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The influence of acculturation and breast cancer-specific distress on perceived barriers to genetic testing for breast cancer among women of African descent

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Abstract

Objective—Rising health disparities are increasingly evident in relation to use of genetic services (including genetic counseling and testing) for breast cancer risk, with women of African descent less likely to use genetic services compared with Whites. Meanwhile, little is known regarding potential within-group acculturation and psychological differences underlying perceived barriers to genetic testing among women of African descent.

Methods—Hypothesized contributions of acculturation factors and breast cancer-specific distress to perceived barriers to genetic testing were examined with a statistical analysis of baseline data from 146 women of African descent (56% US born and 44% foreign born) meeting genetic breast cancer risk criteria and participating in a larger longitudinal study that included the opportunity for free genetic counseling and testing. Perceived barriers assessed included: (1) anticipation of negative emotional reactions, (2) stigma, (3) confidentiality concerns, (4) family-related worry, and (5) family-related guilt associated with genetic testing.

Results—In multivariate analyses, being foreign born was a significant predictor of anticipated negative emotional reactions about genetic testing (β= 0.26; SE=0.11; p = 0.01). Breast cancer-specific distress scores (avoidance symptoms) were positively related to anticipated negative emotional reactions (β = 0.02; SE= 0.005; p = <0.0001), confidentiality concerns (β = 0.02; SE = 0.01; p = 0.02), and family-related guilt (β = 0.02; SE=0.01; p = 0.0009) associated with genetic testing.

Conclusions—Results suggest an influence of acculturation and breast cancer-specific distress on perceived barriers to genetic testing among women of African descent. The potential utility of culturally tailored genetic counseling services taking into account such influences and addressing

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emotional and psychological concerns of women considering genetic testing for breast cancer should be investigated.

Keywords

cancer; oncology; genetic testing; breast; African

Introduction

Women with a mutation in one of the major breast cancer susceptibility genes *BRCA1 or BRCA2* have a 40–66% lifetime risk of developing breast cancer, as well as a 13–46% risk of developing ovarian cancer, and if they have already been diagnosed with breast cancer in one breast they have up to a 52% risk of developing cancer in their other breast [1,2]. Genetic services for breast cancer (including genetic counseling and testing) allow women with family histories of the disease an opportunity to make more informed decisions regarding cancer prevention options, including risk reducing surgery, chemoprevention, and surveillance/ screening [3,4]. Yet, despite the growing use of genetic services for breast cancer in recent years, research documents rising racial disparities in the use of such services [5,6]. White women are almost five times more likely to undergo genetic counseling for *BRCA1/2* testing compared with women of African descent, controlling for other factors [7]. Such disparities are particularly alarming as studies suggest that between 16 and 28% of women of African descent with personal or family history of breast and/or ovarian cancer may carry *BRCA1/2* mutations [8–11]. Further, despite a lower breast cancer incidence rate, women of African descent tend to be diagnosed younger, with more advanced, more aggressive disease, and are more likely to die of breast cancer [12–16].

To reduce disparities in the use of genetic services for breast cancer, the recent research has called for the creation of group-specific culturally relevant services based on perceived barriers identified by women of African descent [3,17–19]. In fact, research examining psychosocial predictors of uptake and use of *BRCA* genetic services suggests that women of African descent who decline genetic counseling report higher perceived barriers to genetic services [20], including negative affect, anticipation of adverse emotional reactions related to test results, concerns about stigmatization and confidentiality, as well as family-related worry and guilt [20–23]. However, little is known about potential within-group differences that may underlie such perceived barriers to *BRCA* genetic services.

To date, acculturation remains a relatively unexplored potential within-group difference that may underlie perceived barriers to *BRCA1/2* genetic services in women of African descent. Acculturation is traditionally defined as the degree to which the majority culture is adopted by a minority culture [24], with more recent accounts incorporating the process of ethnic groups exchanging cultural elements and complexes [25]. There are a range of approaches that currently exist for the assessment of acculturation, including measuring nativity, language use, proportion or years residence in the US, and cultural immersion [26–29], although there is no clear consensus on most useful measures. Although a burgeoning body of research addresses the role of acculturation in cancer outcomes for Latinos [30–33], there is a surprising lack of research reflecting the acculturation-related context and heterogeneity of the African-descent population in the US, 6% of which is foreign born and 10% of which has foreign ancestry [34,35]. In a diverse metropolitan setting such as New York City, documenting this heterogeneity is even more critical as approximately 25% of the African-descent population is Caribbean immigrants [36]. Examining individuals of African descent by subgroups may better reflect variations in health [37–39]; rates of breast cancer incidence and screening behaviors may vary by acculturation within individuals of African descent [40,41].

