Do Caregiving Hours Impact on Female Caregivers’ Receipt of Mammogram?: A Comparison with Non-Caregivers

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Abstract

Background caregiving responsibilities significantly impact females’ decisions on adhering to preventive mammography. The purpose of this study is to examine (1) the levels of Mammogram receipt, (2) the role of caregiving factors on the receipt of mammogram in caregiving group, and (3) the role of cancer beliefs on Mammogram screening in caregivers and non-caregivers. Methods the 2017 Health Information National Trends Survey (HINTS) provides samples of 1228 women aged 40 to 75 years old for this secondary analysis. By using Andersen's Behavioral Model of Health Services Use, a binomial logistic regression model was used to analyze associations between mammography and socioeconomic factors, caregiving factors, and cancer belief factors. Results caregivers who provided more hours of caregiving per week (OR=0.749, 95% CI=0.564-0.94) and caregivers who had the belief of rather not know the likelihood of getting cancer (OR=0.673, 95% CI=0.496-0.914) were less likely to use mammogram. However, caregivers who believed cancer is more common than heart disease (OR=1.490, 95% CI=1.302-2.151) were more likely to use mammogram. Non-caregivers who worried about getting cancer (OR=1.158, 95% CI=0.793-1.691) were more likely to use mammogram, but non-caregivers who had the belief of rather not know the likelihood of getting cancer (OR=0.825, 95% CI=0.713-0.955) were less likely to use mammogram. Conclusions to support caregivers’ breast cancer prevention, caregiving-related policies based on caregiving hours should be developed. Particularly, effort to promote breast cancer screening education and care support among older primary caregivers will likely increase their adherence to preventive mammography uptake. Development of targeted cancer prevention interventions on specific cancer beliefs held by both groups are also urgently needed to promote mammography.

Introduction

Breast cancer is the most common cancer, and the second leading cause of cancer death among U.S. women [1]. After a period of declining (1999–2004), the incidence rate of breast cancer has slightly increased (0.4%) in recent years (2004–2014); however, the mortality rate of breast cancer has declined significantly (39%) over the past decades [1]. In 2019, an estimated 268,600 new cases of invasive breast cancer and 62,930 new cases of non-invasive breast cancer are expected to be diagnosed in women in the U.S.; also an estimated 41,760 women are expected to die from breast cancer [2].

Previous evidence suggest that the decrease of incidence and mortality rate were partially due to the extensive use of preventive mammograms, which offer opportunities for early detection and treatment of breast cancer [3, 4]. The latest American Cancer Society breast cancer screening guidelines recommend that “all women should begin having yearly mammograms by age 45, and can change to having mammograms every other year beginning at age 55” [5]. However, getting recommended mammograms is one of the unmet health care among female caregivers [6]. Approximately, 23.5% of female caregivers never received a mammogram particularly, female caregivers have significantly lower odds of the receiving mammography [7, 8]. Notably, little knowledge is available on the associations among hours of caregiving, cancer beliefs, and female caregiver’s mammogram screening behavior.
Andersen’s Behavioral Model of Health Services Use is a leading model for analyzing the use of cancer prevention services. The conceptual model categorizes factors into three dynamics: predisposing factors, enabling factors, and need factors [9]. Predisposing factors are characteristics including demographics (e.g., age and gender), social structure (e.g., education, occupation, and ethnicity), and health beliefs (e.g., attitudes, values, and knowledge about health and health services) [9]. Significant age-related trends in mammogram use were observed [3, 10, 11, 12]. Previous studies generally reported that, after the age of 45 and particularly 65 to 75, older women are less likely than younger women to have mammograms [10, 13]. In addition, Burg and her colleagues suggested that receipt of mammogram improved with higher levels of education [13, 14]. However, other studies reveal no significant association between education and mammogram uptake [15]. Cancer beliefs play a critical role in using mammograms. A lack of knowledge regarding breast cancer and cancer screenings is a primary barrier for using mammograms, as suggested by previous studies [16, 17, 18, 19, 20]. Women’s perceived risk of breast cancer is positively associated with mammograms use [21].

Enabling factors include personal, family, and community resources that are necessary when using health care services, such as income, insurance coverage, medical care providers, and types of health service organizations in the community [9]. The financial matter is an aspect impacting mammography recipient. Women without insurance coverage, and women with low-income have an increased risk for late-stage breast cancer diagnosis due to lower mammography screening rates [22]. A recent study found that doctor recommendation and perceived barriers are predictors for both low- and high-income women’s usage of mammography [23].

