

Health beliefs and practices related to breast cancer screening in Filipino, Chinese and Asian-Indian women

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Accepted 9 June 2005

Abstract

Background: Cultural-appropriate strategies can be designed to promote cancer screening if the unique needs and characteristics of ethnic groups are identified. Most of the data available for Asian immigrants living in the U.S. has been aggregated under the Asian-American/Pacific Islanders (AAPI) ethnic category. **Methods:** A total of 125 women completed self-administered questionnaires that assessed screening practices (i.e. breast self-exam, clinical breast exam, and mammography), related beliefs and knowledge. This paper reports examined cancer-related practices and beliefs among three subgroups of Asian-American women (47 Filipinos, 40 Chinese, and 38 Asian-Indians). **Results:** The sample mean age was 50.2 years and majority of women (76%) were married. Their length of residence in the United States ranged from less than one year to 37 years, with an average length of residence of 18 years. Results from two-way analyses of variance (ANOVAs) showed the strong influence of ethnicity on perceptions of susceptibility [$F(2, 95) = 5.11, p = 0.01$] and seriousness [$F(2, 99) = 4.85, p = 0.01$] related to breast cancer, in addition to an interaction detected between ethnicity and income in terms of perceived barriers [$F(5, 107) = 3.04, p = 0.01$]. The results also indicated that three common barriers were reported in all three ethnic groups, and three unique barriers were more frequently identified by Chinese (i.e. do not need mammogram if I feel ok [OR = 5.450, 95%; CI = (1.643, 18.081)] and waiting time is too long [OR = 5.070, 95%; CI = (1.674, 15.351)]) and Asian-Indian women (i.e. do not know where to get a mammogram [OR = 9.237, 95%; CI = (3.153, 27.059)]). **Conclusions:** These findings can be used to develop interventions that are tailored to the special characteristics of immigrant women from different Asian groups.

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Keywords: Asians (Asian-Americans); Health belief model; Clinical breast exam; Mammography; Screening practices; Breast cancer screening; Demographic characteristics; Education level; Annual income; Perceived susceptibility; Perceived benefits; Perceived barriers; Ethnicity; Study limitations

1. Introduction

The Asian-American population is the fastest-growing ethnic group in the United States. According to the 2000 U.S. census, 11.9 million people identified themselves as Asian, representing about 4.2% of the U.S. population [1]; similarly in Michigan, the Asian population reached more than 208,000 in 2000, a 101.3% increase from 1990 [2,3],

and now is one of the largest minority groups in the state. Although the leading cause of mortality in Asian-American men is heart disease, for Asian women, cancer is the leading cause of death for Asian women, with the breast being the most frequent cancer site for Chinese-American (55/100,000), Filipino-American (73/100,000), and Korean-American (29/100,000) women [25]. Currently, there are no data available for cancer mortality among Asian-Indian-American women.

In the United States, there is increased attention on the need to reduce racial and ethnic disparities in health care.

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Disparities that have been documented include unequal access to screening, diagnosis, and medical treatment; this has contributed to poorer health care outcomes among medically underprivileged ethnic groups [4]. Despite this, the data for Asian-Americans is relatively limited, and the special needs and characteristics of cancer prevention and control for Asian-Americans have been largely overlooked. Most of the data available for Asian immigrants living in the U.S. has been aggregated under the Asian-American/Pacific Islanders (AAPI) ethnic category. This population group includes Chinese, Filipinos, Koreans, Japanese and Asian-Indians; and Pacific Islanders, including groups such as Hawaiians, Samoans, and Fijians. It is clear that the AAPI population category represents individuals from diverse countries and geographic locations with different languages, religions, cultures, and lifestyles. Nevertheless, the least amount of baseline data is on Asian and Pacific Islanders in *Healthy People 2000* compared to other racial and ethnic groups with the fewest objectives [5]. In addition, Asian-American/Pacific Islanders were not discussed within the topic of breast cancer screening among racial/ethnic minorities [6], and only a few surveys included sufficient sample sizes of Asian and Pacific Islanders [7–9].