Furthermore, acculturation represents a complex psychological process of adaptation to stress, including changes in lifestyle, behaviors, beliefs, values, and identity as a result of contact with different cultural groups [42,43]. Although Caribbean women of African descent may initially have lower rates of psychological illnesses compared with US-born individuals of African descent [35], with increasing generation status, immigrants may become faced with the 'double burden of acculturation', as they acclimate to both mainstream America and Black America. Through processes of externally ascribed racial categorization, Caribbean immigrants may undergo exposure to increased levels of minority status and inequalities, making this subpopulation particularly vulnerable to increased risks of psychological stress and illnesses [35,44–46]. Combined with the recent literature documenting the need for within-group comparisons of psychological functioning in women of African descent at increased risk of breast and ovarian cancer, specifically breast cancer-specific distress [47], exploration of psychological predictors thus inevitably becomes linked to any study examining the potential association of acculturation and perceived barriers of *BRCA1/2* testing.

The goal of this study was to fill a gap in the current research by examining the relationship of acculturation and breast cancer-specific distress with perceived barriers to genetic testing among a diverse sample of women of African descent in New York City at increased risk of hereditary breast and/or ovarian cancer. Study outcomes were chosen as they have been previously validated and measured for use within urban African-American women to examine perceived barriers of genetic testing for breast cancer susceptibility [20]. These previously validated measures for perceived barriers include: (1) anticipation of negative emotional reactions, (2) stigma, (3) confidentiality concerns, (4) family-related worry, and (5) family-related guilt associated with genetic testing for breast cancer [20]. The primary aim was to investigate the potential association between acculturation and perceived barriers to genetic testing within women of African descent. A secondary aim was to explore the potential associations of breast cancer-specific distress with perceived barriers of genetic testing, as breast cancer-specific distress has previously been identified as a predictor of *BRCA* counseling and testing decisions within African-American women [20].

Methods

Study setting and population

We analyzed baseline information on 146 women of African descent available from a larger longitudinal study examining *BRCA1/2* decision-making and the psychosocial impact of standard genetic counseling versus culturally tailored genetic counseling in women at increased risk. The participants were recruited in the greater New York City area via an existing study on biobehavioral factors and breast cancer risk as well as through community outreach. A trained research assistant explained the study to potential participants and completed a family history form to determine eligibility based on family history suggestive of breast and/or ovarian cancer. Although there are different models and risk assessments related to the probability of carrying a *BRCA1/2* mutation, for this study women were considered eligible if they met the criteria of at least one of the three commonly used *BRCA1/2* risk estimation models (*BRCA*Pro, Penn, Myriad) [48–50]. Additional eligibility criteria included: women who self-identified as being of African descent, age 18 or older, English speaking, able to provide consent, and had not previously undergone genetic counseling or testing for hereditary breast or ovarian cancer. Women who were pregnant (based on participant disclosure) were excluded from this study, as pregnancy may cause additional distress that could impact concerns about genetic testing for breast and/or ovarian cancer. After the determination of eligibility by the research assistant, consent forms were mailed to all eligible women who met the study criteria. Following the collection of baseline information through a telephone interview, all participants were given the option of receiving free genetic services for *BRCA1/2*. The participants were

then randomly assigned to one of the two types of genetic counseling (standard genetic counseling versus culturally tailored genetic counseling) and followed up at 1 month to determine their decision-making related to *BRCA1/2* genetic testing. For the cross-sectional analysis presented in this study, we focus only on the baseline data collected from telephone interviews, conducted by trained research assistants and including questions related to sociodemographics, psychological factors, cancer history, and attitudes and beliefs about *BRCA* genetic testing. Study protocols were approved by Mount Sinai's Institutional Review Board.