Regarding caregiving factors, caregiver burden is an identified barrier for mammography screening [24]. Generally, caregivers who have caregiver procrastination and high burden have less frequent breast examinations [24]; however, another study found no significant association (Kim et al., 2004). Caregivers of people with chronic conditions (e.g., dementia) perceive a significantly greater caregiving burden, more mental health concerns (e.g., depression, anxiety, or hostility), and less preventive health care use than caregivers of other diseases [25]. However, caregivers of cancer patients have an increased likelihood of receiving cancer preventive screenings, including mammogram [26, 27]. Increase of likelihood may be due to the high supply of cancer information from medical professionals, leading to increased awareness of preventive screenings [27].

Need factors refer to the measured individual perceived need for using health care services including having chronic diseases or having poor health status [9]. People who have family cancer history and cancer survivals have increased odds in receiving mammograms [21, 28, 29]. Furthermore, the utilization rate of mammography is higher among women with family or personal breast cancer history than the general population of women [30, 31, 32, 33]. However, one study proposed that about a quarter of breast cancer survivors still underused annual surveillance mammography [28]. Additionally, women with comorbid health conditions have a greater likelihood of using mammograms due to increase in contact with health care provider [34]. In addition, depression is a risk factor for mammography underuse [35].
Women who are depressed are less likely to receive screening, and female caregivers are at risk of underuse due to the heavy caregiver burden [35, 36, 37].

By using the Behavioral Model of Health Services Use, our study compared mammogram screening behaviors between caregivers and non-caregivers to examine (1) the levels of mammogram receipt, (2) the role of caregiving factors, and (3) the role of cancer beliefs on mammogram screening of caregivers and non-caregivers. The hypotheses were:

1 The likelihood of using mammogram would be associated with predisposing factors (age, education, beliefs about cancer).

2 The likelihood of using mammogram would be associated with enabling factors (income, confident about getting health information, number of people under caregiver's caregiving, caregiving hours per week, care receiver's cancer, care receiver's chronic illness).

3 The likelihood of using mammogram would be associated with need factors (general health, depression, ever had cancer, family ever had cancer).

Methods

Research Design and Data Source

This study analyzed data from the 2017 Health Information National Trends Survey (HINTS). HINTS 5's Cycle 1 (2017) data were collected from January to May, and a single-mode mail survey was generated. The original sample included 3,285 respondents, but our study sample was 1,228 by only including women aged 40 to 75 years. The sample was categorized into two subgroups: caregivers and non-caregivers. Overall, the sample consisted of 277 caregiving women and 951 non-caregiving women aged 40 to 75 years. More details about the development of HINTS have been reported elsewhere [38].

Measurement

Dependent Variable. Mammogram screening was defined as having received screening within the past year (12 months). Participants' self-reported mammogram screening over the past 12 months was analyzed as a dichotomous variable (0 = did not have a recent mammogram screening; 1 = had a recent mammogram screening).

Independent Variables. Predisposing factors were age (40 to 75), education (1 = Less than eight years to 7 = Postgraduate), and beliefs about cancer. To assess cancer beliefs, the HINTS included eight items. Six items were assessed by asking respondents to rate on a Likert scale (1 = strongly disagree; 2 = somewhat disagree; 3 = somewhat agree; 4 = strongly agree) their cancer beliefs (it seems like everything causes cancer; there's not much you can do to lower your chances of getting cancer; there are so many different recommendations about preventing cancer, it's hard to know which ones to follow; cancer is more common than heart disease in adults; when I think about cancer, I automatically think about death; I'd
rather not know my chance of getting cancer). Other items (how likely are you to get cancer in your lifetime; how worried are you about getting cancer?) were assessed by asking respondents to rate on a five-point scale (1 = very unlikely; 2 = unlikely; 3 = neither unlikely nor likely; 4 = likely; 5 = very likely, 1 = not at all; 2 = slightly; 3 = somewhat; 4 = moderately; 5 = extremely).