According to Kagawa-Singer and Pourat, a secondary analysis of data collected in the National Health Interview Survey (NHIS, 1993, 1994) found that breast cancer screening rates for AAPIs were below those for white women and well below established national objectives and guidelines [10]. The study also indicated that even with higher income, more education and better insurance coverage, AAPI women and their subgroups still have lower rates on both cervical and breast cancer screening. In addition, Asian women diagnosed with breast cancer were more likely to receive a diagnosis at a later stage and to have larger tumors at the site than white women [11,12]. Issues on cancer prevention and control for Asian and Pacific Islanders are of prominent concern because of the unsurpassed growth rates in the U.S. of this population group and their low cancer screening rates. Health education programs, including those that promote early detection, will result in cancers being detected earlier and more effective treatment if the needs and characteristics of these ethnic groups are treated uniquely so culturally appropriate strategies can be designed and implemented.

There are limited national studies that have reported on the comparison of mammography screening rates for specific groups of Asian-American women [10,13]. Tu and colleagues employed a prospective cohort study design to investigate and compare the breast cancer screening practices of four subgroups of Asian-Americans – Chinese, Japanese, Vietnamese, and Korean – with a group of non-Asian women enrolled in a Breast Cancer Screening Program (BCSP) in the state of Washington [13]. The participants in this study did not have any out-of-pocket costs for mammography screening. The study found that despite the lack of financial barriers, the Asian-American

women in this study still were less likely to enroll in a breast screening program (Odds ratio = 0.53, 95% CI = 0.43–0.64). When aggregating the data, these Asian-American women had similar participation rates as non-Asian women; however, when the data were analyzed separately for each Asian subgroup, there were variations among the Asian-American groups. In this study, older Chinese-American women with health insurance had lower mammography participation rates than non-Asian women. The authors suggested evaluating additional cultural barriers to mammography participation.

The health belief model (HBM) has been widely used to examine beliefs related to breast cancer screening behaviors, such as receipt of breast self-examination (BSE), clinical breast examination (CBE), and mammography [14]. Based on the HBM, individuals are more likely to engage in preventive health behaviors if they perceive themselves to be susceptible to a certain disease/illness (perceived susceptibility), perceive the condition to have potentially serious consequences (perceived severity), believe that a course of action will produce positive outcomes (perceived benefits), or perceive that obstacles or barriers to taking actions are outweighed by the benefits. Previous studies that applied the HBM to breast cancer screening have provided evidence that HBM variables are associated with this behavior [15]; however, the majority of these studies were conducted with white and African-American subjects [15] and only two studies have considered Chinese and Asian-Indian women [16].

The purpose of this study was to identify differences between ethnic groups of Asian-American women (i.e. Chinese, Filipino, and Asian-Indian women) in perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers for engaging in breast cancer screening after controlling for income level. Based on our previous experiences working with Asian immigrants, we have found that many immigrants come to the U.S. with high education levels; however, their incomes or occupations in the U.S. do not reflect their educational backgrounds. Therefore, we decided to use income (instead of education) as an indicator of subjects' social economic status. The information obtained from this study may provide health professionals with recommendations on approaches to assist these women to receive recommended breast cancer screening examinations and to reduce differences in screening practices compared to other ethnic groups.

The following hypotheses were tested in this study:

1. There are significant differences in Chinese, Filipino and Asian-Indian women in perceived susceptibility, perceived seriousness, perceived benefits and perceived barriers to the receipt of mammography, after controlling for income level;
2. There are different salient barriers identified by these three Asian groups after controlling for the level of income.

2. Methods

2.1. Study design

The current project used a cross-sectional descriptive design to examine differences in health beliefs (i.e. perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers) toward breast cancer screening in Filipino, Chinese, and Asian-Indian women. Prior to data collection, the study was approved by the Institutional Review Board (IRB) for human subjects of Eastern Michigan University. Participants provided written consent before completing the survey questionnaire. Eligibility criteria for participants of this study were: (a) women who are currently living in southeastern Michigan and who identified themselves as being from one of the following ethnic groups—Chinese/Taiwanese, Filipino, or Asian-Indian American; (b) 30 years of age or older; and (c) able to communicate either in English or their native language.