Measures

Predictors

Acculturation-related predictors: Acculturation-related predictors included participants' nativity (foreign versus US born) and proportion of one's life spent living in the US.

Although there are numerous ways to measure acculturation, these measures were selected as they have been previously identified in immigrants (Latinos) as influential factors affecting cancer screening uptake and knowledge and beliefs and attitudes about genetic testing and were therefore hypothesized to influence perceived barriers to genetic testing among women of African descent in this study [30,51–54]. In addition, selection of acculturation measures was limited by the baseline interview, which did not collect information on cultural immersion.

Breast cancer-specific distress: The Impact of Events Scale (IES) [55], including total score and intrusive and avoidance symptoms subscales, was used to assess breast cancer-specific distress. This scale was chosen as it has previously been identified as a psychosocial predictor of *BRCA* counseling and testing decisions among urban African-American women and therefore may be applicable to women of African descent [20]. All items were measured on a 4-point Likert scale (weighted as 'not at all' = 0, 'rarely' = 1, 'sometimes' = 3, and 'often' = 5). The intrusive symptoms subscale included seven items measuring intrusive ideation associated with the stressor of breast cancer (range = 0–35). The avoidance symptoms subscale included eight items measuring avoidance stress associated with the stressor of breast cancer (range = 0–40). The IES total included all 15 items (range = 0–75). The internal reliability of these measures was considered good ($\alpha = 0.91$ for IES total, $\alpha = 0.83$ for intrusion, and $\alpha = 0.86$ for avoidance).

Covariates

Sociodemographic background factors—Sociodemographic background factors included participants' age, race/ethnicity, education, income, marital status, and insurance status.

Breast and/or ovarian cancer history—Information about participants' personal diagnosis and family history of breast and/or ovarian cancer was included.

Outcomes

The baseline interview provided a one-paragraph description in layman's terms of the hereditary basis of breast and ovarian cancer and how genetic tests may be used to determine which family members have inherited a genetic mutation. The participants were asked how much they agreed or disagreed with a series of statements about the potential benefits and barriers of genetic testing, knowing that a blood test for inherited breast cancer is currently available. This study assessed five perceived barriers to genetic testing as described in Table 1. These outcomes have previously been validated for use in African-American women and examined as potential cons of *BRCA* testing [20] and were created based on previous research

[56–58]. All questions were measured on a 5-point Likert-type scale (strongly disagree to strongly agree), with total scores computed by summing individual questions and taking the average (range = 1–5). Internal reliability of all scales was considered adequate (α = 0.68 for anticipation of negative emotional reactions, α = 0.73 for stigma, α = 0.72 for confidentiality concerns, α = 0.62 for family-related worry, and α = 0.65 for family-related guilt associated with genetic testing).

Analytic plan—After computing basic descriptive statistics, we compared foreign-born and US-born women of African descent in terms of sociodemographics, cancer history, and psychological factors using χ^2-tests and *t*-tests. Crude univariate linear regression analyses tested each predictor (acculturation factors and breast cancer-specific distress) and covariate individually and its potential association with study outcomes. Multivariable linear regression models were developed separately for each study outcome with the following steps: All significant variables ($p \leq 0.10$) in univariate analyses were chosen as covariates for inclusion in the candidate short list for multivariable models. A forward selection test was conducted as the automatic statistical procedure of choice to control for potential problems of collinearity. Owing to a relatively small sample size, a level of significance of $p \leq 0.10$ was chosen as most appropriate for determining initial entry into the forward selection test. Variables significant from the forward selection test were included in the final multivariable linear regression models. All other covariates independently associated with the outcomes or with significant differences found between foreignborn and US-born women were added one by one to test for potential confounding. Any such covariates producing a change of at least 20% in the β's of predictors already in the model (from forward selection) were considered to be confounders and included in the final models. Any theoretically necessary sociodemographic variables were also added. A level of $p \leq 0.05$ was used to determine the overall statistical significance of variables in the final model. The percentage of the variability explained by the final multivariable linear regression model was computed using an R^2-test. SAS software package v.9.1.3 was used to conduct all statistical procedures.

