HHS Public Access

Author manuscript

Ethn Health. Author manuscript; available in PMC 2022 April 01.

Published in final edited form as:

Ethn Health. 2021 April ; 26(3): 431–447. doi:10.1080/13557858.2018.1520813.

Analyzing Factors Associated with Decisional Stage of Adopting Breast Cancer Screening among Korean American Women Using Precaution Adoption Process Model

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Abstract

Background—Korean American (KA) women have experienced higher prevalence and lower survival rates of breast cancer (BC) than other ethnic groups in the United States. However, BC screening rates for KA women remain significantly lower than the national target (81.1%) specified by Healthy People 2020. Few studies have explained how the decision to adopt BC screening occurs and progresses and what factors contribute to this decision among KA women. This study used Weinstein's Precaution Adoption Process Model (PAPM) as a theoretical framework to examine characteristics and factors associated with the decisional stage of mammography adoption.

Methods—A cross-sectional self-report survey was administered among KA women (N = 308) ages 50 to 80 from the Atlanta metropolitan area. A total of 281 KA women completed the survey, answering questions about socio-demographics, health-related information, mammography history, doctor recommendation, BC screening knowledge, self-efficacy for BC screening, decisional balance scores on attitudes and beliefs pertaining to mammography, and the seven-stage PAPM.

Results—KA women reported a low rate of mammography uptake with about 24% and 35% of the participants undergoing mammography within the last year and two years, respectively. KA women in stages 5 (decided yes), 6 (action), and 7 (maintenance) were likely to have increased screening-related knowledge, positive decisional balance, and regular medical check-up compared to those in stages 1 (unaware), 2 (unengaged), and 3 (deciding).

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Conclusion—This study highlights important factors that could potentially facilitate BC screening among KA women in Georgia. The findings also provide implications for interventions and practice for increasing mammography screening among medically underserved populations.

Keywords

Breast Cancer Screening; Mammography; Korean American Women; Precaution Adoption Process Model; Decisional Stage of Mammography Adoption

Introduction

Breast cancer (BC) is the second most common type of cancer and the second leading cause of death among American women (American Cancer Society 2017). For the last two decades, due to continued multi-level efforts such as decreasing use of hormone therapy after menopause and fostering adoption of screening exams, BC incidence and mortality, respectively, have declined and persisted (Chlebowski and Anderson 2015; American Cancer Society 2016; National Cancer Institute 2017).

In contrast, over the same period, Korean American women have experienced higher prevalence and lower survival rates of BC than other ethnic groups in the United States (U.S.) (K. S. Choi et al. 2010; H. Y. Lee, Stange, and Ahluwalia 2015; Center for Disease and Control 2017). BC for Korean American women is the most commonly diagnosed cancer and the second leading cause of death (Z. Kim et al. 2014). More specifically, non-U.S.-born Korean American women tend to have a higher prevalence of BC compared to those born in the U.S. (Gomez, Quach, et al. 2010; Gomez, Clarke, et al. 2010).

Literature shows that this reverse trend in regards to BC manifested in Korean American women is associated with diagnosis at advanced stages of the disease and poor adherence to screening (H. Y. Lee, Lundquist, et al. 2011). The American Cancer Society (ACS) had recommended beginning screening mammography at the age of 40 for women at average risk (ACS 2017b). In October 2015 the ACS updated the screening guideline to receiving mammography screening annually for women ages 45 to 54 and either biennially or annually for women ages 55 and older (ACS 2017b). The U.S. Preventive Services Task Force (USPSTF) also recommends biennial mammography screening for women 50–74 years (USPSTF 2016).

Despite the significant burden of BC and affirmative screening guidelines from the health institutes, BC screening rates for Korean American women remain significantly lower than the national target (81.1%) (Center for Disease and Control 2017; Department of Health and Human Services 2010). Previous studies show that only 22–39% of Korean American women underwent mammography in the past year, and 34–57% of Korean American women had one in the past two years (Chawla et al. 2015; K. S. Choi et al. 2010). These rates are far below the mammography screening rates (63–68%) for the U.S. general women (CDC 2015) as well as the goal (81.1%) set by Healthy People 2020 (Department of Health and Human Services, 2010).