2.2. Study sample

The current study focused on women of Asian origin from China, Taiwan, the Philippines, and India who live in southeastern Michigan. The Asian population in Michigan is concentrated in the southeastern region; therefore, the research site included the five Michigan counties with the largest Asian population—Livingston, Macomb, Oakland, Wayne, and Washtenaw. According to the 2000 U.S. census, the numbers of immigrant women aged 30 and older living in Michigan who identified themselves as being Chinese, Filipino, and Asian-Indian were 8925, 6538 and 11,778, respectively. These three ethnic groups are the three most populous Asian groups in Michigan.

To recruit eligible women to participate in this study, several innovative strategies were used, including: (1) collaborating with the local community, ethnic social groups,

professional organizations, and religious associations to distribute information to their members; (2) collaborating with student ethnic associations at local universities to recruit their mothers and other female relatives into the study; (3) posting flyers at community ethnic grocery stores, restaurants, beauty salons, etc.; (4) making presentations and volunteering at local ethnic celebrations (e.g. New Year celebration, Mid-Autumn festival).

The survey was either mailed to study participants or filled out by subjects at the locations where recruitment took place. The convenience sample consisted of 125 women whose ages ranged from 31 to 78 years (mean = 50.2 years, S.D. = 11.1). For the Chinese women ($n = 40$), about 70% ($n = 28$) originally came from Taiwan, 29% ($n = 11$) were from mainland China, and one woman was from Hong-Kong. The majority of subjects (76%) were married. Their length of residence in the United States ranged from <1 to 37 years, with an average length of residence of 18 years. For about 67% of these women, their annual household income was greater than \$50,000; 47% of the women had a college education and 67% of the women were currently working or students. Ninety-one percent of the participants reported having health insurance. Demographic differences between the three Asian groups are provided in Table 1. The results of a one-way analysis of variance (ANOVA) indicated that age and ethnic group are highly associated [$F(2, 119) = 12.0$, $p < 0.01$]; in particular, the Chinese women were somewhat younger (mean age = 44.2 years), and the Filipino women were older (mean age = 55.1 years). Despite the fact that the Filipino women had the highest annual income, with 75% of their households earning more than \$50,000, there were no statistical differences between the three groups in terms of annual household income. In terms of educational backgrounds, the majority of women in all three groups have college degrees; however, Filipino women were significantly less likely to attend graduate school (Table 1). The education levels were relatively similar for the Asian-Indian and

Table 1
Demographic characteristics of the three Asian groups in the sample ($N = 125$)

Characteristics	Filipino ($n = 47$)	Chinese ($n = 40$)	Asian-Indian ($n = 38$)	Test statistics, p -value*
Age (mean)	55.1 (S.D. = 8.6)	44.2 (S.D. = 10.1)	50.3 (S.D. = 12.0)	$F(2, 119) = 12.0$, $p < 0.01$
>50 years	85%	16%	57%	$\chi^2(2) = 40.9$, $p < 0.01$
Married	68%	83%	79%	$\chi^2(2) = 2.7$, $p = 0.26$
Income				$\chi^2(6) = 9.2$, $p = 0.16$
<\$15,000	19%	10%	30%	
\$15,000–24,999	0%	8%	3%	
\$25,000–49,999	6%	10%	3%	
≥\$50,000	75%	72%	64%	
Education level				$\chi^2(8) = 30.5$, $p < 0.01$
Less than high school	9%	0%	5%	
High school graduate	6%	8%	10%	
College level	72%	32%	32%	
Graduate level	13%	60%	53%	

Note: The category, less than high school, includes the category of no formal education.

* F -statistic and p -value are based on the results of a one-way ANOVA; remaining p -values arise from χ^2 -tests of association between ethnic group and the characteristic of interest.

Chinese/Taiwanese groups, although more Indian women had an education level of less than high school. In other words, the Asian-Indian women had more heterogeneous status than the Chinese women for education level; i.e. the levels of education in Asian-Indians were distributed in all four categories. The sample had a relatively high education background, which could be due to the proximity to several colleges and universities in southeastern Michigan.

