer in the U.S.A, however, in Texas, it is the most frequently diagnosed cancer among women (CDC, 2022a; Texas Cancer Registry, 2022). The estimated number of new cases in 2022 will be 19,921, and the estimated number of deaths will be 3,415 (Texas Cancer Registry, 2022). The risk of breast cancer increases with age and BMI, a history of cancer in the family, early menarche, or late menopause (CDC, 2022b). Although the breast cancer risks of all racial/ethnic groups are positively associated with high socioeconomic status (SES), its relationship with low SES is modified by factors of social determinants of health over the life course of a woman (Williams, Mohammed, & Shields, 2016; Yin, et al., 2010). However, the risk of breast cancer can be reduced by adherence to screening guidelines, follow-up of abnormal screening outcomes, and a healthy lifestyle (Pagan, et al., 2012). As a breast cancer preventative measure, U.S. Preventative Services Task Force (USPSTF) recommends biennial screening mammograms for women aged 50 to 74 years (Siu, 2016). Most U.S. health insurance allows full coverage of screening mammograms every one or two years for women beginning at age 40 and in the absence of insurance, there are government-sponsored programs that offer free or low-cost mammograms (CDC, 2022c).

Despite recommendations, the adherence to mammograms of age-eligible women in Texas is low. According to BRFSS 2018 data, 74.9

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% of women in Texas aged 50–74 years were adherent to breast cancer screening guidelines (Texas Cancer Registry, 2022). Texas screening mammogram adherence rate in 2018 was not only lower than the Healthy People 2020 target of 81.1 %, but it was also lower than the national average of 78.8 % (Texas Cancer Registry, 2022; Office of Disease Prevention and Health Promotion, 2022). Breast cancer screening adherence varies by access to healthcare coverage, race/ethnicity, income, geographical location, acculturation, family history, psychosocial barriers, and behavioral risks (Liu, Zhang, & Du, 2016; Hirth, Laz, Rahman, & Berenson, 2016; Jerome-Demilia, 2015; Pagan, et al., 2012; Sarma, 2015). In Texas, Non-Hispanic Blacks (NHB) have the highest breast cancer screening prevalence, followed by Non-Hispanic Whites (NHW) and Hispanics (Texas Cancer Registry, 2022). Moreover, in Texas, even among insured women, only 74.1 % of age-eligible were breast cancer screening adherent (Texas Cancer Registry, 2022).

In 2017, women constituted half of the Texas workforce. In 2017, 48 % of employed women in Texas had a job in the three of the most female-dominated occupation categories (health care support, personal care and services, and office and administrative support), which were also the lowest paying jobs in the state (Texas Comptroller of Public Accounts, 2017). With increased life expectancy and increased cost of living, recently more senior women either continued to delay retirement and stayed in the workforce, and those who were economically vulnerable returned to employment (Jagsi, et al., 2014; Pleau, 2010).

The economic burden of cancer in the United States is substantial and it is expected to increase significantly in the future because of the increase in population growth rate, life expectancy, and advancement in cancer detection and treatment (Karim et al., 2022; Yabroff, Lund, Kepka, & Mariotto, 2011). Furthermore, out-of-pocket healthcare expense is a significant concern for most cancer patients and particularly impact those with high deductible healthcare plans (Abdus & Keenan, 2018). Patients with breast cancer not only face higher out-of-pocket expenses but also have difficulty retaining employment compared to healthy controls further limiting their ability to pay medical bills (De Boer, Taskila, Ojajrvi, Van Dijk, & Verbeek, 2009). Moreover, even for women with comprehensive health insurance plans, the financial burden of breast cancer can be substantial (Arozullah, et al., 2004). Breast cancer survivors reported that medical expenses of care post-cancer diagnosis have led to treatment nonadherence and poor quality of life (Jagsi, et al., 2014; Fenn et al., 2014).

The financial burden of cancer health is levied on employers too. The loss of productivity due to absenteeism related to cancer treatment; the loss of trained workforce due to early death or early retirement due to cancer; leads to the financial burden of cancer on the employers. Furthermore, with the aging workforce and increasing cancer care costs, the impact of cancer on employers is undeniable. Moreover, chronic conditions are common among cancer survivors, which leads to additional loss of productivity for employers. (Kendall, 2012; Collins, et al., 2005).

