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Associations Between Religion-Related Factors and Breast Cancer Screening Among American Muslims

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Abstract

American Muslims have low rates of mammography utilization, and research suggests that religious values influence their health-seeking behaviors. We assessed associations between religion-related factors and breast cancer screening in this population. A diverse group of Muslim women were recruited from mosques and Muslim organization sites in Greater Chicago to self-administer a survey incorporating measures of fatalism, religiosity, discrimination, and Islamic modesty. 254 surveys were collected of which 240 met age inclusion criteria (40 years of age or

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older). Of the 240, 72 respondents were Arab, 71 South Asian, 59 African American, and 38 identified with another ethnicity. 77 % of respondents had at least one mammogram in their lifetime, yet 37 % had not obtained mammography within the past 2 years. In multivariate models, positive religious coping, and perceived religious discrimination in healthcare were negatively associated with having a mammogram in the past 2 years, while having a PCP was positively associated. Ever having a mammogram was positively associated with increasing age and years of US residency, and knowing someone with breast cancer. Promoting biennial mammography among American Muslims may require addressing ideas about religious coping and combating perceived religious discrimination through tailored interventions.

Keywords

Mammography; Islam; Fatalism; Modesty; Cancer screening disparities

Introduction

Increased mammography screening has contributed to a significant portion of the nearly 20 % decline in breast cancer mortality in the past 20 years [1–4]. However, both the decline in mortality and mammography screening rates are lower in racial and ethnic minorities [1, 5]. The reasons underlying these disparities are subject to intense research and intervention. For instance, structural factors affecting minorities are addressed by providing access to doctors and mammography screening at reduced costs [6]. Interventions such as mobile mammography vans traverse social and access-related barriers by performing screening in community settings. Similarly, community health workers, patient navigators, and peer educators simultaneously address educational and cultural obstacles to mammography [7–9].

Religion-related barriers to screening are much less understood, even though religious values may influence preventive health behaviors in ways that socioeconomic or acculturative factors do not. American Muslims are a diverse group of African Americans (35 %), Arabs (25–30 %) and South Asians (20–25 %) [10, 11] that number between 5 and 7 million [11–14], and appear to be similarly influenced by Islam in their health behaviors [15]. Aside from sharing a God-centered framework of health, diverse groups of Muslims seek Islamic guidance when choosing therapies and take care to maintain Islamic values such as modesty during clinical encounters [16, 17].

Few studies have measured mammography rates among American Muslims, yet nearly all report rates of biennial mammography that are lower than the national averages of 67 % for women over 40 years, 74 % for women between 50 and 74, and the Healthy People 2020 target of 81 % [18, 19]. For example, a Chicago-based survey of 215 Arab and South Asian Muslim women over 40 reported 52 % of respondents had a mammogram in the previous 2 years [20], similar to the 54 % rate found in a California-based study of 180 Muslims [22]. Studies of Iranian women in California note rates between 47 and 81 % of respondents having screening mammography in the past year [21, 22]. Surveys among South Asians and Arabs, a significant proportion of whom are Muslim, also note low screening rates. A study of 160 Asian-Indian women in Detroit reported a 64 % biennial mammography rate [23],

similar to the rates from population-based representative samples in California [24–26]. Another study of 365 Arab women in Detroit yielded a 58 % mammography rate [27]. These low screening rates demonstrate the need to better understand screening barriers among American Muslims.

Conceptual Framework

As there has been little study regarding religious influences upon screening, we sought to assess relationships between several religion-related factors and breast cancer screening in this group. Using the Islamic Influences on Health Behavior Model (IIHB) as a framework for understanding how religious beliefs, values and identity impact cancer screening behaviors we hypothesized that, fatalistic beliefs such as cancer is fated or is a death sentence would be associated with lower screening rates based on findings from other minority groups in the US [28–36]. We further hypothesized that concerns about maintaining modesty would also impede mammography screening as well [16, 17, 37–39]. Additionally, since perceived discrimination may influence how and when breast cancer screening is sought [35, 40–42], we expected this factor to contribute to lower screening rates.