2.3. Measures

The questionnaire used in this study was developed and tested in a previous study to assess four health belief model constructs: perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers related to breast cancer screening in Chinese-American women [17]. The four subscales had Cronbach's- α ranging from 0.77 to 0.90, which indicates high internal consistency of the items forming the subscales. These measures of internal consistency are similar to those found in other studies applying the HBM to non-Asian populations. Construct validity was supported by exploring the factor structure of the instrument using confirmatory factor analysis; the results demonstrated acceptable to excellent overall model fit for the four subscales. In addition, predictive validity was established by testing the hypothesized relationships between the four subscales and mammography practice using Biserial correlation and regression analysis. The results showed that the perceived seriousness subscale and the perceived barriers subscale were both significantly correlated with mammography use ($r = 0.21$ and -0.46 respectively, $p < 0.05$). Details on individual items and the process of questionnaire development have been published elsewhere [17].

The questionnaire has a total of 34 items (four items in the perceived susceptibility subscale; seven items in the perceived seriousness subscale; five items in the perceived benefits subscale, and 17 items in the perceived barriers subscale). Possible responses to the items ranged from one (strongly agree) to four (strongly disagree). Each subscale was scored by calculating the means of all item scores (scoring range of 1–4). Screening behavior was assessed by women participants' self-report on breast self-examination (BSE), clinical breast examination (CBE), and mammography. Women were asked whether they had ever had any of these three modalities of breast cancer screening, and if so, the length of time since their last screening/examination. They also were asked whether they had ever heard of these breast cancer screening modalities.

The questionnaire first was developed in English and then was translated into the three native languages, Mandarin, Tagalog, and Hindu, using the standard back translation technique. All the questionnaire items and instructions were assessed to be at or below the eighth grade reading level using Microsoft Word's (version 2000) readability program.

2.4. Data analysis

Data from the 125 completed questionnaires were coded and entered into the statistical package for social sciences (SPSS) version 12.0. In order to test hypothesis 1, the data were analyzed using two-way analysis of variance (ANOVA) on the scores of the perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers subscales. The main and interaction effects of ethnicity (Chinese/Taiwanese, Filipino, and Asian-Indian) and annual household income (four levels: $< \$15,000$; $\$15,000$ – $24,999$; $\$25,000$ – $59,999$; $> \$50,000$) on these subscales were examined. Next, in order to elucidate specific barriers to cancer screening for each ethnic group, the top five barrier items were ranked using the mean scores for the specific barrier items. Logistic regression was performed to determine whether the presence (in terms of agreeing that the barrier is present) of these five salient barriers could be explained by income level or ethnicity. For this purpose, the five barrier items were recoded into dichotomous variables (agree (1) versus disagree (0)) and used as dependent variables. The independent variables considered in the logistic regression models were income level and ethnicity. The variables measuring age and education were not considered as independent variables in the multivariate analyses, due to their high correlation with the ethnicity variable (see Table 1 and Section 4.4). The primary results of the analyses presented in Sections 3.2 and 3.3 did not change when adjusting for age and education in secondary analyses.

2.5. Power analysis

Power analyses for this study were conducted using the nQuery Advisor 5.0 software package. Analyses indicated that given a sample size of 30 in each of three groups (or $n = 90$ total), a two-way analysis of variance with a 0.05 significance level will have more than 90% power to detect effect sizes of 0.2 corresponding to the main effects of ethnicity and income and the interaction effect between ethnicity and income. These effect sizes have been defined by Cohen [18] to be small to moderate, meaning that the present study ($n = 125$; see Table 1 for a breakdown by ethnic group) will have ample power to detect effects of interest in the two-way analysis of variance [18]. Analyses also indicate that given a sample size of 125, a comparison of proportions in the three groups will have more than 80% power to detect an effect size of 0.1 (defined by Cohen as small to moderate), meaning that the study will also have ample power to detect effects of interest when comparing the proportions in the groups (see Table 2). For the subgroup of women age 40 and older ($n = 94$; see Table 2), a χ^2 -test with a 0.05 significance level will have 87% power to detect a difference in proportions characterized by an effect size of 0.15, defined by Cohen as a small-to-moderate-sized effect.