Results

Sample characteristics

Sample characteristics are presented in Table 2. One hundred and forty-six women were included in the sample. The participants were divided between US born (56%) and foreign born (44%), of which the majority emigrated from Caribbean countries (89%). The mean proportion of years lived in the US among immigrants was 0.4 (SD = 0.3) and the mean age of the participants was 45.8 (SD = 9.6; min = 22, max = 79). The majority of participants had incomes ≥$20 000/year, had attained more than a high school diploma, were not currently married, and were insured. Most women had a personal diagnosis (70%) and/or family history of breast and/or ovarian cancer (81%). The mean total score for the IES scale was 25.2. (SD = 17.3; min = 0, max = 60), suggesting moderate distress related to breast cancer [59]. Sociodemographic comparisons found that US-born women of African descent were more likely to have attained a high school education, make ≥$20 000/year, and be insured compared with foreign-born women of African descent.

Univariate results

Table 3 reports the significant unadjusted predictors of the study outcomes.

Anticipation of negative emotional reactions related to genetic testing—Results indicate that foreign-born women of African descent reported more anticipation of negative emotional reactions related to genetic testing for breast cancer compared with US-born women of African descent, although proportion of years in the US was not related to this outcome.

Other significant predictors included education and breast cancer-specific distress (total IES score, intrusive, and avoidance symptoms).

Stigma related to genetic testing—Age was an independent predictor of stigma related to genetic testing.

Confidentiality concerns related to genetic testing—Independent predictors of confidentiality concerns related to genetic testing were education, income, breast cancer-specific distress (avoidance symptoms), and family history of breast and/or ovarian cancer.

Family-related worry associated with genetic testing—For family-related worry associated with genetic testing, independent predictors included education and breast cancer-specific distress (IES total and intrusive symptoms).

Family-related guilt associated with genetic testing—Variables significant in univariate analysis for family-related guilt included breast cancer-specific distress (IES total, intrusive, and avoidance symptoms) and family history of breast and/or ovarian cancer.

Multivariate results

Table 4 reports the final multivariate results for models that included significant acculturation factors and breast cancer-specific distress as predictors of perceived barriers to genetic testing. In these final models, age, family, and personal history of breast cancer were considered theoretically necessary (if not otherwise previously entered into the model) as they have been shown to influence breast cancer risk and screening practices and beliefs, attitudes, and concerns about genetic testing in women of African descent [60,61].

Anticipation of negative emotional reactions related to genetic testing—In testing the primary study aim, we found that foreign-born women of African descent reported more anticipation of negative emotional reactions related to genetic testing for cancer risk compared with US-born women of African descent ($\beta = 0.26$; SE = 0.11; $p = 0.01$), controlling for relevant factors. Related to the secondary study aim, we also found that women who had higher avoidance symptoms for breast cancer-specific distress reported more anticipation of negative emotional reactions related to genetic testing for cancer risk ($\beta = 0.02$; SE = 0.005; $p<0.0001$).

Confidentiality concerns related to genetic testing—In the final multivariate model adjusted for relevant factors, women who had higher avoidance symptoms for breast cancer-specific distress reported more confidentiality concerns related to genetic testing ($\beta = 0.02$; SE = 0.01; $p = 0.02$).

Family-related guilt associated with genetic testing—Breast cancer-specific distress (avoidance symptoms) was positively related to family-related guilt associated with genetic testing ($\beta = 0.02$; SE = 0.01; $p = 0.0009$) in the final multivariate model, adjusted for relevant factors.

Discussion

These results demonstrated that acculturation (specifically nativity) and breast cancer-specific distress may represent independent factors associated with perceived barriers to genetic testing among women of African descent. First, we found that foreign-born women of African descent reported more anticipation of negative emotional reactions about genetic testing compared with US-born women of African descent. Second, breast cancer-specific distress was also independently related to this perceived barrier to genetic testing. In this study, breast cancer-