Methods

More than 400,000 Muslims [43] live in the Chicago metro area, and the city hosts several national Muslim civic organizations. We used a community-based participatory research approach in collaborating with the Council of Islamic Organizations of Greater Chicago (CIOGC), a federation of over 60 mosques, Muslim community centers, and social service organizations, and formed a Community Advisory Board (CAB) [44] consisting of three prominent community leaders. Potential CAB members were identified by CIOGC leaders as individuals with prominent advocacy roles in Muslim community health. The PI then met with each candidate to discuss the study and invited them to serve on the CAB. Ultimately three individuals felt they could serving on the CAB by providing feedback on study design and survey instruments, facilitating data collection and dissemination, and assisting with data interpretation. The study was approved by the University of Chicago's Institutional Review Board.

Participant Recruitment and Data Collection

We recruited self-identified Muslim, English-speaking women over the age of 40 from 11 CIOGC-affiliated organizations. We purposively selected sites to achieve near-equal representation of Arab, South Asian, and African American Muslims, and at least one mosque and one non-mosque site for each ethnic/racial group. Participants were invited to complete a self-administered survey, after verbal consent was obtained, and were provided $20 along with materials on breast cancer prevention and free mammography centers.

Survey Measures

Outcome Variables—The three primary outcomes were (1) ever having a mammogram or (2) a clinical breast exam (CBE), and (3) having undergone mammography in the previous 2 years.

Independent Variables—Independent variables covered four domains: Islam-related factors (religiosity, modesty, and perceived religious discrimination in healthcare), fatalism, breast cancer knowledge, and sociodemographic characteristics.

Islam-Related Factors: (1) Religiosity: The first item was the Self-Rating of Religiosity (SRR) item which asks respondents to rate their religiosity along a 10-point scale [45]. The second item, taken from the Hoge Intrinsic Religious Motivation Scale [46], assesses agreement along a 5 point scale with the statement "I try hard to carry my religious beliefs over into all my other dealings in life." Two subscales from the Psychological Measure of Islamic Religiousness (PMIR) were included [47, 48]. The PMIR-Positive Religious Coping and identification subscale measures the extent to which Muslims use religious coping methods (e.g., reading Qur'an) to deal with life stressors [48]. The PMIR-Punishing Allah Reappraisal subscale assesses the belief that obstacles in life are a result of God's punishment. We rephrased items to refer to a "health problem." In our sample, the Islamic Positive Religious Coping and identification Subscale had a Cronbach's α of 0.9, and the Punishing Allah Reappraisal an α of 0.78.

Islam-Related Factors: (2) Modesty: We drew upon our previous qualitative data to develop 8 items, rated along a level of agreement scale, that assessed behavioral and attitudinal components of modesty (see Table 1). The measure's α was 0.83 in our sample.

Islam-Related Factors: (3) Perceived Religious Discrimination in Healthcare: We adapted the seven-item Discrimination in Medical Settings (DMS) scale by replacing the words "other people or others" with "non-Muslims" on three items (e.g., you are treated with less courtesy than non-Muslims) to assess perceived religious discrimination [49, 50]. This measure's α was 0.93.

Fatalism: We used two measures that are associated with breast cancer screening practices [51–53]. The modified Powe Fatalism Inquiry (mPFI) defines fatalism as the belief that cancer is a death sentence, whereas the Religious Health Fatalism Questionnaire (RHFQ) assesses the belief that health outcomes are inevitable and controlled by God [30, 51]. We rephrased items to be relevant for Muslims, and deployed all items from the mPFI, and the Divine Provision and Destined Plan subscales of the RHFQ [51–53]. The mPFI had a Cronbach's α of 0.80, while for the RHFQ—Divine Provision's α = 0.65 and the RHFQ-Destined Plan, 0.85.

Breast Cancer Knowledge: These items were taken from the breast cancer knowledge test (BCKT) [54] and ask participants how breast lumps are found, as well as screening guidelines.