Enabling factors were income (1 = $0–9,999 to 9 = ≥$200,000) and confidence about health information (1 = Not confident at all; 2 = A little confident; 3 = Somewhat confident; 4 = Very confident; 5 = Completely confident). We included four additional items that are related to the caregiving characteristic for the caregiver group. The continuous variables included the number of people under their care, and the categorical variables included the caregiving hours per week (1 = < 5 hours per week; 2 = 5–14 hours per week; 3 = 15–20 hours per week, 4 = 21–34 hours per week; 5 = 35 or more hours per week), care receiver’s cancer (1 = yes; 0 = no), and care receiver’s chronic illness (1 = yes; 0 = no).

Need factors included four items (general health, depression, ever had cancer, and family ever had cancer). For self-rated health status, participants reported their general health status using a five-point Likert scale (1 = Poor; 2 = Fair; 3 = Good; 4 = Very Good; 5 = Excellent). HINTS contained four items related to depressive symptoms (little interest or pleasure in doing things; feeling down, depressed, or hopeless; feeling nervous, anxious, or on edge; not being able to stop or control worrying). We constructed a depression score by adding a value for the four items that ranged from “not at all” (1) to “nearly every day” (4). We also categorized caregiver’s “Ever had cancer” and “family ever had cancer” to “yes” (1) or “no” (0).

Data Analysis

General characteristics of caregivers and non-caregivers were described by calculating the frequencies, percentages, averages, and standard deviations. We examined the association between independent variables and mammogram screening behavior by conducting a cross-tabulation analysis. Finally, we estimated a binomial logistic regression model that included predisposing, enabling, and need factors as independent variables and dichotomous indicator of mammogram screening behavior as the dependent variable. All analyses incorporated replicated sampling weights provided by HINTS to generate unbiased estimates and were conducted using the Stata 12.0 software package [39].

Results

Characteristics of the Sample and Rates of Mammography

First, Tables 1 and 2 describes the characteristics of our study sample. Of the 277 in the caregiver group, 176(63.5%) received mammogram screenings. Of the 951 in the non-caregiver group, 601(63.3%) received mammogram screening. Caregivers were younger (56.3 years old, SD = 9.315) than non-caregivers (58.6, SD = 9.222). About 72.4% of the caregiver group had completed some college and higher education, while 33.4% of the non-caregiver group had a high school diploma or less. The majority of both groups reported their health as more than good and not ever having had cancer. The average
depression level was higher among the caregiver group (6.291, SD = 3.192) than the non-caregiver group (6.008, SD = 2.959). Two-fifths of participants in both groups reported that their family members have had cancer. More than two-thirds were caring for more than two persons, and most of the caregivers (92.8%) were providing care for less than 20 hours per week. Of the caregiver group, 18.8% have provided care for cancer patients, and 38.5% have provided care for patients who have chronic conditions.
| Variables                        | Frequency (%) | Screen | No (%) | Yes (%) | p       |
|---------------------------------|---------------|--------|--------|--------|---------|
| **Dependent Variable**          |               |        |        |        |         |
| Mammogram Screening             | 176(63.5)     |        |        |        |         |
| **Predisposing factor**         |               |        |        |        |         |
| Age                             | 56.25(9.315)  |        |        |        |         |
| Education                       |               |        |        |        |         |
| High-school diploma or less     | 75(27.6)      |        | 40.00  | 60.00  | .8494   |
| Some college and higher         | 197(72.4)     |        | 34.01  | 65.99  |         |
| **Beliefs about cancer**        |               |        |        |        |         |
| Likelihood of getting cancer    |               |        |        |        |         |
| Very unlikely and Unlikely      | 49(18.5)      |        | 38.78  | 61.22  | .8543   |
| Neither unlikely nor likely     | 121(45.7)     |        | 32.23  | 67.77  |         |
| Likely and Very likely          | 95(35.8)      |        | 36.84  | 63.16  |         |
| Everything causes cancer        |               |        |        |        |         |
| Agree                           | 186(68.4)     |        | 34.95  | 65.05  | .1313   |
| Disagree                        | 86(31.6)      |        | 37.21  | 62.79  |         |
| Prevention is not possible      |               |        |        |        |         |
| Agree                           | 70(26.2)      |        | 38.57  | 61.43  | .2820   |
| Disagree                        | 197(73.8)     |        | 35.03  | 64.97  |         |
| Too many recommendations        |               |        |        |        |         |
| Agree                           | 202(75.4)     |        | 34.16  | 65.84  | .5959   |
| Disagree                        | 66(24.6)      |        | 39.39  | 60.61  |         |
| Cancer more common              |               |        |        |        |         |
| Agree                           | 117(43.8)     |        | 28.21  | 71.79  | 4.4746* |
| Disagree                        | 150(56.2)     |        | 40.67  | 59.33  |         |
| Cancer fatal                    |               |        |        |        |         |
| Agree                           | 151(55.5)     |        | 35.76  | 64.24  | .0015   |
| Disagree                        | 121(44.5)     |        | 35.54  | 64.46  |         |