specific distress did not vary based on acculturation and therefore did not mediate the relationship between nativity and anticipation of negative emotional reactions. These results may contradict previous research identifying different levels of psychological stress in Caribbean immigrants compared with US-born women of African descent [35,45], at least for breast cancer-specific distress. However, we may speculate that other factors that were not measured here may be potential mediators of a relationship between nativity and anticipation of negative emotional reactions related to genetic testing, including acculturative stress and social support. Acculturative stress occurs when individuals face psychological problems as a result of the acculturation process [62]. Among Latinos, acculturative stress has been associated with negative emotional states and poorer psychological functioning [63,64] and may similarly apply to Caribbean immigrants of African descent, thereby impacting emotional reactions to genetic testing. In this study, US-born individuals of African descent may perceive a greater sense of support from family and friends compared with foreign-born individuals of African descent, decreasing the likelihood of anticipation of negative emotional reactions to genetic testing in US born. Meanwhile, among immigrants, social support may mediate a relationship between acculturative stress and perceived emotional reactions to genetic testing, as research with Latinos found that individuals reporting high acculturative stress with high levels of perceived social support reported fewer anxiety and depressive symptoms [63].

These results also revealed a positive relationship between breast cancer-specific distress and barriers to genetic testing, including anticipation of negative emotional reactions, confidentiality concerns, and family-related guilt. Although research has examined the impact of genetic testing on psychological distress [65,66], to date little is known about how psychological distress may influence genetic testing beliefs. Results found remarkably high levels of breast cancer-specific distress across women in our sample, even higher than elevated levels of distress during genetic counseling and testing reported in the recent research among African-American women at increased risk of hereditary breast and ovarian cancer [47]. Further, the positive association of breast cancer-specific distress (avoidance) and anticipation of negative emotional reactions related to genetic testing suggests a concordance between the current trauma/subjective stress and anticipation of stress. Finally, women who more often avoid thinking about breast cancer also reported more confidentiality concerns and family-related guilt related to genetic testing, suggesting these women may be particularly worried about matters of personal privacy, disclosure, and stress caused to their family.

It is unclear how these factors may ultimately impact the use of genetic services for breast cancer. Previous research has associated participation in genetic testing with increased anxiety and worry due to ambiguity and uncertainty presented by questions of whether and when cancer will develop [58,67]. Although behavior change theory postulates that negative emotional reactions may drive the use of genetic services for breast cancer [68–70], the current research documents both a negative and a positive effect of emotional reactions on genetic service use [3,7,20]. High levels of fear may lead to increased vigilance and use of genetic services [3,7, 71] or act as a deterrence to such use [3,20].

Clinically, these results support the use of genetic counseling to help alleviate emotional fears arising from concerns about receiving a positive test result among foreign-born women of African descent and among those with high levels of breast cancerspecific distress. Endorsed by the American Society of Clinical Oncologists, pre- and post-test genetic counseling is often a prerequisite for genetic testing and is useful for providing education about genetic testing as well as explaining psychological and social consequences of testing to the patient [72,73]. Genetic counseling, which provides psychological reinforcement, informs women of how they can make use of genetic testing results, and addresses the emotional repercussions stemming from genetic testing, may be particularly suitable to the needs of women of African descent [3,58,60]. Previous research shows that counseling, which includes personalized exploration

of psychosocial issues in genetic testing, increases intentions to be tested and provision of a blood sample in women of African descent compared with information-only approaches [19]. For women of African descent with high levels of breast cancer-specific distress, as found in this study, genetic counseling may play less of an information-seeking role but instead represent more of an emotion management strategy [20].

Ultimately, these results contribute to the previous literature by highlighting the increasing need for culturally based interventions that accurately address the perceptions of women of African descent toward genetic services [3,17–19,74]. Furthermore, studies that provide a greater understanding of how cultural background may influence reactions to genetic services will ultimately influence the design of more culturally sensitive protocols [19]. Based on our results, we argue that acculturation is an important cultural influence that may impact perceived barriers related to *BRCA* genetic testing. For this reason, it is important that genetic counselors should consider such possible acculturation-related differences within women of African-descent populations in order to ensure that decisions are fully informed and culturally appropriate. Ultimately, by better understanding how nativity shapes the perceptions of genetic services within women of African descent, we will be better equipped to develop interventions that successfully address these perceptions [3,61].