This disparity in BC screening in Korean American women is closely linked to multiple cultural and structural barriers to accessing screening services. The barriers these women face include inappropriate knowledge of BC and screening guidelines, culture-interwoven beliefs and perceptions (e.g., a person's diagnosis of cancer means death of the person and going to see a doctor only when a person gets sick), emotional modesty or embarrassment, low levels of acculturation into the host culture, and poor English proficiency (Chawla et al. 2015; Harcourt et al. 2014; Kagawa-Singer et al. 2007; Sentell et al. 2015; Suh 2008). Research also has indicated some modifying factors that enable Korean American women to engage in BC screening including appropriate health insurance coverage, receipt of doctor recommendation, prior positive screening experiences, having regular medical check-up, having a family member diagnosed with cancer, positive attitudes toward screening, and greater self-efficacy (J. H. Kim et al. 2010; S.-Y. Lee 2015; Oh, Taylor, and Jacobsen 2017; Han, Williams, and Harrison 2000; H. Y. Lee, Roh, et al. 2011; Juon, Seo, and Kim 2002).

These findings were useful in identifying contributors and moderators related to BC screening behavior for developing interventions aimed at facilitating BC screening among Korean American women. However, because of their focus on the factors contributing to whether or not Korean American women underwent BC screening, these findings provide little information to understand how decision of adopting BC screening occurs and progresses as the corresponding decisional stage advances (Hester et al. 2015; William Rakowski et al. 1996). As a result, it remains unclear what factors are associated with people's different decisional stages for screening adoption and what factors may close the gap between people's knowledge regarding the risks of BC, the benefits from screening, and their engagement in BC screening (Strong and Liang 2009; Reyna et al. 2015; Hee Sun Kang et al. 2008; Taymoori, Berry, and Roshani 2014).

Thus, the present study employed the Precaution Adoption Process Model (PAPM) as a theoretical framework to examine characteristics and investigate factors associated with the decisional stage for mammography adoption. The research questions of this study included (a) how do characteristics of decisional stage for mammography adoption differ by stages? and (b) what factors distinguish individuals who have decided to uptake mammography from those who have not yet decided to uptake mammography? The findings of this study provide implications for interventions and practice aimed at facilitating mammography adoption among Korean American women.

Theoretical Framework

Weinstein's PAPM is a stage model of health behavior that derives from social learning theory and health belief model (Weinstein 1988; Weinstein and Sandman 1992). The PAPM has been widely used for health behavioral change from exercise and smoking cessation to cancer screening promotion (Costanza et al. 2005). The PAPM was chosen as a theoretical framework for this study because it offers more detailed stage—especially early stages from awareness to decision regarding health-related behavior—compared to other stage of change models (Glanz, Rimer, and Viswanath 2008). Moreover, the PAPM contains a stage of decision against targeted behavioral adoption, which allows for controlling for characteristics of individuals in this stage. Like other stage-based behavioral change models,

the PAPM also posits that decisional balance (i.e., attitudes toward screening) plays a key role in adopting cancer screening behavior, including BC screening among Korean American women (Glanz, Rimer, and Viswanath 2008; Clemow et al. 2000). Through using the three criteria of awareness, previous health behavior (i.e., engagement), and intention, the PAPM discerns the following seven stages of adoption of health behavior: Stage 1—unaware; stage 2—unengaged; stage 3—deciding; stage 4—decided no; stage 5—decided yes; stage 6—action; and stage 7—maintenance (Hester et al. 2015; S. Choi, So, and Park 2015). Comparisons of these distinct stages offer useful information on the process regarding adoption for BC screening.

Methods

Sampling and Data Collection

Quota sampling by age (50 to 64 vs. 65 to 80) was used to recruit Korean American women ages 50 to 80 from Korean American communities in the Atlanta metropolitan area from May 2015 to February 2016 in order to reflect characteristics of Korean Americans residing in the state of Georgia (GA). Participants were recruited through various advertisements via a local ethnic radio station, senior centers, ethnic religious organizations, and referrals. The study's inclusion criteria were self-identified Korean American women, 50 to 80 years old, and residents of GA. The exclusion criteria for this study were Korean American women self-reporting any type of cancer history due to different screening guidelines for individuals at high risk of BC (ACS 2015). This study also excluded Korean American women ages below 50 or above 80 because the ACS and the USPSTF both commonly recommend having mammography screening between the ages of 50 and 80 at the time of data collection (ACS 2016; USPSTF 2016).

For the recruitment, a list of Korean American community organizations and their contact information was generated which included senior centers, churches/temples, and associations. Each organization was contacted by the research team via phone call and email for data collection. With each organization or individual's permission and convenience for time and place, self-report survey questionnaires were administered, followed immediately by explanation of the nature and purpose of the study and then by administration of informed consent documents from those who were interested in the study. Variables used in the survey were selected with guidance by the existing literature and the PAPM. All measures used in the survey were translated into Korean using a back-translation to assure comparability and equivalence in the meaning of measures.