Table 2
Breast cancer screening practice of sample for three Asian groups ($N = 125$)

	Filipino ($n = 47$) (%)	Chinese ($n = 40$) (%)	Asian-Indian ($n = 38$) (%)	χ^2 -test, p -value
BSE frequency (monthly)	51	23	5	$\chi^2(2) = 22.7, p < 0.01$
BSE knowledge	69	64	n.a.	$\chi^2(1) = 0.3, p < 0.62$
CBE interval ^a	69	62	48	$\chi^2(2) = 3.2, p = 0.21$
CBE knowledge accuracy ^b	30	30	n.a.	$\chi^2(1) = 0.0, p = 0.96$
Mammogram interval ^a	71	57	70	$\chi^2(2) = 1.3, p = 0.51$
Mammogram knowledge accuracy ^b	48	60	53	$\chi^2(2) = 1.3, p = 0.53$

Note: For CBE and mammography interval measures, percentages were restricted to women age 40 and older ($n = 94$ total; 45 Filipino women, 22 Chinese women, and 27 Indian women); n.a., data not available for this group.

^a The percentages in these two categories indicate the percentage of women whose last mammography was taken within the last 2 years and last CBE within a year or less.

^b The percentage in knowledge items were calculated for women who could accurately identify the correct age to begin having an annual CBE and mammography according to recommendations of the American Cancer Society (ACS) and the National Cancer Institute.

Table 3
Descriptive statistics for the four health belief model dependent variables ($N = 125$)

Variable	Filipino ($n = 47$)	Chinese ($n = 40$)	Asian-Indian ($n = 38$)
Perceived susceptibility	2.83 (S.D. = 0.88)	3.12 (S.D. = 0.63)	2.19 (S.D. = 0.99)
Perceived seriousness	3.12 (S.D. = 0.70)	3.30 (S.D. = 0.59)	2.52 (S.D. = 0.74)
Perceived benefits	3.60 (S.D. = 0.51)	3.73 (S.D. = 0.34)	3.86 (S.D. = 0.29)
Perceived barriers	1.49 (S.D. = 0.54)	1.80 (S.D. = 0.73)	1.91 (S.D. = 0.77)

Note: For all four cognition subscales (i.e. perceived susceptibility, perceived seriousness, perceived benefits and perceived barriers), the mean scores ranged from 1–4 with 1, strongly disagree and 4, strongly agree.

3. Results

3.1. Breast cancer screening practices

Although the majority of these women (91%) reported that they have heard of breast self examination, their perception of the recommended frequency for BSE varied greatly, ranging from as often as during every bath, to weekly, bi-weekly, monthly, and as often as possible. Despite the fact that the majority (67%) of these women correctly responded that BSE should be performed monthly, only 28% of the women in this sample reported following the American Cancer Society's recommendation of performing a BSE once a month. The percentage of subjects who followed this ACS recommendation varied greatly between the three groups, ranging from five for Asian-Indian women to 51% for Filipino women (Table 2). For the women aged 40 and older, 59% reported their last clinical breast examination was a year ago or less, and 64% had received a mammogram within the past 2 years. Fewer than 60% of the Asian-Indian and Chinese women age 40 and up reported they had an up-to-date CBE and mammogram, respectively (Table 2). The data also showed that it is more likely for those women who have resided in the U.S. for 10 years or longer to report regular mammogram practices than those who were more recent immigrants ($\chi^2(1) = 63.6, p < 0.05$). No such trends were seen in CBE and BSE practices related to the length of U.S. residency.

3.2. Cancer-related beliefs, ethnicity and income

Hypothesis 1 aimed to identify differences in the health belief model (HBM) dependent variables of perceived susceptibility, seriousness, benefits, and barriers between the groups defined by the independent variables of ethnicity (three groups) and income (four levels). In this analysis, two types of effects were examined: main effects of the two independent variables, and the two-way interaction effect. The descriptive statistics for the four HBM subscales are presented in Table 3. Chinese women had the highest mean score for the perceived susceptibility and seriousness subscales, while Asian-Indian women had the highest mean score for the perceived benefits and perceived barriers subscales. Two-way ANOVAs were performed to examine the effects (both main and interaction) of ethnicity and income on the four HBM subscales.