While studying the broader implications of cancer on employees and employers, (Lawless, 2009) found that breast cancer was the most common cancer among employees undergoing treatment while continuing to work. Much research has been done on the employer cancer cost burden for employed survivors and ways to mitigate employer challenges associated with cancer cost burden. However, limited information is available on cancer prevention initiatives by employers (for fully insured, partially insured, and uninsured employees), which has the potential to reduce the cancer risk, resulting in reducing the cost burden for the employer and employees.

Cancer care cost burden could be reduced by implementing employer-based health promotion programs. These programs were proven effective in reducing health risks (such as cardiovascular disorders, adverse mental health, and obesity), improving employee health and well-being, enhancing productivity, and eventually contributing to the success of an organization (Proper and van Oostrom, 2019; Butler, Clark, Burlis, Castillo, & Racette, 2015; VanderVeur, Gilchrist, & Matson-Koffman, 2016). According to a systematic review of worksite mammogram programs in the U.S., an employer-based program focusing on education about breast cancer risk, detection, diagnosis, treatment, and mammogram at the worksite has great potential to increase early detection of breast cancer and reducing the need for expensive and invasive treatment, and reduce mortality risk (Glanz et al., 1992). With the rising share of the female workforce in Texas, it is deemed beneficial for employers to have employer-based health promotion programs focusing on breast cancer prevention. A significant number of the insured population in Texas have access to employer-based health promotion programs. However, there is a dearth of information on the effectiveness of such programs on breast cancer screening in Texas. Since breast cancer is the most frequently diagnosed cancer among women in Texas, the goal of the study was to investigate if such health promotion programs improve adherence to breast cancer screening.

Therefore, in this study, we assessed if the age-eligible employed women in Texas with employer-based health programs have higher odds of adhering to screening mammogram guidelines than employed women who do not have access to such health promotion programs. We hypothesize that on average screen eligible employed women with access to employer-based health programs are more likely to be adherent to screening mammograms than employed women who do not have access to employment-based health programs.

2. Material and methods

2.1. Study population and procedures

Data on a nonprobability sample of adult Texas residents was collected using an online health screening survey. To ensure representation, a target was set for strata by sex (50 % male and 50 % female), ethnicity/race (34 % Hispanic/Latinos, 36 % NHWs, 25 % NHBs, and 5 % Asian/other), annual household income (48 % $<$ \$50,000, 30 % \$50,000-\$99,999, and 22 % $\geq$ \$100,000), and locale (60 % urban and 40 % rural). NHBs were oversampled on purpose to increase the robustness of data for the subgroup reflecting the demographics of the state population (U.S. Census Bureau, 2015). Strata for household income were based on 2018 data for the state (Household Income in Texas, 2018). To determine urban–rural locale, respondents' ZIP codes were matched to county and county to rural/urban designations using 2018 data from the Texas Department of State Health Services (Designations, 2020; Texas, 2022). The survey was administered using Qualtrics. The study participants were representative of the Texas population. Further details of the survey participants, design, and data collection method were previously published. Informed consent was obtained and the study was approved by The University of Texas MD Anderson Cancer Center's Institutional Review Board (PA16–0724).

3. Measures

3.1. Outcome variable

The primary outcome of this study was self-reported screening mammogram adherence. It was derived from the cancer screening section of the survey, which included questions regarding screening mammogram uptake and frequency of uptake among eligible women. Two questions from the survey were used to define the outcome variable: 1) "A mammogram is an X-ray of each breast to look for breast cancer. Have you ever had a mammogram?" with a binary "yes" or "no" responses; those who responded "yes", were asked a second question (2) "How long has it been since you had your last mammogram?" The response could be either "within the past year (anytime$<$12 months ago)", "within the past 2 years", "within the past 3 years", "within the past 5 years", or "5 or more years ago". The participants were considered

adherent if they had a screening mammogram within the last two years at the time of the survey. Those who had a screening mammogram more than two years ago or never had screening mammograms were considered non-adherents.

4. Predictor variable

The primary predictor variable, namely, access to employer-based health promotion programs, was measured for employed women only using the survey question "In the past year, were health promotion programs made available to you by your employer? Examples of health promotion programs include education about weight management, smoking cessation, screening for high blood pressure, high cholesterol, or other health risks, and onsite fitness facilities or discounted gym memberships." The response options included "yes" and "no.".