A total of 308 Korean American women participated in a cross-sectional self-report survey, but 281 of the participants (91.2%) completed the survey. The participants were asked to provide information in regard to socio-demographics, health-related information (i.e., regular medical check-up and family cancer history), mammography history, doctor recommendation, knowledge of BC and mammography, self-efficacy for BC screening, decisional balance scores on attitudes pertaining to mammography, and PAPM stage. On average, the survey took approximately 45 minutes to complete. This study was approved by an institutional review board.

Measures

Outcome variable: PAPM stage—The main outcome of this study was PAPM stage of adoption for mammography: Stage 1—unaware of mammography; stage 2—aware of yet unengaged with mammography; stage 3—deciding mammography; stage 4—decided not to uptake mammography; stage 5—decided to uptake mammography but not yet in action; stage 6— ever had a mammography; and stage 7—being up-to-date with mammography. As guided by the previous studies (Costanza et al. 2005; Clemow et al. 2000), the stage was determined by the aforementioned criteria: (1) awareness of mammography, (2) engagement with mammography, and (3) intention on mammography.

First, awareness of mammography was measured by asking “Have you ever heard of mammography?” Those who had reported having never heard of mammography were assigned into stage 1 (unaware). If the participants answered ‘yes’ to the question, they were followed by a further question, “Have you ever had mammography?” to determine engagement with mammography. Those who had reported having ever had mammography were asked to report the month and year of the last mammography uptake to identify being up-to-date with annual mammography. This study operationalized stage 7 as being up-to-date with annual mammography. Originally, PAPM defined stage 7 as maintenance of a specific health behavior (Weinstein 1988). For example, maintenance of exercise is often determined by the frequency and duration of a particular exercise on a weekly basis and its specified lasting period. Unlike exercise, because cancer screenings like colonoscopy and mammography occur with a relatively long interval (e.g., every ten years and annually, respectively), there is a need for a different operationalization of maintenance for yearly mammography. Thus, this study assigned those who had completed mammography within the last year into stage 7 (maintenance) and those who were not up-to-date with mammography annually but had a mammogram in the past were assigned into stage 6 (action). However, for data analysis purposes, this study combined stage 7 of maintenance into stage 6 of action in order to avoid any disagreement on the distinction between stage 6 and 7 (Costanza et al. 2005).

The remaining stages (i.e., stages 2 to 5) were determined by assessing the intentions on future mammography uptake among the participants who were not yet assigned into any stage. They were asked the question, “Are you willing to have mammography in 6 months?” with a five-Likert scale, ranging from “never,” to “neutral,” to “very likely.” Those who had chosen “never” were assigned into stage 4 (decided no); “less likely” or “neutral” into stage 2 (unengaged); “more likely” into stage 3 (deciding); and “very likely” into stage 5 (decided yes). For data analysis purposes, we then combined all these seven stages into the following three stages: (1) *pre-adoption* which combines stage 1 (unaware), 2 (unengaged), and 3 (deciding); (2) *refusal* (stage 4 [decided no]); and (3) *adoption* stage by combining stage 5 (deciding yes), stage 6 (action), and stage 7 (maintenance). We shortened the 7 stages into the 3 stages because the study’s primary focus was on understanding variables that promote adoption for mammography screening.

Independent variables

Knowledge of mammography.: Knowledge of mammography was measured by five knowledge items adopted from the ACS's BC screening guideline (ACS 2017a, 2016) and five familiarity items adopted from Han and colleagues (H.-R. Han et al. 2014). The five knowledge items consist of three items of general mammography-related knowledge (e.g., "Women at age of 40 are recommended to begin mammography") (ACS 2017a) and two items of knowledge of breast cancer risk factors (e.g., "Age raises the risk of breast cancer") with the selection of 'true' and 'false' (ACS 2016). Each knowledge item is rescaled to 0 if the answer was wrong or 1 if the answer was correct. The five familiarity items assess how familiar a respondent is with the BC screening-related terms (e.g., Hyperplasia, Lump, Lymph, Metastasis, and Nipple) which are most commonly used over the procedure of mammography screening, on a five-Likert scale from 0 (= 'not familiar at all') to 4 (= 'very much familiar'), which has been rescaled from 0 to 1 so that 1 stands for 'very much familiar.' The Cronbach's alpha of the five knowledge items and the five familiarity items in this study was 0.8008, which indicates relatively high internal consistency. A composite score of mammography knowledge was obtained by principal components analysis with the ten items, which does not require the same scales of the original items. The composite score was standardized in order to make it easier to interpret the score in terms of standard deviations from the mean.