The main effects were assessed to identify the effects of ethnicity on the four cognition subscales, i.e. perceived susceptibility, perceived seriousness, perceived benefits and perceived barriers. For the subscale of perceived susceptibility, a main effect was found for ethnicity [$F(2, 95) = 5.11, p = 0.01$] and the results from post-hoc pairwise comparisons of the means using Tukey's test showed that the Filipino and Chinese women had significantly higher levels of perceived susceptibility than the Asian-Indian women. For perceived seriousness, there was also a main effect for ethnicity [$F(2, 99) = 4.85, p = 0.01$]. A similar trend was found for this subscale; that is, the Filipino and Chinese

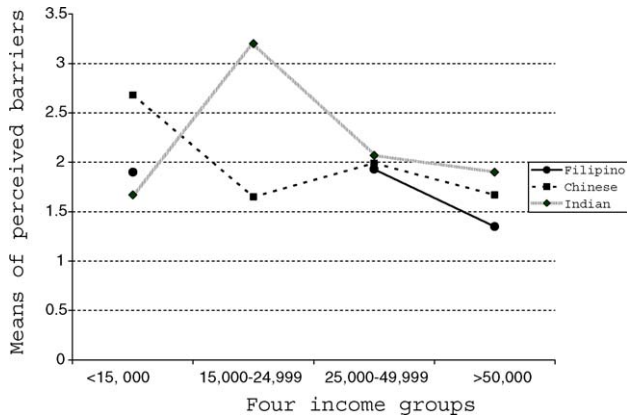


Fig. 1. Main and interaction effects of ethnicity and income on perceived barriers.

women had significantly higher levels of perceived seriousness than the Asian-Indian women. No significant differences were found when considering perception of benefits for the three groups. For the subscale of perceived barriers, the results showed that differences in the mean barrier scores came from the interaction between ethnicity and income [$F(5, 107) = 3.04, p = 0.01$]; in other words, the relationships of income with perceived barriers were not consistent across the three ethnic groups (Fig. 1). Although there was a trend that women with higher incomes had fewer perceived barriers, two exceptions occurred when a relatively lower income group (\$15,000–24,999) of Chinese women had the lowest perception of barriers and the lowest income group of Asian-Indian women reported lowest levels of barriers (Fig. 1). Lower income (\$15,000–24,999) Indian women had the highest perception of barriers.

3.3. Salient barriers by Filipino, Chinese and Asian-Indian women

Hypothesis 2 aimed to identify the salience of different barriers for these three Asian groups and to examine if differences in perceived barriers continued to exist after controlling for income level. To elucidate specific barriers to mammography perceived by these three groups, the top five barriers were identified by calculating the mean score for

each of the 17 barrier items. The mean scores were then compared within these three groups, and the top five barriers were identified for each ethnic group based on the values of mean scores. The results showed that three barriers were common across all three groups: being examined by a male practitioner, having the breast touched by a stranger, and being exposed to unnecessary radiation (Table 4). The barrier “having a mammogram will be painful” also was identified by both Filipino and Asian-Indian women as the most common and fourth barrier, respectively. Unique items were also identified as specific barriers by particular ethnic groups, but not reported as top five barriers by the other two ethnic groups. For example, the item “afraid that mammogram will find cancer” was important for Filipino women; the items “do not need mammogram if I feel ok” and “waiting time is too long” were frequently identified as barriers by the Chinese women; and “do not know where to get a mammogram” was a common barrier for the Asian-Indian women.

In order to determine if the ethnicity or income levels predicted the likelihood of agreeing that any of the four identified barrier items (i.e. afraid mammograms will find cancer, do not need mammogram if I feel ok, waiting time is too long, and do not know where to get a mammogram) was in fact a barrier, logistic regression analyses were performed on each of the four recoded dichotomous barrier items using ethnicity and income level as predictors. The results showed that income level did not appear to predict agreement with any of the four unique barriers; however, the odds of agreeing were found to vary significantly across ethnic groups for three out of the four barrier items. Chinese women are five times more likely than others to identify “do not need one if I feel ok” as a barrier [OR = 5.450, 95%; CI = (1.643, 18.081)], controlling for income. Chinese women are also five times more likely than others to identify “waiting time too long” as a barrier [OR = 5.070, 95%; CI = (1.674, 15.351)], controlling for income. Asian-Indian women are nine times more likely than others to say “do not know where to find mammogram” as a barrier [OR = 9.237, 95%; CI = (3.153, 27.059)], controlling for income. The odds of agreeing with the barrier item “being afraid that a mammogram would find cancer” did not vary significantly across the ethnic groups.