5. Covariates

Our analysis was adjusted for other known predictors and covariates including access to healthcare coverage, cancer beliefs, health and behavioral risks, and demographic and socioeconomic factors.

Healthcare coverage: Access to healthcare coverage was determined using the question "Do you have any kind of healthcare coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service? The response options included "yes" and "no".

Cancer beliefs: Cancer beliefs questions in the survey were categorized to measure fatalism, perceived risk of cancer, and perceived benefits of screening. Fatalism was measured using 3 questions (1) "It seems like everything causes cancer" (2) "There's not much you can do to lower your chances of getting cancer" (3) "When I think of cancer, I automatically think of death." The responses to these questions were categorized as strongly disagree/somewhat disagree versus strongly agree/somewhat agree. Perceived risk was measured using the question "Compared to other people your age, how likely are you to get cancer in your lifetime?" The response to this question was categorized as very unlikely/unlikely, neither unlikely or likely, and likely/very likely (reference category). The perceived benefit of cancer screening was measured using the question "Please indicate how important or unimportant these cancer prevention topics/efforts are for you." The responses to the cancer screening topic were categorized as very important/somewhat important, not important, and not sure/no opinion (reference category).

Health and behavioral risks: The health risk was measured using the question "Have you ever taken hormone replacement therapy?" The response was categorized as "yes" and "no". The smoking status was categorized as current, former, and never smokers (reference category).

Trust in doctors: Trust in doctors was assessed using the question "how much would you trust information about health or medical topics from each of the following." The response to "A doctor" was categorized as some/a lot versus not at all/a little.

Additionally, demographic and socioeconomic factors including age, ethnicity/race, country of origin, education, marital status, residence (rural or urban), occupational status, and annual household income were included in the analysis of breast cancer screening adherence.

5.1. Statistical analysis

The study sample was calibrated against state demographics by ICF International, Inc (Fairfax, Virginia), using the 2015 5-year American Community Survey-Texas (United States Census Bureau, 2018). Weights were calculated using a three-dimensional ranking approach and iterative post-stratification based on sex, age, and four-category race/ethnicity (NHW, NHB, Hispanic, and other) (Mercer et al., 2018). Data was then screened to match the USPSTF eligibility criteria (Siu, 2016) to include 50–74 years old female Texan residents who do not have a history of breast cancer. We calculated mean and standard deviation for continuous variables and weighted percentages and 95% confidence interval for categorical variables. Multivariable survey logistic regression with survey weights was performed using PROC SURVEYLOGISTIC (SAS Institute Inc, 2019) to examine the relationship between breast cancer screening adherence and access to employer-based health programs (SAS Institute Inc, 2019).

6. Results

The study population included 318 females from Texas who were 50–74 years old and did not have a history of a breast cancer diagnosis. Table 1 shows weighted percentages of sociodemographic characteristics, health, behavioral risk, perceived risk, and cancer beliefs of the respondents stratified by adherence status. There were 205 women (62.4 %) adhering to USPSTF screening mammogram guidelines and 113 women (37.6 %) nonadherent to guidelines. The mean age of the study population was 58.9 years (ranging from 50 to 74 years; standard deviation of 6.42). Women adherent to the guidelines had a mean age of 57.9 years (standard deviation of 5.7), and those not adherent had a mean age of 59.6 years (standard deviation of 6.3). While 60 % employed women reported not having access to an employer-based health promotion program, among those who had access, 65.4 % were adherent and 34.6 % were non-adherent to the guidelines.

Adherence was noted higher among minorities (NHB, and Hispanic) than NHW (70.7 % among NHB, 71.0 % among Hispanics, versus 57.5 % among NHW). Adherence was higher among those with access to healthcare coverage (69.4 % adherent coverage versus 30.7 % non-adherent).

Among those who took hormone replacement therapy, 72 % were adherent and 28 % were not adherent. A greater percentage of "never smokers" were adherent (68.7 %). Among women who held the following fatalistic cancer beliefs, a higher proportion was adherent than non-adherent: "It seems like everything causes cancer" (65.7 % versus 34.3 %), "There's not much you can do to lower your chances of getting cancer" (53.8 % versus 46.2 %), and "When I think about cancer, I automatically think about death" (62.6 % versus 37.3 %). Proportionately more adherent women believed that cancer screening is important compared to non-adherent women (67.2 % versus 32.8 %). Those with the perception that "Compared to other people your age, how likely are you to get cancer in your lifetime?" had a higher percentage of adherent than non-adherent (61.7 % versus 38.8 %). A higher proportion of adherent women reported that they trust information from "a doctor" for health or medical information than nonadherent women (63.5 % versus 36.7 %). The study population was 55.1 % rural and predominantly born in the U.S.A (94.3 %).