Self-efficacy for mammography.: Perceived self-efficacy for mammography was assessed by the four items from Luszczynska and Schwarzer's self-efficacy scale, on a seven-Likert scale from 1 (= 'strongly disagree') to 7 (= 'strongly agree') (Luszczynska and Schwarzer 2003). This self-efficacy scale asked certainty of overcoming expected difficulties in having mammography. Example items included: "I am able to perform mammography regularly even if I will have to make a detailed plan describing how to remember about mammography" and "I am able to perform mammography regularly even if I will have to overcome my different habit of non-examination." However, for this study, only three items out of the four were used to measure the self-efficacy because one item ("I am able to change the screening schedule if I would like to take mammography") did not fit well in the scale with low item-test and item-rest correlations. The Cronbach's alpha of the three items in this study was 0.9501, which shows very high internal consistency. The standardized score of the mean of the three items was used as a composite score of perceived self-efficacy for mammography.

Decisional balance.: Attitudes and beliefs (i.e., 'pros' and 'cons') about mammography were measured by an adapted version of the 18-item decisional balance scale used by Costanza and colleagues on a five-point Likert-type scale from 'strongly agree' to 'strongly disagree' (William Rakowski et al. 1996; W. Rakowski et al. 1997). The 18 items consisted of seven positive statements and 11 negative statements about mammography. A positive statement example includes "Having mammography screening gives me peace of mind about my health"; a negative statement example includes "Screening causes me a lot of worry or anxiety about getting breast cancer." The Cronbach's alpha of the 18 items in this study was 0.7742, which denotes moderate internal consistency. The standardized score of

the mean value of the 18 items was calculated as a composite score of the decisional balance.

Other independent variables.: Lastly, regular medical check-up and family cancer history were measured by one item each: “Do you receive regular medical check-up every year?” and “Has any of your family (parents, grandparents, siblings, or close relatives) ever had cancer of any kind?”, respectively (‘yes’ = 1, ‘no’ = 0). The variable of family cancer history measured a history of both BC and other types of cancer in that a family member’s diagnosis even with any type of cancer might influence one’s attention, awareness, practice, and intention regarding BC screening (Ramsey et al. 2006; Lang 2017). Having doctor recommendation for mammography was also measured by an item: “Has a doctor ever recommended you to have mammography?” with ‘yes’ = 1 or ‘no’ = 0. The selection of ‘no’ indicates that a participant had never had mammography recommendation from a doctor.

Control variables—Sociodemographic information was the control variables of this study and was assessed as follows: length of residence in the U.S. as a continuous variable; age (50 to 54, 55 to 64, 65 +); marital status (single, married/cohabiting, separated/divorced, widowed, other); education (primary school graduate, middle school graduate, high school graduate, college graduate, graduate school graduate); income (<$20,000, $20,000 - $39,999, $40,000 - $59,999, $60,000 - $79,999, $80,000 - $99,999, $100,000 +); economic status (very bad, bad, moderate, good, very good); English proficiency (very bad, bad, moderate, good, very good); and health insurance (yes, no) as categorical variables.

Data Analysis

Descriptive statistics and univariate analysis were conducted to examine sociodemographic characteristics and mammography history. Frequency analysis was used to assess the distribution of the decisional stage of mammography adoption. To investigate bivariate associations between PAPM stages and variables, a Chi-square test and F-test were implemented for categorical and continuous variables. Finally, multiple logistic regression analysis was conducted to assess associations of potential factors with mammography adoption. For these analyses, as mentioned earlier, the PAPM stages were categorized into three groups: (a) pre-adoption group (stages 1 to 3); (b) refusal group (stage 4); and (c) adoption group (stages 5 to 7). Stata/SE 14.1 was used for the analyses, and a 5% significance level was used as a criterion for all statistical tests in the study.

Results

Sociodemographic Characteristics

Table 1 shows characteristics of all eligible participants (N = 281). Their mean age was 58.1 (SD = 7.81) and the average length in the U.S. was 21.4 years (SD = 10.89). The majority of the participants were married or cohabited (79.5%) and insured (72.4%). More than half of the participants (52.6%) graduated from college and above, and 40.6% of the participants had an annual household income below $40,000. About 22% self-rated their economic status as bad or very bad; over half of the participants (51.6%) self-rated English proficiency as bad or very bad.

Mammography History and PAPM Stage Distribution

Table 2 shows history of mammography uptake in the sample. Among 281 participants, 19 participants (6.8%) did not report information regarding mammography uptake, and 69.8% reported having ever had a mammography, while 34.9% reported having a mammography within the last two years and 23.5% in last year.

Table 3 shows the distribution of PAPM stages of mammography adoption. About a quarter (n = 71, 25.5%) of the sample fell into the mammography pre-adoption group, 71.2% (n = 198) into the mammography adoption group, and about 3% (n = 9) into the mammography refusal group.