Sociodemographic Descriptors: Several items inquired about characteristics known to predict mammography screening such as having a primary care physician (PCP) recommend a mammogram, marital status, and knowing someone with breast cancer. Additionally, conventional descriptors such as age, ethnicity, country of origin, duration of US residency, household income, level of educational attainment and health insurance status were included.

Data Analyses

254 surveys were collected of which 14 were from women younger than 40 years of age. Since mammography screening guidelines only apply to women over the age of 40 (or 50 according to some authorities) we discarded the 14 surveys from women younger than 40 years. The remaining 240 surveys constituted our respondent pool and were independently entered into Research Electronic Data Capture software by two research assistants [55]. Nineteen women reported having had breast cancer. While responses from these participants were retained in nearly all of our analyses, they were removed from models predicting biennial mammography adherence because this particular screening guideline does not apply to women with a history of breast cancer. Summed scores for the modesty scale, the DMS, the PMIR subscales, the mPFI, and RHFQ subscales were all transformed by assigning each response category a numerical value between 0 and 10. Correct responses to the BCKT items were each accorded a value of one, thereby yielding summed scores from 0 to 3.

Using STATA/SE 12.1 software, logistic regression models were employed to test the associations between all independent variables and each of the outcome variables in bivariate fashion and yielding unadjusted odds ratios. Variables from the two main domains of interest: Islam-related factors (religiosity, modesty, and perceived religious discrimination in healthcare) and fatalism that were found to be associated with outcomes at the level of $p < 0.1$ on bivariate analysis were next placed into single multivariate models (A, B, C, etc.) by adjusting for sociodemographic characteristics and breast cancer knowledge (where these variables were also significant at the $p < 0.1$ level) so as to test for an independent association with cancer screening outcomes. When there were multiple different variables within a specific domain, for example the modified Powe and the RHFQ measures of fatalism, each was entered into a separate multivariate regression model so as to avoid multicollinearity. To further avoid multicollinearity only the variable associated with having a PCP, and not referral to mammography by a PCP, was placed into multivariate models predicting breast cancer screening outcomes, and other clinical outcomes (pap smear and CBE status) were also similarly excluded from multivariate models. However, the results of bivariate testing, i.e., the unadjusted odds ratios, are reported in the tables. Interaction terms between sociodemographic variables were analyzed and interpreted when significant.

Results

Participant Characteristics (Table 2)

One hundred and ninety out of two hundred and thirty-three respondents (82 % of 233 respondents) reported having had a CBE at least once in their lifetime, while 181 (77 % of 234 respondents) had obtained a mammogram at least once in their life. Eighty-five women (36 % of the 234 respondents) did not have a mammogram in the past 2 years. One hundred and fifty-two respondents (71 % of 215) marked their religiosity between 8 and 10 on a 10-point scale, while 162 (73 % of 223) completely agreed with the statement “I try hard to carry my religious beliefs over into all my other dealings in life,” and 191 (84 % of 227) completely agreed with “maintaining Islamic modesty is important to me.”

Factors Associated with Ever Having a Mammogram (Table 3)

Factors Related to Islam—The PMIR-Punishing Allah Reappraisal (OR 0.87; $p < 0.01$) subscale was significantly associated with ever having a mammogram on bivariate analysis, but not in multivariate models adjusted for sociodemographic characteristics (Model B). All other factors were not significant on bivariate testing.

Fatalism—The mPFI and RHFQ-Divine Provision scales had statistically significant relationships with ever having a mammogram on bivariate analyses (OR 0.79; $p < 0.01$; OR 0.84; $p < 0.01$ respectively), but were no longer significant after adjusting for sociodemographics (Model C and D).