7. Correlates of screening mammogram adherence

Table 2 shows the adjusted odds ratios (AOR), confidence intervals, and p-values of screening mammogram adherence adjusted for sociodemographic characteristics, health and behavioral risk, and cancer beliefs reported by breast cancer screening-eligible women in Texas. The survey weighted logistic regression model found that employee-based health promotion program was statistically not a significant factor for screening mammogram adherence for employed women (AOR: 0.85 [0.15–4.79], p-value = 0.86). However, as expected, the other covariates and predictors such as access to healthcare coverage and cancer beliefs were statistically significant determinants of a screening mammogram. Higher screening mammogram adherence was noted among those who have healthcare coverage (AOR: 7.58 [2.89–19.88], p-value < 0.001) versus those with no healthcare coverage. Women who "strongly disagree/somewhat disagree" that "It seems like everything causes cancer" (AOR: 2.99 [1.45–6.19], p-value < 0.001) had higher odds of being adherent to breast cancer screening guidelines compared to those who "strongly agree/somewhat agree." Women who believed

Table 1
Characteristics of respondents by adherence (N = 318).

VARIABLES	Total N	% Weighted (97 % CI)	Adherent N	% Weighted (97 % CI)	Non-adherent N	% Weighted (97 % CI)
Respondents	318	100	205	62.4	113	37.6
Employer-based health programs						
In the past year, were health promotion programs made available to you by your employer?						
No	67	60.1 (50.9–69.3)	38	55.7 (43.2–68.3)	29	44.3 (31.7–56.8)
Yes	55	39.9 (30.7–49.1)	37	65.4 (51.6–79.2)	18	34.6 (20.8–48.4)
Does your employer provide incentives to participate (in health promotion programs)?						
No	24	46.8 (32.1–61.5)	24	17 (67.4–46.7)	7.0	32.6 (11.8–53.3)
Yes	31	53.2 (38.5–67.9)	31	20 (63.6–45.2)	11.0	36.4 (18.0–54.8)
Would you be interested in these types of health promotion programs?						
No	23	35.9 (23.4–48.3)	11	45.4 (24.1–66.7)	12	54.6 (33.3–75.9)
Yes	44	64.1 (51.7–76.6)	27	61.5 (46.2–76.7)	17	38.5 (23.3–53.8)
Socio-demographic factors						
Ethnicity/Race White, non-Hispanic	139	58.9 (53.4–64.5)	80	57.5 (49.2–65.8)	59	42.5 (34.2–50.8)
Black, non-Hispanic	89	13 (10.2–15.8)	63	70.7 (61.2–82.2)	26	29.3 (19.8–38.8)
Hispanic	66	20.9 (16.3–25.4)	47	71.0 (60.0–82.1)	19	29.0 (17.9–40.0)
Others	24	7.2 (4.4–10)	15	62.8 (43.4–82.4)	9	37.2 (17.8–56.6)
Income $\leq$ $19,999	39	12.1 (8.2–16.1)	23	60.0 (43.1–76.1)	16	40.0 (23.1–56.9)
$20,000-$49,999	101	32.7 (27–38.4)	65	59.4 (48.9–69.9)	36	40.6 (30.1–51.1)
$50,000-$74,999	75	27 (21.5–32.4)	42	57.0 (45.2–68.7)	33	43.0 (31.3–54.8)
$75,000-$99,999	43	14.8 (10.5–19.2)	33	77.8 (64.5–91.1)	10	22.0 (8.9–35.5)
$\geq$ $100,000	40	13.3 (9.2–17.4)	30	67.7 (51.6–83.8)	10	32.3 (16.2–48.4)
Healthcare Coverage: No	56	17.4 (13–21.9)	20	29.2 (17.0–41.5)	36	70.8 (58.5–83)
Yes	262	82.6 (78.1–87)	185	69.4 (63.4–75.4)	77	30.7 (24.6–36.6)
Education: No greater than 12 years/ completed high school	75	33.4 (26.9–39.9)	41	55.5 (43.6–67.4)	34	44.5 (32.6–56.4)
Post-high school training /some college	22	7.9 (4.4–11.4)	18	80.2 (61.9–98.5)	4	19.8 (1.5–38.1)