PAPM Stage Characteristics

Panel A of Table 4 shows characteristics of categorical variables by a group of PAPM stage of mammography adoption: pre-adoption, refusal, and adoption groups. The PAPM stage groups were significantly associated with education level ($p = .014$), doctor recommendation ($p < .001$), and regular medical check-up ($p = .011$). The rate (37.7%) of graduates from college and above is lower than the rate (62.3%) of graduates from high school and below in the pre-adoption group, whereas the rate of graduates from college and above is higher than the rate of graduates from high school and below in both refusal and adoption groups. For doctor recommendation, the refusal group had the lowest rate (25.0%), while the adoption group had the highest (65.0%). Finally, the rate of having annual medical check-up was the highest (88.9%) in the refusal group, while its rate was the lowest (53.1%) in the adoption group. There was no significant association between other variables and the PAPM stage group at 5% significance level.

Panel B of Table 4 shows characteristics of continuous variables by a group of PAPM stage of mammography adoption. There was a significant difference in screening knowledge ($p < .001$), mammography self-efficacy ($p < .001$), and decisional balance scores ($p < .001$), respectively, by the PAPM stage groups. The mean scores of knowledge and decisional balance for mammography were in a gradual increase from the pre-adoption group, to refusal group, to the adoption group. The mean score of self-efficacy for mammography was the lowest (Mean = −1.03) in the refusal group and the highest (Mean = .21) in the adoption group; that is, on average, the refusal group has 1.03 SD lower self-efficacy score than the overall mean self-efficacy score, while the adoption group has 0.21 SD higher self-efficacy score than the average self-efficacy score of the sample.

Factors Associated with Mammography Adoption

Pre-Adoption (stage 1/2/3) vs. Adoption (stage 5/6/7)—A multiple logistic regression analysis was implemented to determine factors associated with adoption for mammography. For the model, Hosmer-Lemeshow goodness-of-fit test, Wald χ^2 test, and McFadden Pseudo R^2 all indicated a good model fit for the data. Table 5 shows the results.

In this Model, the adoption group (stage 5/6/7) in which individuals had decided to uptake mammography was compared to the pre-adoption group (stage 1/2/3), as a reference group, in which individuals had not decided yet to uptake mammography. Those in the adoption

group were likely to have greater knowledge of mammography (OR = 4.70; 95% CI = 1.68 – 13.17), higher scores of decisional balance (OR = 1.96; 95% CI = 1.18 – 3.24), and regular medical check-up (OR = 4.09; 95% CI = 1.32 – 12.69) compared to those in the pre-adoption group, controlling for other variables.

Discussion

This study found that Korean American women had low rates of mammography uptake with about 23% having mammography within the last year and 35% within the past two years. According to previous studies, the rate of mammography uptake in the last year found in the current study is similar to that of Korean American women (22–39%) but lower than those (over 50%) of non-Hispanic White, African American, and Hispanic American women (E. E. Lee et al. 2016; Kagawa-Singer et al. 2007). Furthermore, the rate (35%) of mammography uptake within the past two years in this study is almost half of those of Asian Americans (72%) and non-Hispanic Whites (73%) (Oh, Taylor, and Jacobsen 2017; Seo, Bae, and Dickerson 2016). This underutilization of mammography screening in Korean American women can be partly explained by the factors found in this study, including BC screening-related knowledge, decisional balance, and regular medical check-up.

First of all, this study found Korean American women in the pre-adoption group (stage 1/2/3) to have poorer knowledge of BC screening compared to those in other stages (i.e., the refusal and the adoption groups). The study also found the screening knowledge to be a factor that distinguishes the adoption group (stage 5/6/7) from the pre-adoption group (stage 1/2/3) among Korean American women. Previous intervention studies also demonstrated that increased knowledge regarding BC screening is associated with greater intention on participating in mammography screening for Korean American women (Jin Hee Kim and Menon 2009; Wismer et al. 1998; E. Lee et al. 2014). These findings suggest that appropriate screening knowledge can be an essential factor that helps Korean American women who have not decided yet to uptake mammography move forward to the next decisional stage. However, it is also worthwhile to note that the knowledge alone may not be sufficient to influence the decision for adopting BC screening in that there are barriers which prevent Korean American women from deciding for BC screening adoption, although they have proper knowledge of BC screening. Therefore, further research is needed to assess what (sets of) factors contribute to closing the gap between knowledge and decision making pertaining to BC screening.