Note: * p < .05; ** p < .01, *** p < .001
## Caregiver (N = 277)

|                      | Agree | Disagree |
|----------------------|-------|----------|
| Rather not know the likelihood |       |          |
| Agree                | 89(33.0) | 39.33 60.67 .8818 |
| Disagree             | 181(67.0) | 33.52 66.48 |
| Worried about cancer |       |          |
| Not extremely        | 249(91.9) | 37.75 62.25 7.2583** |
| Extremely            | 22(8.1) | 9.09 90.91 |
| Enabling Factors     |       |          |
| Income               |       |          |
| $0–74,999            | 171(67.1) | 37.43 62.57 .0066 |
| ≥$75,000             | 84(32.9) | 36.90 63.10 |
| Confident about getting health information |       |          |
| Very confident       | 155(58.3) | 29.68 70.32 5.2092* |
| Not very confident   | 111(41.7) | 43.24 56.76 |
| Caregiving Characteristic |       |          |
| Number of people under their care |       |          |
| One                  | 82(33.7) | 39.02 60.98 .8903 |
| More than two or more |       |          |
| Caregiving hours per week |       |          |
| < 20 hours per week  | 180(92.8) | 33.89 66.11 .4621 |
| 21–34 hours per week | 14(7.2) | 42.86 57.14 |
| Caregiving Cancer (Ref = the others) |       |          |
| Yes                  | 55(18.8) | 34.29 65.71 .0272 |
| No                   | 238(81.2) | 35.71 64.29 |
| Caregiving Chronic (Ref = the others) |       |          |
| Yes                  | 105(38.5) | 39.05 60.95 .9211 |
| No                   | 168(61.5) | 33.33 66.67 |
| Need factors         |       |          |
| General Health       |       |          |
| More than Good       | 221(81.5) | 37.10 62.90 1.4774 |
| Less than Fair       | 50(18.5) | 28.00 72.00 |
|                      |       | 6.291(3.192) |
| Depression           |       |          |
| Ever had cancer      |       |          |
| Yes                  | 34(12.5) | 32.35 67.65 .1713 |
| No                   | 239(87.5) | 35.98 64.02 |
| Family ever had cancer |       |          |
| Yes                  | 210(78.4) | 33.33 66.67 1.2920 |

Note: * p < .05; ** p < .01, *** p < .001
| Caregiver (N = 277) |   |   |   |
|--------------------|---|---|---|
| No                 | 58(21.6) | 41.38 | 58.62 |

Note: * p < .05; ** p < .01, *** p < .001
Table 2
Demographic Characteristics of Mammogram and Variables by Non-Caregiver

| Variables                                | Frequency (%) | Screening No (%) | Yes (%) | 2     |
|------------------------------------------|---------------|------------------|---------|-------|
| **Non-Caregiver (N = 951)**              |               |                  |         |       |
| **Dependent Variable**                   |               |                  |         |       |
| Mammogram Screening                      | 601(63.3)     |                  |         |       |
| **Predisposing factor**                  |               |                  |         |       |
| Age                                      | 58.61(9.222)  |                  |         |       |
| Education                                |               |                  |         |       |
| High-school diploma or less              | 313(33.4)     | 41.21            | 58.79   | 4.0276*|
| Some college and higher                  | 623(66.6)     | 34.51            | 65.49   |       |
| **Beliefs about cancer**                 |               |                  |         |       |
| Likelihood of getting cancer             |               |                  |         |       |
| Very unlikely and Unlikely               | 180(19.8)     | 37.78            | 62.22   | 0.0439|
| Neither unlikely nor likely              | 417(45.8)     | 36.93            | 63.07   |       |
| Likely and Very likely                   | 314(34.5)     | 36.94            | 63.06   |       |
| Everything causes cancer                 |               |                  |         |       |
| Agree                                    | 626(67.6)     | 36.42            | 63.58   | 0.0725|
| Disagree                                 | 300(32.4)     | 37.33            | 62.67   |       |
| Prevention is not possible                |               |                  |         |       |
| Agree                                    | 245(26.5)     | 35.10            | 64.90   | 0.3740|
| Disagree                                 | 681(73.5)     | 37.30            | 62.70   |       |
| Too many recommendations                 |               |                  |         |       |
| Agree                                    | 691(74.7)     | 35.60            | 64.40   | 1.5707|
| Disagree                                 | 234(25.3)     | 40.17            | 59.83   |       |
| Cancer more common                       |               |                  |         |       |
| Agree                                    | 421(46.6)     | 35.39            | 64.61   | 0.2300|
| Disagree                                 | 482(53.4)     | 36.93            | 63.07   |       |
| Cancer fatal                             |               |                  |         |       |
| Agree                                    | 524(57.0)     | 38.36            | 61.64   | 1.9121|
| Disagree                                 | 395(43.0)     | 33.92            | 66.08   |       |