College/postgraduate	145	58.7 (52.1–65.4)	95	64.8 (56.4–73.1)	50	35.2(26.9–43.6)
Occupational status: Employed	196	61.7 (56–67.4)	130	64.2 (57–71.5)	66	35.8 (28.5–43.0)
Unemployed/Homemaker/Student/Retired/Disabled/others	122	38.3 (32.6–44)	75	59.6 (50.2–68.9)	47	40.4 (31.1–49.8)
Marital status: Single/Widowed/Divorced/Separated	150	42.1 (36.4–47.9)	92	58.8 (50.1–67.5)	58	41.2 (32.5–49.5)
Living as Married/Married	168	57.9 (52.1–63.6)	113	65.1 (57.5–72.7)	55	34.9 (27.3–42.5)
Residence: Rural	144	55.1 (49.3–60.8)	87	60.0 (51.8–68.3)	57	40.0 (31.7–48.2)
Urban	174	44.9 (39.2–50.7)	118	65.4 (57.6–73.1)	56	34.6 (26.9–42.4)
Born in U.S.A: No	19	5.7 (3.1–8.3)	15	78.4 (59.4–97.4)	4	21.61 (2.6–40.6)
Yes	299	94.3 (91.7–96.9)	190	61.5 (55.5–67.4)	109	38.5 (32.6–44.5)
Health and Behavioral Risks						
Hormone replacement therapy: No	231	70.9 (65.4–76.3)	142	58.5 (51.6–65.4)	89	41.5 (34.6–48.4)
Yes	87	29.1 (23.7–34.6)	63	72.0 (62.1–82.0)	24	28.0 (18.0–37.9)
Smoking Status: Never	193	58.6 (52.8–64.5)	136	68.7 (61.6–75.8)	57	31.3 (24.2–38.4)
Former	79	26.7 (21.4–32)	45	55.3 (43.7–66.9)	34	44.7 (33.1–56.3)
Current	45	14.6 (10.4–18.8)	23	49.3 (33.6–65.0)	22	50.7 (35.0–66.4)
Perceived risks and beliefs about cancer						
Fatalism:						
It seems like everything causes cancer						
Strongly disagree/Somewhat disagree	87	26.1 (21–31.2)	47	53.2 (42.0–64.5)	40	46.8 (35.5–58.0)
Strongly agree/Somewhat agree	231	73.9 (68.8–79)	158	65.7 (59.1–72.3)	73	34.3 (27.7–40.9)
There's not much you can do to lower your chances of getting cancer						
Strongly disagree/Somewhat disagree	219	67.9 (62.3–73.4)	149	66.5 (59.7–73.3)	70	33.5 (26.7–40.3)
Strongly agree/Somewhat agree	99	32.1 (26.6–37.7)	56	53.8 (43.3–64.2)	43	46.2 (35.8–56.6)
When I think about cancer, I automatically think about death						
Strongly disagree/Somewhat disagree	126	39.2 (33.4–44.9)	81	62.1 (52.9–71.3)	45	37.9 (28.7–47.1)
Strongly agree/Somewhat agree	192	60.8 (55.1–66.6)	124	62.6 (55.3–70.0)	68	37.3 (30.0–44.7)
Perceived benefits of cancer screening:						
Importance of Cancer Screening						
Not important	15	5.8 (2.9–8.7)	2	14.6 (0.0–33.4)	13	85.3 (66.6–100)
Not sure/no opinion	9	3.2 (1.1–5.3)	1	12.8 (0.0–36.2)	8	87.2 (63.8–100)
Very/Somewhat important	294	91 (87.5–94.6)	202	67.2 (61.4–73)	92	32.8 (27.0–38.5)
Perceived risk of cancer:						
Compared to other people your age, how likely are you to get cancer in your lifetime?						
Very likely/Likely	62	20.9 (16–25.7)	38	61.7 (48.9–74.5)	24	38.8 (25.5–51.1)
Very unlikely/Unlikely	71	20.7 (16–25.4)	45	58.2 (45.6–70.8)	26	41.8 (29.2–54.4)
Neither unlikely or likely	184	58.4 (52.6–64.2)	122	64.7 (57.2–72.1)	62	35.3 (27.9–42.8)
Trust in doctor:						
How much would you trust information about health or medical topics from each of the following:						
Trusts a doctor for medical or health information						
Not at all or a little	18	5.4 (2.8–8)	9	48.1 (23.5–72.8)	9	51.85 (27.2–76.5)
Some or A lot	300	94.6 (92–97.2)	196	63.5 (57.4–69.1)	104	36.7 (30.9–42.6)
Trusts family or friends for medical information						
Not at all or a little	138	43.7 (37.8–49.5)	90	62.5 (53.8–71.3)	48	37.5 (28.7–46.2)
Some or A lot	180	56.3 (50.5–62.2)	115	62.4 (54.8–70.0)	65	37.6 (30–45.2)