Table 4
Top five barriers for mammography screening for Filipino, Chinese, and Asian-Indian women (N = 125)

Statement from barrier subscale	Filipino (n = 47)		Chinese (n = 40)		Asian-Indian (n = 38)	
	Rank	Mean (S.D.)	Rank	Mean (S.D.)	Rank	Mean (S.D.)
Mammogram is not needed when I feel ok	–	–	3	2.09 (1.09)	–	–
Do not know where to get a mammogram	–	–	–	–	2	2.60 (1.38)
Waiting time for mammogram is too long	–	–	4	2.04 (0.96)	–	–
Afraid mammogram will find cancer	3	1.74 (1.09)	–	–	–	–
It is difficult to be examined by a male practitioner	5	1.70 (1.01)	1	2.26 (1.24)	3	2.39 (1.23)
It is uncomfortable to let strangers touch my breasts	2	1.84 (1.08)	2	2.13 (1.02)	1	2.72 (1.20)
Having mammogram will be painful	1	2.10 (1.19)	–	–	4	2.38 (1.34)
Mammogram would expose me to unnecessary radiation	5	1.70 (1.01)	5	2.00 (1.04)	5	2.19 (1.19)

4. Discussion

4.1. Breast cancer screening practices and knowledge

This study was one of the few to investigate and compare similarities and differences in breast cancer-related practices and beliefs among specific subgroups of Asian-American women. While participants in the current study were relatively highly educated and the majority had health insurance, the mammography screening rate still was below the *Healthy People 2010* target rate of 70%; Chinese women (57%) had relatively lower rates for mammography screening during the past 2-year interval. However, the percentage for regular mammography screening dropped to 40% for those more recent immigrants who have resided in the U.S. less than 10 years. Consistent with the findings from a qualitative study on cultural views on breast cancer screening practices for Filipino-American women [Wu TY, Bancroft JM. The perceptions and experiences of breast cancer screening for Filipino-American women], this study emphasized the importance and the needs of educating immigrant women on current recommendations of the three modalities for breast cancer screening in the U.S., particularly for those who were from the countries that health care serves primarily for the treatment of acute illnesses.

The study results were similar to results from previous studies that were conducted in these three ethnic groups of women from an integrative literature review [16]; in particular, our reported screening rates in Filipino and Asian-Indian women were higher and at about the median for Chinese women. Interestingly, despite the fact that only 30% of these Filipino and Chinese women were able to identify correctly the age to start having an annual CBE, twice as many women had this examination annually, probably due to the high percentage of these women who had health insurance. The literature on the effectiveness of BSE as a means for detecting breast cancer has been somewhat controversial and has shown mixed results [19–21]; however, the American Cancer Society updated their guidelines in 2003 and encourages women to be aware of how their breasts look and feel so they will be able to recognize any changes and promptly report them [21]. In order to achieve this goal, women need to be taught to practice BSE competently and at the recommended frequency. Only a small percentage of these Asian-Indian and Chinese women reported practicing BSE monthly.

4.2. Cancer-related beliefs, ethnicity and income

This study was conducted to investigate whether there were differences in breast cancer-related beliefs among three subgroups of Asian women. The study findings suggest the strong influence of ethnicity on perceptions of susceptibility and seriousness related to breast cancer. In this study, fewer Asian-Indian women perceived themselves as being vulnerable to getting breast cancer and did not view breast cancer as

a serious illness; this supports the importance of tailoring breast cancer efforts toward this ethnic group. Interestingly, interactions were noted for the mean score of the perceived barrier subscale. These results indicated that the Asian-Indian women with the lowest income level also perceived the fewest barriers to obtaining screening, whereas the Asian-Indian women with more moderate lower income (\$15,000–24,999) had the highest level of barriers. It is likely that majority of women (57%) in the lowest income level group (versus 31% in other income groups) reported not having their regular mammogram screening, therefore, they probably did not encounter the actual barriers experienced in mammogram screening as experienced by the other income groups. However, the mechanism of this phenomenon needs to be further explored and understood. Those Filipino and Chinese women with higher income levels generally reported lower mean barrier scores with an exception in one income group (\$25,000–49,999) of Chinese women.