Note: * p < .05; ** p < .01, *** p < .001
About 18.5% of the caregiver group thought that they were unlikely or very unlikely to get cancer in their lifetime, and about 68.4% agreed that it seemed like everything could cause cancer. Moreover, nearly 26% of participants reported that there was not much they could do to lower their likelihood of getting cancer, and 75% agreed that there were so many different recommendations about cancer prevention that it was difficult to know which to follow. Nearly half of participants reported that cancer is more common than heart disease (43.8% of caregivers and 46.6% of non-caregivers), and when they think about cancer, they automatically think about death (55.5% of caregivers and 57.0% of non-caregivers). About 33% of caregivers and 37.4% of non-caregivers agreed that they would rather not know their likelihood of getting cancer. Most (91.9% of caregivers and 93.9% of non-caregivers) participants in both groups reported that they were not extremely worried about getting cancer. About 67.1% of the caregiver group and 65.9% of the non-caregiver group members earned <$75,000 per year. About 60% of both groups reported that they felt confident about getting health information.
As can be seen by the cross-tabulated frequencies in Table 1, there were significant relationships between perceiving cancer as more common than heart cancer ($\chi^2 = 4.4746, p < 0.05$), worries about cancer ($\chi^2 = 7.2583, p < 0.01$), confidence about getting health information ($\chi^2 = 5.2092, p < 0.05$), and getting mammogram screenings in the caregiver group. Moreover, in Table 2, there were significant relationships between education ($\chi^2 = 4.0276, p < 0.05$), rather not know the likelihood ($\chi^2 = 13.5159, p < 0.001$), income ($\chi^2 = 5.0811, p < 0.05$), general health ($\chi^2 = 9.4769, p < 0.01$), ever had cancer ($\chi^2 = 4.5869, p < 0.05$), family ever had cancer ($\chi^2 = 5.4602, p < 0.05$), and taking mammogram screenings in the non-caregiver group.

Mutivariate analysis

Binominal Logistic Regression

Estimates from the binominal logistic regression model presented in Tables 3 and 4 show that mammogram screening was positively associated with age (OR = 1.058, 95% CI = 1.022–1.095, OR = 1.029, 95% CI = 1.013–1.046) and negatively with “rather not know my likelihood of getting cancer” (OR = .673, 95% CI = 0.496–0.914, OR = .825, 95% CI = 0.713–0.955) for both groups. However, among the caregiving group, the dependent variable was positively associated with confidence in getting health information (OR = 1.432, 95% CI = 1.049–1.955) and “cancer is more common than heart disease” (OR = 1.490, 95% CI = 1.032–2.151) and negatively associated with caregiving hours per week (OR = .749, 95% CI = 0.564–0.994). For the non-caregiver group, the dependent variable was positively associated with how worried they were about getting cancer (OR = 1.156, 95% CI = 1.000-1.337) and negatively associated with depression (OR = .919, 95% CI = 0.871–0.969).
### Table 3
Logistic Regression on Receipt of Mammogram Screening by Caregiving Group