Table 2
Multilevel survey logistics regression model identifying factors affecting breast cancer screening adherence.

VARIABLE	Adjusted Odds Ratio (95 % CI)	p-value
Employer-based Health Promotion		
In the past year, were health promotion programs made available to you by your employer?		
No	0.85 (0.15–4.79)	0.86
Yes	Reference	NA
Does your employer provide incentives to participate (in health promotion programs)?		
No	1.49 (0.28–7.79)	0.64
Yes	Reference	NA
Would you be interested in these types of health promotion programs?		
No	1.42 (0.35–5.79)	0.62
Yes	Reference	NA
Health care coverage		
yes	7.58 (2.89–19.88)	<0.001
No	Reference	NA
Perceived risks and beliefs on cancer		
It seems like everything causes cancer		
Strongly disagree/Somewhat disagree	2.99 (1.45–6.19)	<0.001
Strongly agree/Somewhat agree	Reference	NA
There's not much you can do to lower your chances of getting cancer		
Strongly disagree/Somewhat disagree	0.53 (0.25–1.13)	0.10
Strongly agree/Somewhat agree	Reference	NA
When I think about cancer, I automatically think about death		
Strongly disagree/Somewhat disagree	0.78 (0.39–1.55)	0.48
Strongly agree/Somewhat agree	Reference	NA
Importance of Cancer Screening		
Very important/somewhat important	12.36 (2.26–67.47)	<0.05
Not sure/no opinion	2.02 (0.11–37.307)	0.64
Not important	Reference	NA
Compared to other people your age, how likely are you to get cancer in your lifetime?		
Very unlikely/unlikely	1.12 (0.40–3.70)	0.73
Neither likely/neither unlikely	1.44 (0.60–3.42)	0.41
Very likely	Reference	NA
Trust doctors for medical information		
Some/a lot	2.41 (0.62–9.4)	0.20
Not at all/little	Reference	NA
Trust family or friends for medical information		
Some/a lot	0.88 (0.46–1.69)	0.71
Not at all/ little	Reference	NA
Socio-demographic factors		
Ethnicity/Race		
Hispanic	2.50 (0.90–6.95)	0.08
Non-Hispanic Black	2.36 (0.79–6.96)	0.11
Others	1.27 (0.26–6.31)	0.77
Non-Hispanic White	Reference	NA
Income		
$20,000-$49,999	0.62 (0.21–1.84)	0.39
$50,000-$74,999	0.44 (0.13–1.51)	0.19
$75,000-$99,999	1.00(0.26–3.87)	1.00
≥ $100,000	0.43 (0.11–1.64)	0.21
<$20,000	Reference	NA
Marital status		
Living as Married/Married	1.42 (0.7–2.9)	0.33
Single/Widowed/Divorced/Separated	Reference	NA
Residency		
Rural	1.23 (0.52–2.94)	0.63
Urban	Reference	NA
Born in USA		
Yes	3.22 (0.37–28.09)	0.29
No	Reference	NA
Occupational status		
Employed	0.50 (0.14–1.82)	0.29
Unemployed/Homemaker/Student/Retired/ Disabled/others	Reference	NA
Health and behavioral risks		
Smoking		
Former smoker	0.63 (0.29–1.34)	0.23
Current smoker	0.46 (0.16–1.3)	0.15
Never Smoked	Reference	NA
Underwent hormone replacement therapy		
Yes	1.65 (0.82–3.33)	0.12
No	Reference	NA

that cancer screening is "very important/somewhat important" (AOR: 12.36 [2.26–67.47], $p < 0.05$) had higher odds of being adherent to breast cancer screening guidelines compared to those who responded cancer screening was not important".