Sociodemographic Variables and Breast Cancer Knowledge—Participants who were older (OR 1.1; $p < 0.01$), lived in the US longer (ORs between 5 and 5.2; $p < 0.01$), had higher levels of education (ORs between 3 and 7; $p < 0.05$), and those knowing someone with breast cancer (OR 3.3; $p < 0.0001$) were more likely to have had a mammogram in their lifetime. These relationships remained significant in multivariate models (Models A–D). Having a PCP increased the chance of having a mammogram upon bivariate testing (OR 4.9; $p < 0.001$) but not in multivariate models adjusted for other sociodemographic variables. Additionally, mammography referral from a PCP (OR 9.7; $p < 0.001$), and having received a CBE or a pap smear increased the odds of having received a mammogram (OR 18; $p < 0.001$; and OR 12; $p < 0.001$).

Factors Associated with Having a Mammogram Within the Past 2 years (Table 4)

Factors Related to Islam—Higher SRR trended towards significance ($p < 0.1$) upon bivariate and multivariate testing with those with higher religiosity being less likely to have had a mammogram in the past 2 years. Participants with greater positive religious coping mechanisms had lower odds of having a mammogram in the previous 2 years upon bivariate testing (OR 0.44; $p < 0.1$) and this relationship was maintained in multivariate models (Model B; OR 0.33; $p<0.05$; Model D OR 0.21; $p<0.05$). Perceptions of religious discrimination were negatively associated with biennial mammography upon bivariate testing (OR 0.79; $p < 0.05$), and in a multivariate model adjusted for having a PCP and other religiosity factors (Model D OR 0.74; $p < 0.05$).

Sociodemographics and Breast Cancer Knowledge—Participants with a PCP (OR 4; $p < 0.05$) had greater odds of having a mammogram within the past 2 years in bivariate and multivariate models (Models A–C).

Factors Associated with Ever Having a Clinical Breast Exam (CBE) (Table 5)

Factors Related to Islam—While perceptions of religious discrimination trended towards significance with a decreased odds of having had a CBE (OR 0.86, $p < 0.1$) on bivariate testing this relationship was not significant upon multivariate modelling (Model A).

Fatalism—The mPFI trended towards significance (OR 0.87; $p < 0.1$), while the RHFQ-Divine Provision subscale significantly decreased the odds of having had a CBE (OR 0.80, p

< 0.001) upon bivariate testing. Neither association was significant in multivariate models (Models B and C).

Sociodemographics and Breast Cancer Knowledge—Participants who were older (OR 1.1; $p < 0.01$), resided in the US for greater than 20 years (OR 4.4; $p < 0.01$), had higher educational attainment (ORs between 2.4 and 10; $p < 0.1$), and a PCP (OR 5; $p < 0.001$) were at increased odds of having undergone a CBE in both bivariate and multivariate models (A–C). Breast cancer knowledge (OR 1.4; $p < 0.1$) and knowing someone with breast cancer (OR 2.9; $p < 0.01$) increased the odds of having a CBE in bivariate testing, but not when other variables were adjusted for (Models A–C).Having already obtained a pap smear was also associated with CBE status (OR 13; $p < 0.001$).

Discussion

This study of an ethnically and racially diverse Muslim population found relatively high rates of having a mammogram at least once, but relatively low rates of having a mammogram within the previous 2 years. Rates of mammography did not appear to differ by race or ethnicity, but they did vary based on Islam-related factors. We found that respondents who perceived religious discrimination in healthcare, and those with positive religious coping mechanisms, were less likely to have had a mammogram in the past 2 years. Contrary to our hypotheses, modesty and fatalism were not related to either CBE or mammography status.

While biennial mammography rates in our sample are lower than the Healthy 2020 target of 81.1 %, our sample had screening mammography rates greater than those reported in prior Muslim samples [20, 22]. One of these prior studies was conducted in Greater Chicago [20], and it may be that increased awareness of breast cancer screening in the community explains our higher rates. Additionally, a high percentage of participants reported having health insurance and access to PCPs, which increases access to mammography. Without population-based repeated surveys of American Muslims, overall trends and specific predictors of screening mammography in this population remain elusive. In our sample, Arab, South Asian, and African Americans were all equally likely to have breast cancer screening. This finding contrasts with those from two studies conducted in California in which one found that South Asians were more likely to have had mammograms than their Arab and African American counterparts [22]. The other reported African Americans and Asians more likely to have had screening than Arabs [56]. Since Islam-related factors, but not race and ethnicity, were associated with mammography rates, assessing the religious characteristics of racial and ethnic minorities appears important for cancer disparity research [15].