For example, previous research with multicultural populations suggests that barriers to communication about genetic testing may occur when there is incompatibility between 'Western' and traditional beliefs [75]. In fact, culturally tailored genetic counseling for women of African descent, which attempts to overcome such communication barriers, has found that women receiving this format were more likely to report lessened worries about genetic testing compared with women undergoing standard genetic counseling [17]. In the light of study results demonstrating higher levels of anticipation of emotional reactivity related to genetic testing in foreign-born women of African descent, it is argued that culturally tailored counseling works with immigrant participants specifically to identify ways to reduce this reactivity. Furthermore, our secondary finding that breast cancer-specific distress was significantly related to perceived barriers to genetic testing underscores the need for genetic counseling to also consider the role of affective factors among women of African descent.

This study has several limitations. Owing to our small sample size and concerns about low power, we neither conduct analyses differentiating between the Caribbean and non-Caribbean foreign-born population nor examine possible country of origin differences. While this study sought to reveal the heterogeneity of African-descent individuals, some potential subgroup differences may have unfortunately been masked. For example, research suggests that the subcategory of African-descent Caribbean immigrants may mask variations in mental health [35]. Further, as noted earlier, there are many ways to measure acculturation and the selection of acculturation measures used in this study (nativity and proportion years in the US) was limited by variables available from the baseline interview. In addition, acculturative stress and social support were not measured and may serve to mediate a relationship between nativity and perceived negative emotional reactions about genetic testing [62–64], along with other more general measures of psychological well-being, including depression and anxiety. Future studies incorporating these acculturation and psychological-related factors are thus warranted.

While the perceived barriers chosen as outcomes for this study were previously validated and measured within African-American women [20], another limitation is that there may be other barriers to genetic testing that this study may not have addressed; future studies should thus include qualitative open-ended questions regarding barriers to genetic testing. In addition, as the majority of research conducted to date in this area has been atheoretical, future studies could benefit from the incorporation of theoretically driven models, such as the Health Belief

Model [76–78], to analyze other factors including perceived severity and risk, barriers, and benefits that may be related to the uptake of genetic testing.

Generalizability of study results may also be limited, as this study was conducted within a diverse sample of individuals of African descent in New York City; results may only be applicable to metropolitan areas in the US with similarly diverse samples. Possible selection bias for participation in the larger study may also limit the generalizability of the study results as these women are likely to be more open to the use of genetic testing services than would be the case in the general population. Furthermore, since the majority of participants were insured, women may have faced substantially different barriers to genetic services compared with an uninsured population. Qualitative research with women of African descent describes how the cost of genetic services is one of the most influential factors inhibiting the decision to receive these services [3]. A final limitation inherent to the cross-sectional nature of this analysis is that we cannot rule out the direction of causality for breast cancer-specific distress and its relationship with perceived barriers to genetic testing.

Conclusion

In conclusion, results uniquely contribute to the literature by suggesting an influence of nativity and breast cancer-specific distress on perceived barriers to genetic testing within women of African descent. The potential utility of culturally tailored genetic counseling services taking into account such influences and addressing emotional and psychological concerns of women considering genetic testing for breast cancer should be investigated.

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Table 1

Description of perceived barriers related to genetic testing

Perceived barriers related to genetic testing	Items included	Internal reliability (α)
(1) Anticipation of negative emotion reactions	• I would be frightened if I were found to carry the gene mutation • Knowing that I carry the gene mutation would leave me in a state of hopelessness and despair • I would consider suicide if I were found to carry the gene mutation for breast cancer • If I underwent genetic testing for cancer, I would not be able to handle it emotionally	0.68
(2) Stigma	• If I were found to carry the gene mutation for breast cancer, I would feel singled out • If I were found to carry a gene mutation for cancer, it would cause others to view me negatively • I would be ashamed if I were found to carry the gene mutation	0.73
(3) Confidentiality concerns	• If I were found to carry the gene mutation, I would worry the results would not stay confidential • Being tested for the gene mutation could jeopardize my insurance coverage	0.72
(4) Family-related worry	• If I were found to carry the gene mutation for breast cancer, I would worry about passing the gene to my children • Knowing that I carry the gene mutation would cause me to worry more about other family members who could be carriers (e.g. mother, sisters, daughters)	0.62
(5) Family-related guilt	• If I were found to carry the gene mutation for breast cancer, I would feel guilty if my daughter(s) developed breast cancer • I would feel guilty if one of my relatives had the gene mutation and I did not	0.65