Furthermore, this study found that decisional balance in BC screening predicts the adoption group (stage 5/6/7), compared to the pre-adoption group (stage 1/2/3). Prior studies employing stages of change models also identified the pattern that decisional balance increases as a stage progresses, showing the positive associations between scores of decisional balance and stages of mammography adoption (S. Choi, So, and Park 2015; Costanza et al. 2005; Strong and Liang 2009; Hester et al. 2015). These findings suggest that it can be critical for improvements in decisional balance regarding BC screening to occur in order to positively influence adoption for BC screening and being up-to-date with the screening guideline. The decisional balance is a cognitive evaluation of ‘pros’ and ‘cons’ toward screening adoption, so advancing decisional balance warrants decreasing negative

attitudes (cons) and increasing positive attitudes (pros) toward the screening. To facilitate BC screening among Korean American women, it is necessary to develop interventions that target Korean American women with negative decisional balance in BC screening.

Finally, this study found that regular medical check-up distinguishes between the pre-adoption group (stage 1/2/3) and the adoption group (stage 5/6/7). Existing literature also supported that having routine medical check-up is significantly associated with adoption for mammography (Juon, Seo, and Kim 2002; E. E. Lee et al. 2016; E. E. Lee, Fogg, and Sadler 2006). The findings suggest that routine medical check-up can play a critical role in influencing decision making for adopting BC screening among Korean American women. One explanation can be because it is likely for Korean American women who visit clinics regularly for medical check-up to have more opportunities to receive information on BC screening and health providers' recommendations compared to those who visit clinics irregularly, which in turns leads to improving their adoption for BC screening. Another explanation can be because it is likely for Korean American women with regular medical check-up to have better established relationships with their health providers. Researchers have underscored patient-centered care, patient-doctor shared decision making, and the quality of relationships between patients and health providers in maintaining and improving health outcomes, including cancer screening (Martin et al. 2005; Ward 2017; Adams 2010; Joosten et al. 2008). Therefore, these close relationships with their health providers among Korean American women might have positive impacts on their adoption of and being up-to-date with BC screening. The findings also highlight the importance of roles of health providers working with medically underserved groups in facilitating BC screening in communities. Upon the visits to clinics by Korean American women who have not decided for mammography, health providers need to ensure that they have appropriate knowledge of BC screening, abilities to access the screening services, and attitudes toward the screening. It is also important for health providers to take adequate time to fully explain mammography and the screening procedure to Korean American women and to listen to difficulties in completing the screening from them, such as transportation, culture-related misbeliefs or stigma, and English proficiency.

Limitations

The findings of the study have several limitations. Although this study used quota sampling to reflect characteristics of Korean American women, the findings of this study cannot be generalized into all Korean American women residing in the U.S. In addition, the findings of this study showed important associations among study variables, but the findings obtained from cross-sectional survey data cannot explain causal-effect relationships between PAPM stage and the variables. Another limitation is that the uptake of BC screening was self-reported and may be subject to inaccurate recall, although we attempted to mitigate this bias through including descriptions of BC screening in the questionnaire. Additionally, this study used family history of any type of cancer as an independent variable, so specification of family BC history only might influence the associations of factors and PAPM stage. For categorization of PAPM stage, this study assigned participants up-to-date with yearly mammography screening into stage 7 (maintenance). However, due to disagreement on operationalization of the maintenance for cancer screening behavior (i.e., how many years an

individual has been up-to-date with yearly mammography screening can be categorized into maintenance of BC screening), different operationalization of maintenance (stage 7) might reveal different associations with the factors found in this study. Furthermore, although this study found no association between doctor recommendation and mammography uptake, because the survey question regarding previous experience of having recommendation from their doctor for BC screening did not ask when they received the recommendation, inclusion of specific date for the receipt of the recommendation might influence the association. Finally, due to the disproportionate number of participants in the various stages and the analysis purpose of the data, PAPM stages were combined into the three groups. Therefore, an appropriately-distributed number of participants in each stage might reveal other distinguishable characteristics between the stages.

Conclusion

The present study used Weinstein's PAPM as a theoretical framework to examine factors associated with the decisional stage of mammography adoption among Korean American women. Particularly, this study focused on investigating factors that distinguish between lower decisional stages of mammography adoption and higher stages. This study found suboptimal mammography screening outcomes in Korean American women and BC screening-related knowledge, decisional balance, and regular medical check-up, respectively, to be a factor associated with higher stage of adoption for BC screening. The findings of the study provide implications for interventions and practice for increasing mammography screening among medically underserved populations. The present study highlights important factors that could potentially improve BC screening among Korean American women in Georgia. Community-based educational interventions should focus on education about BC screening, improvement of negative attitudes toward BC screening, and work to connect community members with primary care practices especially for regular medical check-up. This study also implies the critical role of health providers working with underserved populations. Health providers should consider the three stages we propose in our study (pre-adoption, refusal, and adoption) to move these women forward from disengagement with BC screening to regular uptake of the screening.