Since the Institute of Medicine drew attention to the causative role of discrimination in disparities, researchers have studied the impact of societal and healthcare-specific discrimination upon health outcomes [57]. With respect to mammography, societal discrimination does not appear to influence screening rates. Societal discrimination was not associated with mammography in the Black Women's Health Study [58], nor in studies of over 1,600 whites, African Americans, Mexicans and Puerto Ricans in Chicago [59] and

over 1,400 white and African American women in Connecticut [60]. However, in the California Health Survey, discrimination in the healthcare setting was associated with significantly lower odds of having a mammogram for African American, American Indian, Asian, and Latino women [61]. In our study, perceived religious discrimination was not associated with ever having a mammogram, but it was inversely associated with biennial mammography. It is possible women saw initial cancer screening as sufficiently important that they were willing to endure discrimination to obtain it, whereas repeat screening might have been seen as less important. Alternatively, women may experience a cumulative effect of perceived discrimination and be disinclined to return for mammograms on an annual or biennial basis. Because the associations between different measures of discrimination and different types of preventive service use remain inconsistent [59], longitudinal studies assessing the relationship between perceived religious discrimination in healthcare and cancer screening are needed.

Moving from religious identity to religious values, we found that positive religious coping was negatively associated with biennial mammography. This finding contrasts with studies of Church-going Latinas, in which positive religious coping significantly increased the odds of undergoing breast, cervical and colon cancer screening [62]. It is possible that the PMIR-Positive Religious Coping scale tapped into attitudes such as complete reliance upon religious healing to the exclusion of conventional medical care. Qualitative studies are needed to understand how diverse groups of Muslims use religious coping methods, and how women's choices to pursue cancer screening are influenced by these notions.

Surprisingly, we found that Islamic modesty was not associated with screening practices even though modesty concerns appear prominent within Muslim women's health decision-making [16, 17, 38, 39, 63]. Since modesty concerns are often voiced in the context of gender discordant care, and most mammography centers are serviced by female staff it is possible that maintaining modesty is easier. Alternatively, recent campaigns to promote breast cancer screening could have allayed modesty concerns within the Muslim community [20, 64].

Fatalistic beliefs include a wide range of attitudes and behaviors. Some consider fatalism to be an interpretation of religious theology where individuals believe preventing disease is beyond human control [33, 51]. Others think of it as a social dynamic that manifests angst and nihilism deriving from the collective poor experiences of a community [52]. Cancer fatalism is defined as the belief that screening and treatment are futile [65], and “that death is inevitable when cancer is present” [66]. Multiple studies, each using different measures of fatalism, demonstrate independent, negative associations between fatalism and breast cancer screening. These studies have been conducted with samples of African Americans [28, 32], American Indians [36], Chinese, Malay and Indian women [33] as well as a sample of women residing in Mississippi [29]. Others have found the association between breast cancer screening and fatalism to be a function of poverty, lower levels of education, and older age [34]. Our findings seem to support this latter group, as fatalism and breast cancer screening were no longer associated after accounting for sociodemographic characteristics of our sample. However, it is also possible that “fatalistic beliefs” may motivate different health behaviors among Muslims. Illustratively, some statements of Islamic positive

religious coping, such as “I remind myself that Allah commanded me to be patient,” may seem fatalistic to non-Muslims even if they do not lead Muslims to be passive. Ethnographic research suggests that a complete reliance on God, and viewing God's decree as the means of cure, does not exclude receiving medical care among Muslims [67]. Analogous concepts are also found among Latinas [68]. Muslim-specific measures may be able to unpack the influence of “fatalistic” ideas on health behaviors in this group. Developing such measures is important for tailored cancer control interventions since studies have found fatalistic beliefs to be independently associated with cancer outcomes [69–71], even apart from their influence on screening behavior.