Table 2

Baseline statistics—perceived barriers related to genetic testing (GT) for cancer risk and comparison of foreign-born versus US-born women of African descent

Predictor variables	Sample Mean (SD)	*N* (%)	Foreign born *N* (%) or mean (SD)	US born *N* (%) or mean (SD)	χ^2- or *t*-test	*p* Value
Acculturation-related factors						
Nativity						
Foreign born	n/a	64 (44)	64 (100)	0 (0)	n/a	n/a
Caribbean	n/a	57 (89)	57 (89)	0 (0)	n/a	n/a
Non-Caribbean	n/a	7 (11)	7 (11)	0 (0)	n/a	n/a
US born	n/a	82 (56)	0 (0)	82 (100)	n/a	n/a
Proportion years lived in US						
Immigrants only	0.4 (0.3)	64	0.4 (0.3)	n/a	n/a	n/a
Psychological factors						
Breast cancer-specific distress						
Impact of Events Scale (IES total) (range = 0–75)	25.2 (17.3)	146	24.5 (16.9)	25.8 (17.7)	0.45	0.66
Intrusive symptoms (range5 0–35)	12.4 (8.5)	146	11.5 (7.9)	13.1 (8.9)	1.21	0.23
Avoidance symptoms (range5 0–40)	12.8 (10.0)	146	13.0 (10.3)	12.6 (9.8)	−0.25	0.80
Covariates						
Sociodemographics						
Age	45.8 (9.6)	146	45.7 (9.4)	45.8 (9.8)	0.06	0.95
Race/ethnicity						
Black/African American	n/a	75 (51)	5 (8)	70 (84)	86.5	< 0.000 1*
Black-West Indian/Caribbean	n/a	63 (43)	54 (86)	9 (11)	78.9	< 0.000 1*
Black-other	n/a	6 (4)	3 (5)	3 (4)	0.09	0.76
Black-African	n/a	2 (2)	1 (1)	1 (1)	0.03	0.86
Education						
≤ High school diploma	n/a	48 (33)	28 (44)	20 (24)	6.10	0.01*
≥ High school diploma	n/a	98 (67)	36 (56)	62 (76)		
Income						
≤ $19 999/year	n/a	44 (31)	25 (43)	19 (23)	6.26	0.01*
≥ $20 000/year	n/a	96 (67)	33 (57)	63 (77)		
Marital status						

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Predictor variables	Sample Mean (SD)	*N* (%)	Foreign born *N* (%) or mean (SD)	US born *N* (%) or mean (SD)	χ^2- or *t*-test	*p* Value
Currently married/living with	n/a	48 (33)	25 (39)	23 (28)	1.98	0.16
Not currently married/living with	n/a	98 (67)	39 (61)	59 (72)		
Insurance status						
Insured (public and private)	n/a	129 (88)	47 (76)	78 (98)	15.55	<0.0001*
Non-insured	n/a	17 (12)	15 (24)	2 (2)		
Cancer history						
Personal breast/ovarian cancer diagnosis						
Yes	n/a	99 (70)	44 (71)	55 (69)	0.08	0.78
No	n/a	43 (30)	18 (29)	25 (31)		
Family history breast/ovarian cancer						
Yes	n/a	113 (81)	46 (78)	67 (84)	0.75	0.39
No	n/a	26 (19)	13 (22)	13 (16)		
Outcome variables—perceived barriers to GT						
Anticipation of negative emotional reactions related to GT	1.9 (0.6)	146	2.0 (0.6)	1.8 (0.6)	−1.97	0.05*
Stigma related to GT	1.8 (0.6)	146	1.8 (0.6)	1.8 (0.6)	−0.3	0.71
Confidentiality concerns related to GT	2.3 (0.9)	146	2.3 (0.9)	2.3 (0.9)	0.3	0.75
Family-related worry associated with GT	3.8 (0.8)	144	3.8 (0.8)	3.7 (0.9)	−0.90	0.37
Family-related guilt associated with GT	2.5 (0.9)	144	2.4 (0.8)	2.5 (0.8)	0.45	0.65

* Significance level $p \leq 0.05$.

