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Developing Community-Based Health Education Strategies with Family History: Assessing the Association between Community Resident Family History and Interest in Health Education

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Abstract

Background.—Family history (FH) is an underutilized genetically informative tool that can influence disease prevention and treatment. It is unclear how FH fits into the development of community-based health education. This study examines the role that FH plays in perceived threat and health education related to mental and chronic physical conditions in the context of the health belief model.

Methods.—Data were collected from 1,048 adult participants aged 18 to 90 years. Approximately 76% of participants indicated African-American race/ethnicity and 35% had less than high school level education. Self-report data were collected on FH of four disorders: anxiety, depression, diabetes, and high blood pressure. Interest in receiving information regarding prevention as well as future testing efforts was assessed broadly.

A series of logistic regressions examined the association between FH for each of the disorders and interest in receiving information on (1) prevention of diseases in general and (2) testing for

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diseases in general. These associations were also analyzed after accounting for the influence of perceived threat of conditions.

Results.—Interest in receiving general health education was significantly associated with FH of depression (OR = 2.72, 95% CI = 1.74–4.25), anxiety (OR = 2.26, 95% CI = 1.45–3.22), and high blood pressure (OR = 2.54, 95% CI = 1.05–6.12). After adjustment for perceived threat, the magnitude of these associations was reduced substantially. The associations between perceived threat and either interest in receiving information on disease testing or receiving general health education were strong and significant across all conditions (OR = 2.11–3.74).

Discussion.—These results provide evidence that perceived threat mediates the association between FH and engagement with health education. Currently available health education programs may benefit from considering the role of FH in an individual's motivation for participation in health education activities alongside other factors.

Keywords

health belief model; community-based; anxiety; depression; diabetes; high blood pressure; family history

Introduction

Family history (FH) is a tool that can be used to stratify risk for chronic disease and translate genetic information into clinical practice (Saul et al., 2017, Yoon et al., 2002). Family history assessment uses health information on family members to evaluate risk of health condition in a genetically related individual. It is a valuable clinical tool to guide disease management because it takes genetic relatedness between individuals into account and acknowledges the influence due to environments shared between family members (York et al., 2005). Family history is a consistent risk factor for a range of conditions (Ashley-Koch et al., 2000; Baptiste-Roberts, 2007; Guttmacher et al., 2004; Harrison et al., 2003; Hettema et al., 2001; Janssens et al., 2012; Meigs, 2000; Nierenberg et al., 2007; Province et al., 1985; Shi et al., 2009; Sullivan et al., 2000; FBPP Investigators, 2002; Valdez et al., 2010; Walter et al., 2004; Yang et al., 2010; Yoon et al., 2002, 2009;). Use of FH in the clinical setting improves the detection of physical and mental health conditions including anxiety (Claassen et al., 2010, McLaughlin et al., 2008), depression (Hardt and Franke, 2007), diabetes (Yang et al., 2010), and high blood pressure (Guttmacher et al., 2004; Harrison et al., 2003; Janssens et al., 2012; Merai et al., 2016; Province et al. 1985,1989, 2003; FBBP Investigators, 2002; Valdez et al., 2010; Yoon et al., 2002, 2009). In addition to its clinical applications, FH may be an ideal tool for use with lay audiences because it is relatively easy to use to gather information via self-report on familial conditions, it quickly identifies risk, and it provides actionable information to the individual. To date, FH is less expensive, faster, and more predictive than use of measured genotypic data for many mental health conditions (Kendler et al., 2015; Yan et al., 2014).Consequently, incorporation of FH within community-based applications such as health education may be a promising strategy for developing awareness and genetics-related health literacy across chronic conditions on a population level (CDC Public Health Genomics, 2018).