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Table 1

Summary of descriptive statistics ($N = 281$)

	n	Mean (SD) or %
Age (years)	281	58.07 (7.81)
50–54 (%)	107	38.08%
55–64 (%)	107	38.08%
65–80 (%)	67	23.84%
Length in the US (month)	279	257.37 (130.62)
Marriage	278	
Single	2	0.72 %
Married/Cohabited	221	79.50 %
Separate/Divorced	30	10.79 %
Widowed	24	8.63 %
Other	1	0.36 %
Education	272	
Primary School Graduate	9	3.31 %
Middle School Graduate	10	3.68 %
High School Graduate	110	40.44 %
College Graduate	121	44.49 %
Graduate School Graduate	22	8.09 %
Income	256	
< $20,000	42	16.41 %
$20,000 - $39,999	62	24.22 %
$40,000 - $59,999	71	27.73 %
$60,000 - $79,999	39	15.23 %
$80,000 - $99,999	23	8.98 %
≥ $100,000	19	7.42 %
Economic Status	276	
Very Bad	10	3.62 %
Bad	50	18.12 %
Moderate	173	62.68 %
Good	30	10.87%
Very Good	13	4.71 %
English Level	281	
Very Bad	39	13.88 %
Bad	106	37.72 %
Moderate	107	38.08 %
Good	22	7.83 %
Very Good	7	2.49 %
Insurance	275	
No	76	27.64 %
Yes	199	72.36 %

Table 2.

Breast cancer screening history ($N = 281$)

When did you undergo mammography?	*n* (%)
Mammography within 1 year	66 (23.49%)
Mammography within 2 years[a]	98 (34.88%)
Mammography ever[a]	196 (69.75%)
Not reported	19 (6.76%)

[a]Cumulative results

Table 3.

PAPM stage of breast cancer screening adoption

Mammography Group	PAPM Stage	*n* (%)
Pre-Adoption	Stage 1: Unaware	62 (22.30%)
	Stage 2: Unengaged	8 (2.88%)
	Stage 3: Deciding	1 (0.36%)
Refusal	Stage 4: Decided No	9 (3.24%)
Adoption	Stage 5: Decided Yes	2 (0.72%)
	Stage 6: Action	130 (46.76%)
	Stage 7: Maintenance	66 (23.74%)
Total		278

Table 4.

Characteristics by PAPM stage of breast cancer screening adoption[a]

Panel A. Categorical Variables				
Characteristics	**Pre-Adoption[b] (*N* = 71)**	**Refusal[c] (*N* = 9)**	**Adoption[d] (*N* = 198)**	***P* value[f]**
	***n*[e] (%)**	***n*[e] (%)**	***n*[e] (%)**	
Age				
40 – 54	27 (38.03%)	5 (55.56%)	73 (36.87%)	0.177
				(0.184)
55 – 64	21 (29.58%)	3 (33.33%)	83 (41.92%)	
65 – 80	23 (32.39%)	1 (11.11%)	42 (21.21%)	
Highest level of education				
< Bachelor's degree	43 (62.32%)	3 (33.33%)	82 (42.93%)	**0.015**
				(0.014)
≥ Bachelor's degree	26 (37.68%)	6 (66.67%)	109 (57.07%)	
Economic Status				
Bad	19 (26.76%)	2 (25.00%)	38 (19.59%)	0.731
				(0.712)
Moderate	43 (60.56%)	5 (62.50%)	123 (63.40%)	
Good	9 (12.68%)	1 (12.50%)	33 (17.01%)	
Income				
< $20,000	15 (24.59%)	1 (11.11%)	26 (14.13%)	0.226
				(0.191)
$20,000 - $39,999	10 (16.39%)	2 (22.22%)	49 (26.63%)	
$40,000 - $59,999	21 (34.43%)	3 (33.33%)	47 (25.54%)	
$60,000 - $79,999	7 (11.48%)	1 (11.11%)	31 (16.85%)	
$80,000 - $99,999	2 (3.28%)	2 (22.22%)	18 (9.78%)	
≥ $100,000	6 (9.84%)	0 (0.00%)	13 (7.07%)	
Marital Status				
Married or living with partner	20 (28.57%)	1 (11.11%)	36 (18.27%)	0.145
				(0.157)
Not married or with partner	50 (71.43%)	8 (88.89%)	161 (81.73%)	
English Level				
Very Bad / Bad	44 (61.97%)	6 (66.67%)	93 (46.97%)	0.169
				(0.149)
Moderate	23 (32.39%)	2 (22.22%)	81 (40.91%)	
Very Good / Good	4 (5.63%)	1 (11.11%)	24 (12.12%)	
General Health (self-reported)				