Other factors such as income level, education, race, residency, marital status, place of birth, behavioral risks of smoking tobacco and health risks of undergoing hormone therapy, and psychosocial factors such as "trust doctors for medical information", "there's not much you can do to lower your chances of getting cancer", "When I think about cancer, I automatically think about death" were not statistically significant factors of breast cancer screening adherence.

8. Discussion

In Texas, breast cancer is the most commonly diagnosed cancer among women and it is the second largest factor accountable for cancer-related mortality (Texas Cancer Registry, 2022). In this representative sample of the Texas population of screening-eligible women, factors contributing to breast cancer screening adherence were assessed. To the best of our knowledge, this is the first study in Texas to assess the effect of employer-based health programs on breast cancer screening adherence among employed women. Since employer-based health promotion interventions were found effective in reducing health risks in different areas such as obesity, nutrition, mental health, cardiovascular, and musculoskeletal disorders, we hypothesized that screen-eligible women with access to employer-based health programs would be more adherent to screening mammograms than screen eligible women who do not have access to employer-based health program (Proper and van Oostrom, 2019; Butler, Clark, Burlis, Castillo, & Racette, 2015; Cheon, Naufal, & Kash, 2020; Wilkinson, Dave, Ozdemir, Rodriguez, & Reininger, 2020). However, the study results did not indicate a significant association between access to employer-based health promotion programs and screening mammogram adherence, after adjusting for income, race, residency, place of birth, marital status, occupational status, access to healthcare coverage, health and behavioral risks, and cancer beliefs. The lack of association between employer-based health-promotion programs and breast cancer screening adherence among employed women in the study indicates the absence of breast cancer screening information and/or support that is needed to adhere to screening mammogram guidelines. It indicates a missed opportunity to reduce breast cancer risk, the second leading cause of cancer deaths among women in Texas (Texas Cancer Registry, 2022). Since employer-based health programs have proven effective in improving health behavior and the female employees avail to them, so tailoring these programs to enhance breast cancer screening will reduce the breast cancer burden.

The current study found access to healthcare coverage to be a significant determinant of mammogram adherence in the study. The finding is consistent with other studies (Hirth, Laz, Rahman, & Berenson, 2016; Sarma, 2015). We also found cancer beliefs to be significant determinants of mammogram adherence. We found that adherent women are more likely not to harbor fatalistic cancer belief, "It seems like everything causes cancer". The finding reflected that people with higher knowledge of cancer and cancer prevention are less likely to hold fatalistic cancer beliefs than those with a low level of cancer-based knowledge, which is consistent with other study findings (Espinosa de Los Monteros and Gallo, 2011; Molaei-Zardanjan, Savabi-Esfahani, &

Taleghani, 2019). The finding indicated the need for tailored education addressing fatalism to improve mammogram adherence. We also found that the perceived benefit of cancer screening was a significant positive determinant of mammogram adherence, which is also consistent with other studies (Stein, Fox, Murata, & Morishky, 1992; Ritchie, Van Den Brouke, & Van Hal, 2021).

We found that race/ethnicity, marital status, residency (rural/urban locale), and place of birth were not significant, especially when adjusted for other demographic variables such as access to healthcare coverage and income. These findings were consistent with other studies (Hirth, Laz, Rahman, & Berenson, 2016; Wilcox, et al., 2016). Since healthcare coverage and cancer beliefs are strongly associated with mammogram adherence in our study, adjusting to these factors attenuated the effect of ethnicity, marital status, and residency on mammogram adherence. According to the literature, the effect of ethnicity on mammogram adherence has reduced because access to health care coverage was a stronger determinant of mammograms for low-income women (irrespective of ethnicity) and the Patient Protection and Affordable Care Act has significantly contributed to increasing screening rates among racial/ethnic minorities that historically had very low adherence (Jerome-Demilia, 2015; De Alba, Hubbell, McMullin, Sweningson, & Saitz, 2005; Agirdas and Holding, 2018). Consistent with other studies, residency (rural–urban locale) was not a significant factor in mammogram adherence in the current study (Shete, et al., 2021). Since mammogram is a geographically well-dispersed medical intervention in the United States, access to mammogram facilities is relatively better than other cancer prevention measures such as colorectal cancer screening (Shete, et al., 2021).