Our results must be interpreted in light of several limitations. We targeted respondents who were English literate, as 87 % of American Muslims are [72], and reside within the large Chicago Muslim community. Therefore, Muslims with lower levels of English literacy, and residing in Muslim communities of smaller size may experience different, and likely greater, barriers to breast cancer screening. Selection bias was also introduced as we purposively recruited participants at Muslim organizations in order to assess relationships between religion and screening. Hence our findings may not be representative of the American Muslim community as a whole.

Contribution to the Literature and Implications

Our work is the first study of which we are aware to quantitatively examine the associations between religion-related factors and breast cancer screening among an ethnically and racially diverse group of American Muslim women, and has important implications for screening interventions. As perceived religious discrimination in healthcare, and positive religious coping significantly decreased the odds of adherence to biennial mammography guidelines, a multi-prong approach, including interventions that address Islam-based religious ideas and practices, may hold the best hope for improving breast cancer screening rates among this growing minority population. Targeting religious concepts related to coping may be best performed in the mosque community setting, while decreasing perceived discrimination could be the focus of healthcare provider-directed religious sensitivity and cultural competency programs. Further, since interventions aimed at increasing initial mammography may not necessarily overcome barriers to repeat mammography, interventions tailored to specific outcomes are required [73]. Finally, our work provides evidence that by focusing only on ethnicity and race, traditional cancer disparity research overlooks the important influence a shared religion may have across racial and ethnic lines. Our findings should spur further research and intervention at the intersection of religion and cancer, and among the under-studied American Muslim population.

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Table 1

Items from pilot measure to assess Islamic modesty

	Question stem
1.	When I am in a mixed gender gathering or outside of the home, I cover my entire body, except my hands and face
2.	When I have guests at my home, men and women sit separately
3.	An unmarried man and unmarried woman should not be alone together
4.	I always look for a female doctor for myself
5.	I have delayed seeking medical care when no woman doctor is available to see me
6.	Hospital gowns are not modest
7.	My clothing demonstrates a commitment to Islamic modesty
8.	Maintaining Islamic modesty is important to me

Table 2

Sociodemographic characteristics of participants (n = 240)

Characteristic	Number (% of n)
Age, n = 206	
40–49	89 (43)
50–74	108 (52)
≥75	9 (4)
Median (range)	51 (range 40–85)
Racial/ethnic background, n = 220	
Arab/Arab American	72 (33)
African American/Black	59 (27)
South Asian	71 (32)
Country of origin, n = 226	
US	74 (33)
Other	152 (67)
Duration in the United States, n = 225	
≤10 years	34 (15)
11–20 years	39 (17)
>20 years	152 (68)
Marital status, n = 223	
Married	160 (72)
Highest level of education, n = 222	
Less than high school	30 (14)
High school	49 (22)
Associates	51 (23)
Bachelors	55 (25)
Advanced degree	37 (17)
Annual household income, n = 213	
≤$45,000	122 (57)
$45,001–$105,000	65 (31)
≥$105,001	26 (12)
Have health insurance, n = 224	168 (75)
Have primary care physician access, n = 235	199 (85)
Have had breast cancer, n = 235	19 (8)
Know someone with breast cancer, n = 235	147 (63)
Have had a clinical breast exam, n = 233	190 (82)
Have had a mammogram, n = 234	181 (77)
Have had a mammogram within the past 2 years, n = 144	111 (77)
Have had a pap smear, n = 233	196 (84)

The total number of respondents to each question (n) varies due to non-respondents