Panel A. Categorical Variables				
Characteristics	**Pre-Adoption[b] (*N* = 71)**	**Refusal[c] (*N* = 9)**	**Adoption[d] (*N* = 198)**	***P* value[f]**
	***n*[e] (%)**	***n*[e] (%)**	***n*[e] (%)**	
Very Bad / Bad	3 (4.35%)	0 (0.00%)	20 (10.20%)	0.437 (0.507)
Moderate	45 (65.22%)	5 (55.56%)	119 (60.71%)	
Very Good / Good	21 (30.43%)	4 (44.44%)	57 (29.08%)	
Health Insurance				
No	25 (36.23%)	3 (33.33%)	48 (24.74%)	0.176 (0.180)
Yes	44 (63.77%)	6 (66.67%)	146 (75.26%)	
Doctor Recommendation				
No	39 (59.09%)	6 (75.00%)	64 (34.97%)	**< 0.001 (< 0.001)**
Yes	27 (40.91%)	2 (25.00%)	119 (65.03%)	
Regular Medical Check-up				
Every year	47 (69.12%)	8 (88.89%)	104 (53.06%)	**0.011 (0.011)**
Not every year	21 (30.88%)	1 (11.11%)	92 (46.94%)	
Family Cancer History				
No	41 (58.57%)	3 (33.33%)	93 (46.97%)	0.153 (0.143)
Yes (any kind of cancers)	29 (41.43%)	6 (66.67%)	105 (53.03%)	
Panel B. Continuous Variables				
Characteristics	Pre-Adoption[b] (*N* = 71)	Refusal[c] (*N* = 9)	Adoption[d] (*N* = 198)	*P* value[f]
	Mean (SD)	Mean (SD)	Mean (SD)	
Knowledge[g]	−0.57 (0.63)	0.14 (1.27)	0.22 (1.02)	**< 0.001**
Self-Efficacy[g]	−0.44 (0.96)	−1.03 (0.69)	0.21 (0.94)	**< 0.001**
Decisional Balance[g]	−0.55 (1.12)	−0.51 (0.66)	0.21 (0.90)	**< 0.001**

[a] Based on adherence to annual mammography.

[b] Pre-Adoption: PAPM stages 1, 2, and 3 / Refusal: PAPM stage 4 / Adoption: PAPM stages 5, 6, and 7

[c] Pre-Adoption: PAPM stages 1, 2, and 3 / Refusal: PAPM stage 4 / Adoption: PAPM stages 5, 6, and 7

[d] Pre-Adoption: PAPM stages 1, 2, and 3 / Refusal: PAPM stage 4 / Adoption: PAPM stages 5, 6, and 7

[e] Sample sizes for individual characteristics may not equal total due to missing values

[f] Chi-squared test for categorical variables (*p*-values for Fisher's exact test in parenthesis) and F-test for continuous variables

[g] Standardized scores

Table 5.

Multiple logistic regression analysis of factors associated with breast cancer screening adoption[a, b, c]

Characteristics	Adoption (Stage 5/6/7) vs. Pre-Adoption (Stage 1/2/3)		
	OR	**(95% CI)**	***P* value**
BC Knowledge[d]	**4.70**	**(1.68 – 13.17)**	**0.0033**
BC Self-Efficacy[d]	1.12	(0.66 – 1.90)	0.6856
BC Decisional Balance[d]	**1.96**	**(1.18 – 3.24)**	**0.0091**
Health Insurance (Ref: No health insurance)	0.57	(0.22 – 1.49)	0.2522
Doctor recommendation (Ref: No doctor recommendation)	1.53	(0.65 – 3.61)	0.3347
Annual Medical Check-up (Ref: No annual check-up)	**4.09**	**(1.32 – 12.69)**	**0.0147**
Family Cancer History (Ref: No family cancer history)	1.02	(0.43 – 2.42)	0.9576
Number of Observations	187		
Wald χ^2	52.57***		
Hosmer-Lemeshow χ^2	4.71		
Pseudo R^2	0.3412		

[a]Age, marital status, self-reported health status, income level, education level, English level, and length in the US are included as control variables. The constant term is also included.

[b]Heterogeneity robust standard errors are used.

[c]The reference group in Model 1 is the Pre-Adoption Group.

[d]1 SD change

*p < 0.05

**p < 0.01

***p < 0.001