Low uptake of breast cancer screening is often associated with risky health behaviors such as smoking (Shete, et al., 2021; Rakowski et al., 2005). However, smoking status did not have any significant impact on mammogram adherence among employed women in our study.

Importantly, our study findings suggest that by simply offering health promotion programs may not be enough and such programs need to be more comprehensive. According to a study by (Glanz et al., 1992), worksite mammogram programs reduced the healthcare access barrier, but providing access to healthcare alone did not increase mammogram acceptability. In the study, authors found that women would be more accepting of mammogram utilization when a variety of individual factors (such as breast cancer knowledge, attitudes, and beliefs), environmental influences (onsite mammogram, company's health culture; access to culturally tailored health programs), healthcare system factors (physician recommendation for screening), and employer factors (employers attitudes towards cancer prevention, ability to avail health programs) were addressed. (Henke, et al., 2013) studied a program called *CEO's Cancer Gold Standard Program*, which offers guidelines for companies interested in cancer prevention, early detection, and access to the best available care for their employees and their dependents. In the study, they found that when Johnson and Johnson adopted the program, in addition to providing 100 % coverage of preventative health screenings, the company encouraged screening also by providing a monetary incentive to both employee and their dependents. Employees had direct access to cancer prevention information, received help to schedule screening, and had on-site mammogram services. Using this program Johnson and Johnson increased breast cancer screening adherence.

Having an onsite mobile mammogram along with a healthcare provider was particularly effective for women who were ethnic minorities, low-income, uninsured, and those who were geographically isolated (especially the elderly) (Trivedi, et al., 2022; Guillame, et al., 2017; Vyas, et al., 2012). Moreover, system-level interventions for the cue to actions such as regular reminders (verbal, printed, or digital) from primary care physicians or OB/GYN, insurance companies, and the employer could be used as they were proven effective in improving adherence (Baron, et al., 2008).

Culturally tailored work-based educational programs were found effective in improving cancer prevention knowledge and breast cancer screening adherence. While studying the effect of employer-based cancer education/screening on cancer knowledge and screening adherence of Latinas working in service and manual labor companies, (Warner, et al., 2019) found that the program was more effective when the screening program was done in collaboration with *Promotora* or community health workers. *Promotoras* are community health workers whose cultural familiarity and personal ties in the network have a significant impact on cancer screening uptake, especially in minority communities (Luque et al., 2019; Savas, Heredia, Coan, & Fernandez, 2018). To increase the effectiveness of employer-based health promotion programs, the culture of health promotion needs to be embraced and demonstrated by the organizational leaders through their behavior and communication to have a companywide impact (Kent, Goetzel, Roemer, Prasad, & Freundlich, 2016).

Financial incentives help encourage employee participation in health promotion programs (Stein et al., 2000; Poole, Kumpfer, & Pett, 2001). The incentive could be provided either by the employer or by the insurance companies either through direct rewards such as healthy food/beverage coupons, free digital recipes, and access to Gym, or through indirect rewards such as reward points from insurance companies towards improved preventive measure adherence scores that would culminate into reduced out of pocket costs for future treatment or doctor visit.

Therefore, as a potential proposed intervention, employers should design comprehensive health promotion programs towards breast cancer screening adherence and other cancer prevention guidelines in collaboration with insurance companies. To improve breast cancer screening outcomes, access to healthcare coverage, financial incentives for adherence, client-based reminders, culturally tailored educational interventions, and if needed onsite mammography along with a healthcare provider is recommended. Breast cancer is one of the most pressing issues in the state of Texas, and it is important that employers realize the missed opportunity and work towards developing a tailored intervention for employed females, so that the risk of breast cancer burden decreases.

The study has some limitations. The data were self-reported, so there is a possibility of recall and social desirability bias. Moreover, the data were collected through a cross-sectional survey so causality cannot be deduced from this data. The study findings are not applicable for foreign-born population because 94 % of the participants were native-born.

9. Conclusion

With the rising female workforce and alarming breast cancer incidence, comprehensive employer-based health promotion program focusing on breast cancer prevention is much needed in the state of Texas. We call for endeavors where employers and insurance companies with the support of the state, develop comprehensive health promotion programs to reduce cancer risk.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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