| Factors Predictors         | Caregiver |            | OR     | 95% CI      |
|---------------------------|-----------|------------|--------|-------------|
| **Predisposing factors**  |           |            |        |             |
| Age                       |           |            | 1.058***| 1.022, 1.095|
| Education                 |           |            | 1.096  | 0.887, 1.355|
| Beliefs about cancer      |           |            |        |             |
| Likelihood of getting cancer |        |            | 1.019  | 0.895, 1.160|
| Everything causes cancer  |           |            | 0.971  | 0.681, 1.384|
| Prevention is not possible |         |            | 0.777  | 0.550, 1.099|
| Too many recommendations  |           |            | 1.158  | 0.793, 1.691|
| Cancer more common        |           |            | 1.490* | 1.032, 2.151|
| Cancer fatal              |           |            | 1.200  | 0.854, 1.685|
| Rather not know the likelihood |    |            | 0.673* | 0.496, 0.914|
| Worried about cancer      |           |            | 1.213  | 0.916, 1.606|
| **Enabling Factors**      |           |            |        |             |
| Income                    |           |            | 1.074  | 0.927, 1.243|
| Confident about getting health information | | 1.432* | 1.049, 1.955|
| Number of people under their care | | 1.523 | 0.889, 2.609|
| Caregiving Hours per week |           |            | .749*  | 0.564, 0.994|
| Caregiving Cancer (ref = others) |     |            | .735   | 0.306, 1.769|
| Caregiving Chronic (ref = others) | | .657    | 0.370, 1.166|

Note: ORs, odds ratios, * p < .05; ** p < .01, *** p < .001
| Factors Predictors       | Caregiver |
|-------------------------|-----------|
| Need factors General Health | 0.803 0.571, 1.128 |
| Depression              | 0.937 0.849, 1.034 |
| Ever had cancer         | 0.696 0.281, 1.723 |
| Family ever had cancer  | 1.404 0.695, 2.837 |
| Number of observations  | 277       |
| Pseudo R²               | 0.124     |
| Log Likelihood Rate Test| 43.05     |

Note: ORs, odds ratios, * p < .05; ** p < .01, *** p < .001
## Table 4
Logistic Regression on Receipt of Mammogram Screening by Non-Caregiving Group

| Factors Predictors | Non-caregiver | OR    | 95% CI       |
|--------------------|--------------|-------|--------------|
| **Predisposing**   |              |       |              |
| factors            |              |       |              |
| Age                |              | 1.029*** | 1.013, 1.046 |
| Education          |              | 1.093 | 0.980, 1.218 |
| **Beliefs about cancer** |         |       |              |
| Likelihood of getting cancer | .932   | 0.866, 1.003 |
| Everything causes cancer | 1.183 | 0.983, 1.423 |
| Prevention is not possible | .989   | 0.823, 1.188 |
| Too many recommendations | 1.060 | 0.876, 1.282 |
| Cancer more common |              | 1.126 | 0.939, 1.349 |
| Cancer fatal       |              | .916  | 0.773, 1.085 |
| Rather not know the likelihood | .825** | 0.713, 0.955 |
| Worried about cancer |          | 1.156* | 1.000, 1.337 |
| **Enabling**       |              |       |              |
| Factors            |              |       |              |
| Income             |              | 1.035 | 0.962, 1.113 |
| Confident about getting health information | 1.021 | 0.868, 1.201 |
| **Need factors**   |              |       |              |
| General Health     |              | 1.138 | 0.952, 1.359 |
| Depression          |              | .919** | 0.871, 0.969 |
| Ever had cancer    |              | 1.351 | 0.899, 2.030 |
| Family ever had cancer | 1.344 | 0.956, 1.891 |

Note: ORs, odds ratios, * p < .05; ** p < .01, *** p < .001
### Discussion

The results of our study revealed similar rates of mammogram screening for both caregivers and non-caregivers, which is consistent with a previous study that used a nationally representative data [27]. The findings of this study partially support our hypotheses. Age was identified as a positive factor for both groups. An increase in hospital visits is associated with age, and as a result, access to medical professionals who will recommend preventive care may contribute to higher screening practice [10, 13].

Our findings from the regression analysis guided by the Anderson Behavioral Model provided important variables. With regard to predisposing factors, caregivers and non-caregivers identified different cancer beliefs factors associated with the utilization of mammograms. Among non-caregivers, worry of getting cancer was a significant predictor of using mammograms. A recent study reported that women who worry about getting breast cancer were more willing to adhere to mammograms [40]. However, our study suggested that this knowledge could not be applied to caregiver populations.