4.3. Common and unique barriers

In addition, in order to elucidate the most salient barriers that were experienced by these three groups of women, the top five barriers within each ethnic group were identified based on the mean values for 17 barrier items. The results indicated that three common barriers (i.e. being examined by a male practitioner, having the breast touched by a stranger, and being exposed to unnecessary radiation) were reported by all three groups. Similar to a previous study that reported physicians working with South Asian women were reluctant to offer CBE and modesty was reported to be a significant predictor for Asian-Americans performing BSE [22], this study reported that study participants also expressed concerns about being touched and examined by a male practitioner or stranger. It is important for health professionals to establish a trusting relationship with their Asian clients while respecting and protecting their feelings of modesty, so that these women can be adequately screened and given appropriate advice regarding breast health practices. Similar to African-American women who were more likely to identify knowledge-based barriers [23], fear of unnecessary radiation and pain were also reported in the current study. This may indicate that dissemination of factual information about mammography screening to Asian-Americans, in particular, about involved risks and benefits has not been as successful as for other U.S. ethnic groups. Strategies to overcome these barriers may include special attention to help Asian-Americans understand issues of radiation safety and preparation for the discomfort that mammography screening may involve. Unpleasant feelings experienced when having a mammogram can be decreased in Asian women by providing for privacy and gentle handling of the breasts during the procedure.

In addition, this study provides new insights into previous studies on mammography utilization in Asian women. That is, these three groups of Asian women identified unique barriers specifically salient to their particular group. For example,

despite the fact that insurance was not an issue to the Asian-Indian women in this sample, they were about nine times more likely than Filipino and Chinese women to report not knowing where to obtain a mammogram. There is a need to make resources on mammography screening available to this group and to translate educational materials in a culturally-appropriate manner so the information is more accessible to Asian-Indian women. Given the high esteem that these women have for physicians, primary care providers who work with this group are in a key position to inform and refer these women to appropriate mammography screening services. The relationship between early detection and better breast cancer outcomes is important and needs to be emphasized to Chinese women who perceive mammograms and other screening modalities as not being needed if they feel they are in good health.

4.4. Study limitations

This study has several limitations. This study was limited by a small convenience sample, self-selection, and geographic location; therefore, findings only can be generalized to populations with similar characteristics. In addition, the smaller sample size in the subgroup of women age 40 and older ($n = 94$) limited the ability to detect small effects in analyzing CBE and mammography practices in Table 2. Because ethnicity was highly associated with age and educational background in the current convenience sample (Table 1), we did not include these two demographic variables in our multivariate analyses to examine their effects on cancer screening practices. Secondary analyses (both two-way ANOVAs and logistic regression models) indicated that when controlling for age and education as covariates, the results presented in Sections 3.2 and 3.3 did not change in terms of direction or significance level. Additional studies using sampling methodology designed to result in comparable ethnic groups (in terms of age, socioeconomic status, and geographic location) are needed to distinguish between effects of ethnicity and demographic effects in multivariate analyses. The use of women's self-report in CBE and mammography screening was not validated and the validity of these measures among Asian women was not available. Future research should include measures to verify women's reports on screening practices with medical record review.

Despite the limitations, this study provided new insights for understanding the attitudes and practices of breast cancer screening among Filipino, Chinese, and Asian-Indian women residing in the Midwestern United States. In order to be effective, interventions should reflect an understanding of the culture and attitudes (including barriers and facilitators toward screening) among ethnic populations [24]. The interaction in perceived barriers and income noted in this study needs consideration when developing effective interventions. In particular, the intervention programs will need to address specific barriers experienced in different income groups. The similarities and differences in beliefs toward breast cancer

and screening for Filipino, Chinese and Asian-Indian women identified in the current study support the notion that in order to design a culturally-appropriate intervention program, the program content needs to be tailored to the unique needs of these Asian women in order to increase utilization of breast cancer screening modalities by this group.

Acknowledgements

This project was supported by the Faculty Research Fellowship and Graduate Studies and Research Support Fund and Faculty Research Fellowships at Eastern Michigan University.

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