Table 3

Relationship between variables of interest and ever having a mammogram

	Unadjusted OR (95 % CI)	Model A Adjusted OR (95 % CI)	Model B Adjusted OR (95 % CI)	Model C Adjusted OR (95 % CI)	Model D Adjusted OR (95 % CI)
Factors related to Islam					
Self-rating of religiosity	1.2[a] (0.98–1.4)	0.99 (0.76–1.3)			
PMIR: Positive Religious Coping	0.88 (0.67–1.1)				
Hoge intrinsic religiosity	1.0 (0.88–1.1)				
Modesty	0.91 (0.79–1.1)				
Discrimination in healthcare	0.94 (0.81–1.1)				
PMIR: Punishing Allah Reappraisal	0.87[c] (0.79–0.96)		0.90 (0.80–1.0)		
Fatalism					
Modified Powe (mPFI)	0.79[d] (0.68–0.90)			0.88 (0.74–1.0)	
RHFQ: Divine Provision	0.84[d] (0.76–0.93)				0.92 (0.80–1.1)
RHFQ: Destined Plan	0.93 (0.84–1.0)				
Breast cancer knowledge	1.2 (0.83–1.7)				
Sociodemographic characteristics					
Age	1.1[c] (1.0–1.1)	1.1[c] (1.0–1.1)	1.1[c] (1.0–1.1)	1.1[b] (1.0–1.1)	1.1[b] (1.0–1.1)
Years in the USA					
<10 years	Reference	Reference	Reference	Reference	Reference
11–20 years	5.0[c] (1.7–15)	10[c] (2.0–50)	5.1[b] (1.3–21)	5.1[b] (1.3–21)	4.0[a] (0.98–17)
>20 years	5.2[d] (2.3–12)	4.4[b] (1.2–16)	2.4 (0.78–7.5)	2.9[a] (0.96–8.7)	2.6[a] (0.86–8.1)
Highest level of education					
Less than HS	Reference	Reference	Reference	Reference	Reference
High school	1.4 (0.56–3.7)	1.8 (0.50–6.5)	1.8 (0.54–6.1)	1.4 (0.44–4.5)	1.6 (0.48–5.6)
Associates	7.0[d] (2.2–23)	12[c] (2.4–60)	8.1[c] (1.7–38)	8.0[c] (1.8–36)	8.2[c] (1.7–39)
Bachelors	3.0[b] (1.1–8.0)	4.1[b] (1.1–16)	2.9[a] (0.83–10)	2.9[a] (0.86–9.9)	2.4 (0.66–8.9)
Adv. degree	3.3[b] (1.1–9.8)	8.3[b] (1.5–15)	2.9 (0.70–12)	2.7 (0.66–11)	2.6 (0.62–11)
Know someone who has had breast cancer	3.3[d] (1.7–6.2)	3.6[c] (1.5–8.5)	2.9[b] (1.3–6.5)	2.5[b] (1.1–5.6)	2.4[b] (1.0–5.4)
Have a primary care physician (PCP)	4.9[d] (2.3–11)	1.6 (0.48–5.0)	2.3 (0.80–6.8)	2.0 (0.73–5.7)	2.1 (0.74–5.9)
Mammogram referral by PCP	9.7[d] (3.9–25)				
Have had a pap smear	12[d] (5.6–28)				
Have had a clinical breast exam	18[d] (8.0–39)				

Each model represents a single multivariate ordered regression equation

OR odds ratio

[a] $p < 0.1$

[b] $p < 0.05$

[c] $p < 0.01$

[d] $p < 0.001$

Table 4

Relationship between variables of interest and having had a mammogram in the past 2 years