Table 3

Significant unadjusted predictor estimates of perceived barriers to genetic testing (GT) for cancer risk outcomes

Outcomes—perceived barriers to GT for cancer risk	Significant unadjusted predictors*	β Coefficient/parameter estimate (SE)
(1) Anticipation of negative emotional reactions related to genetic testing	Nativity	
	Foreign born versus US born	0.19 (0.09)
	Education	
	≤ High school versus ≥ high school	0.18 (0.10)
	Breast cancer-specific distress	
	IES total	0.01 (0.003)
	Intrusive symptoms	0.02 (0.005)
	Avoidance symptoms	0.02 (0.004)
(2) Stigma	Age	0.01 (0.004)
(3) Confidentiality concerns	Education	
	≤ High school versus ≥ high school	−0.27 (0.15)
	Income	
	≤ $19 999/year versus ≥ $20 000/year	−0.30 (0.16)
	Breast cancer-specific distress	
	Avoidance symptoms	0.01 (0.007)
	Family history breast/ovarian cancer	
	Yes versus no	0.41 (0.19)
(4) Family-related worry	Education	
	≤ High school versus ≥ high school	0.33 (0.14)
	Breast cancer-specific distress	
	IES total	0.01 (0.004)
	Intrusive symptoms	0.02 (0.01)
(5) Family-related guilt	Breast cancer-specific distress	
	IES total	0.01 (0.004)
	Intrusive symptoms	0.02 (0.01)
	Avoidance symptoms	0.02 (0.01)
	Family history breast/ovarian cancer	
	Yes versus no	0.60 (0.19)

*Significance level $p \leq 0.10$.

Table 4

Final multivariable models—adjusted predictors of perceived barriers to genetic testing (GT) outcomes

Final models—perceived barriers to GT outcomes	Anticipation of negative emotional reactions related to GT[a]		Confidentiality Concerns associated with GT[b]		Family-related guilt associated with GT[c]	
Characteristic	**β Coefficient/parameter estimate (SE)**	***p* Value**	**β Coefficient/ parameter estimate (SE)**	***p* Value**	**β Coefficient/ parameter estimate (SE)**	***p* Value**
Nativity						
Foreign born versus US born	0.26 (0.11)	0.01*	n/a	n/a	n/a	n/a
Breast cancer-specific distress						
Avoidance symptoms	0.02 (0.005)	<0.0001*	0.02 (0.01)	0.02*	0.02 (0.01)	0.0009*
Insurance						
1Yes versus no	0.27 (0.17)	0.11	n/a	n/a	n/a	
Income						
≤ $19 999/year versus	−0.10 (0.11)	0.38	−0.37 (0.17)	0.03*	n/a	n/a
≥$20 000/year						
Age	0.01 (0.005)	0.25	0.005 (0.01)	0.54	0.0001 (0.008)	0.99
Family history breast/ovarian cancer						
Yes versus no	0.11 (0.13)	0.40	0.49 (0.21)	0.02*	0.75 (0.20)	0.0002*
Personal history breast/ovarian cancer						
Yes versus no	−0.12 (0.11)	0.28	0.29 (0.18)	0.10	0.26 (0.17)	0.13

[a] R^2 = 0.19. Final model includes variables significant from forward selection procedure (nativity and breast cancer-specific distress-avoidance symptoms) plus confounders (insurance, income) and any theoretically necessary covariates (age, family, and personal history of breast/ovarian cancer).

[b] R^2 = 0.12. Final model includes variables significant from forward selection procedure (breast cancer-specific distress-avoidance symptoms, income, and family history of breast/ovarian cancer) plus confounders (none) and any theoretically necessary covariates (age and personal history of breast/ovarian cancer).

[c] R^2 = 0.17. Final model includes variables significant from forward selection procedure (breast cancer-specific distress-avoidance symptoms and family history of breast/ ovarian cancer) plus confounders (none) and any theoretically necessary covariates (age and personal history of breast/ovarian cancer).

* Significance level p≤0.05.