In turn, caregivers identified the belief of cancer being more common than heart disease as a significant predictor in the utilization of mammogram. Also, access to health-related knowledge was positively associated with mammogram use among caregivers. The heightened level of health-related knowledge due to caregiving experience and easier access to medical professionals may facilitate caregivers to receive mammograms [27].

In addition, unwilling to know their possibility of getting cancer is a significant predictor of using mammograms for both caregivers and non-caregivers. Majority of the respondents did not desire to know their possibility of getting cancer as well as associated cancer-related death. These findings add evidence that fear of having cancer is a significant predictor of not receiving a mammogram, which is supported by a previous study [41].

For enabling factors, Mammogram screening behavior is negatively associated with hours of caregiving among caregivers. Caregivers who have more caregiving hours per week are significantly less likely to use mammograms. One previous study found that female caregivers who provide more than 14 hours per week of caregiving have significantly lower odds of receiving mammography [8]. The overwhelming caregiving hours led to underuse of mammogram as they were not able to take time off to care for themselves [8]. However, our study suggested that being a caregiver did not reduce the likelihood of using

| Factors Predictors                             | Non-caregiver |
|------------------------------------------------|---------------|
| Number of observations                         | 951           |
| Pseudo R²                                      | 0.057         |
| Log Likelihood Rate Test                       | 67.51         |

Note: ORs, odds ratios, * p < .05; ** p < .01, *** p < .001
mammograms, comparing to non-caregivers. The possible explanation is that caregivers may have efficient opportunities to learn cancer health knowledge and to access to medical professionals [27].

Finally, regarding need factors, non-caregivers, who showed symptoms of depression, exhibited lower odds of having mammograms. Depression is a risk factor for underuse of mammography because depression generally leads to self-care neglect, including using mammograms [36, 42, 43]. In this analysis, no other need factor associated with mammogram use among caregivers at a significant level.

Limitation

Our study had several limitations. First, as a secondary analysis, we were unable to examine the impact of details regarding the caregiving situation on mammogram screening behaviors. Even though the HINTS provided the information of caregiving status, the information of caregiving duration and situation is lacked, such as years of caregiving, the reason for caregiving, and relationship to the care recipients. However, our study is also strengthened by the high quality of the HINTS, its sampling procedures, and nationally representative samples. Second, the effects of caregiving by race were unable to be examined. Racial dispraise in mammogram use have been well documented for both caregivers and general women [44, 45]. Our study focused on comparing mammogram screening behaviors between caregivers and non-caregivers. Our comparison between caregivers and non-caregivers made an important contribution to this literature, considering the few previous studies examined the impact of caregiving hours on mammogram screening behaviors. Effects of caregiving by caregiving situation and by race require further exploration by additional studies.

Conclusion And Implication

Our results demonstrate that there is no difference in receipt rates of mammograms between caregivers and non-caregivers. However, caregiving hours per week is a negative predictor of having mammograms among women caregivers. In addition, caregivers are more likely than non-caregivers to hold cancer beliefs that increase (e.g., cancer is common), as well as some that reduce (e.g., unwilling to know the screening result), mammogram use. Family-centered and community-based support should be enhanced to reduce the burden of caregiving among middle-aged and older women caregivers and to promote mammogram screening.

Moreover, caregivers who are homebound because of working a high amount of caregiving hours, should be reached by giving access to screening tools that breast cancer screening can be easily done at home. Telehealth or mobile home health care service could increase cancer screening rate. For example, portable X-ray is available nowadays for home care, and image quality is not different from those taken in hospital [46]. In addition, education on breast cancer care and mammograms are necessary to reduce caregivers’ fear of cancer, which may potentially motivate them to use mammograms [16, 17, 18, 19, 20]. In order to increase the use of mammograms, education and access to screening mechanism inside the community are necessary.
Declarations

Ethics approval and consent to participate

Using this public dataset does not meet the regulatory criteria for human subjects research. No Ethics approval is necessary.

Consent for publication

Not Applicable.

Competing interests

None of the authors of this study has an interest conflict.

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Authors' contributions

Conceptualization, SK and HL; methodology, SK, YG, and HL; formal analysis, SK; resources, YG and HL; writing—original draft preparation, SK and YG; writing—review and editing, HL and CW; project administration, HL.

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Availability of Data

Data available in a public from National Cancer Institute, Health Information National Trends Survey datasets.

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