	Unadjusted OR (95 % CI)	Model A Adjusted OR (95 % CI)	Model B Adjusted OR (95 % CI)	Model C Adjusted OR (95 % CI)	Model D Adjusted OR (95 % CI)
Factors related to Islam					
Self-rating of religiosity	0.77[a] (0.56–1.0)	0.74[a] (0.53–1.0)			0.70[a] (0.47–1.0)
PMIR: Positive Religious Coping	0.44[a] (0.18–1.0)		0.33[b] (0.13–0.88)		0.21[b] (0.06–0.72)
Hoge intrinsic religiosity	0.91 (0.75–1.12)				
Modesty	0.81 (0.62–1.0)				
Discrimination in healthcare	0.79[b] (0.63–1.0)			0.83 (0.65–1.1)	0.74[b] (0.54–1.0)
PMIR: Punishing Allah Reappraisal	0.97 (0.86–1.1)				
Fatalism					
Modified Powe (mPFI)	0.97 (0.80–1.2)				
RHFQ: Divine Provision	1.1 (0.94–1.2)				
RHFQ: Destined Plan	0.97 (0.84–1.1)				
Breast cancer knowledge	1.1 (.67–1.7)				
Characteristics					
Have a PCP	4.0[b] (1.3–12)	4.6[b] (1.3–16)	6.7[b] (1.5–29)	4.8[b] (1.4–16)	20[c] (2.8–140)

Each model represents a single multivariate ordered regression equation

OR odds ratio, *PCP* primary care physician

d $p < 0.001$

[a] $p < 0.1$

[b] $p < 0.05$

[c] $p < 0.01$

Table 5

Relationship between variables of interest and having had a clinical breast exam

	Unadjusted OR (95 % CI)	Model A Adjusted OR (95 % CI)	Model B Adjusted OR (95 % CI)	Model C Adjusted OR (95 % CI)
Factors related to Islam				
Self-rating of religiosity	1.0 (0.84–1.3)			
PMIR: Positive Religious Coping	0.91 (0.69–1.2)			
Hoge intrinsic religiosity	1.1 (0.94–1.2)			
Modesty	0.91 (0.78–1.1)			
Discrimination in healthcare	0.86[a] (0.74–1.0)	0.97 (0.76–1.2)		
PMIR: Punishing Allah Reappraisal	0.92 (0.83–1.0)			
Fatalism				
Modified Powe (mPFI)	0.87[a] (0.75–1.0)		0.98 (0.82–1.2)	
RHFQ: Divine Provision	0.80[d] (0.72–0.91)			0.88[a] (0.76–1.0)
RHFQ: Destined Plan	0.96 (0.86–1.1)			
Breast cancer knowledge	1.4[a] (0.94–2.0)	1.3 (0.80–2.2)	1.2 (0.73–2.0)	1.1 (0.64–1.8)
Sociodemographic characteristics				
Age	1.1[c] (1.0–1.1)	1.1[b] (1.0–1.1)	1.0(1.0–1.1)	1.1[a] (1.0–1.1)
Years in the USA				
<10 years	Reference	Reference	Reference	Reference
11–20 years	2.4 (0.82–6.9)	4.7[b] (1.2–18)	3.1[a] (0.87–11)	2.7 (0.74–9.9)
>20 years	4.4[c] (1.8–10)	2.7[a] (0.92–8.1)	3.0[b] (1.0–8.5)	2.9[a] (0.99–8.6)
Highest level of education less than HS	Reference	Reference	Reference	Reference
High school	2.4 (0.84–6.7)	2.5 (0.73–8.4)	2.2 (0.66–7.3)	2.2 (0.61–7.8)
Associates	2.4[a] (0.86–6.5)	2.8 (0.80–9.6)	2.8 (0.79–10)	2.3 (0.61–8.5)
Bachelors	3.3[b] (1.1–9.4)	5.2[b] (1.3–20)	3.5[a] (0.96–13)	2.2 (0.56–8.7)
Adv. degree	10[c] (2.0–51)	7.6[b] (1.3–13)	6.5[b] (1.1–38)	4.9[a] (0.82–29)
Know someone who has had breast cancer	2.9[c] (1.5–5.7)	2.1[a] (0.87–5.0)	1.9 (0.80–4.3)	1.7 (0.71–4.2)
Have a primary care physician	5.0[d] (2.3–11)			
Have had a pap smear	13[d] (5.8–29)			

Each model represents a single multivariate ordered regression equation

OR odds ratio

[a] $p < 0.1$

[b] $p < 0.05$

[c] $p < 0.01$

[d] $p < 0.001$