Family History in Community-Based Health Education

The United States Centers for Disease Control and Prevention, Office of Public Health Genomics adopted a model to integrate evidence-based genomic applications across all levels of public health stakeholders (Green et al., 2015). However, such systematic integration in public health has not yet been realized. Specifically, there is far less knowledge regarding the implementation of FH in the area of health education (O'Leary et al., 2011) outside of clinical settings (Saul et al., 2017, Tarini et al., 2013; Thompson et al., 2015; Yoon et al., 2002;). Prior research indicates that there is little association between FH and behavior change (e.g., engaging in screenings, changing eating habits, and smoking reduction) for some physical conditions (e.g., cancers and cardiovascular disease) (Bousman and Madlensky, 2010; Heshka et al., 2008; Imes and Lewis, 2014; Kip et al., 2002; Madlensky et al., 2005; McCusker et al., 2004; Spector et al., 2009). There is even less research on the association between FH and behavior change in other disease domains (i.e., depression, anxiety, diabetes) (O'Connor et al., 2014). However, the integration of genomics-based applications such as FH may be associated with health information seeking, an important step in the development of health behaviors (O'Neill et al., 2010).

The application of FH within community settings, particularly via health education, remains underutilized and understudied for several reasons. First, the role of FH in the etiology of disease across health conditions may not be uniform. Therefore, there may not be a single FH-based approach for successful preventative care, including health education (Doerr and Teng, 2012). Second, it is unclear whether FH can be successfully integrated into health behavior research across all populations regardless of racial/ethnic and socioeconomic background because the majority of genetically informative research has been conducted in samples with highly educated participants of European descent (Popejoy and Fullerton, 2016). Few studies have investigated the utility of FH in populations with reduced access to health-related resources or in populations with a high proportion of individuals of non-European descent or lower socioeconomic background. Third, the translation of genomics-based research has primarily focused on clinical applications (i.e., Andreassen, 2017; Cornetta and Brown, 2013; Fernandez et al., 2013; Howe et al., 2016; Klitzman et al., 2013); in comparison, far fewer studies have considered the use of this information in community settings (Johnson, 2005; Valdezet al., 2010; Yoon and Khoury, 2002 and 2009;). Fourth, many studies have focused on the role of FH specifically on behavior change. However, behavior change occurs in the context of a series of intervening behaviors such as information seeking or passive exposure to health education to develop a personal level of awareness (Imes and Lewis, 2014; O'Neill et al., 2010).

As genomic information plays an increasingly important role in clinical and public health initiatives, community-based health education may benefit from the inclusion of FH and personalized risk. The use of principles described in the health belief model (HBM) may help understand how FH influences interest in the uptake of health education. The HBM is a conceptual framework used to explain how individuals make lasting decisions toward positive health-related behavior change and maintenance of behaviors (Janz and Becker, 1984). It consists of five dimensions that influence whether people address health conditions by taking action to prevent, to screen for, or to control them: (1) Perceived threat, a construct

that represents the combination of *perceived susceptibility* (i.e., the degree to which an individual perceives themselves to be at risk for experiencing a chronic health condition) and *perceived severity* (i.e., the magnitude of harm the individual expects to receive from the threat); (2) Perceived barriers, or an individual's estimates of the physical, psychological, financial, or other costs involved in a proposed action to address a threat; (3) Perceived benefits, which reflects a belief in the efficacy or value of a behavior that is expected to reduce a threat (Witte and Allen, 2000; Becker et al., 1977); (4) Cues to action, defined as external cues that trigger actions and activate readiness to engage in a behavioral change (e.g., health education activities to promote awareness); and (5) Perceived self-efficacy, which reflects an individual's confidence in their ability to take action. Additional demographic variables including sex, age, educational attainment, and access to health care influence the factors involved in the HBM (Janz and Becker, 1984; Becker et al., 1977; Galloway, 2003).

Family history is anticipated to motivate lifestyle changes through its influence on all dimensions of the HBM, although its effects may vary across conditions. In general, when FH is known, it is likely to influence perceived severity (Becker et al, 1977) as well as perceived threat (Janssens et al., 2012) for developing a disorder. The exact path by which FH influences behavior remains unclear. In some cases, it may reflect an affirmative perceived benefit, increasing self-control and motivating positive preventive action (Claassen et al., 2010; Vornanen et al., 2016). However, it can also be a perceived barrier to changing health behavior. Risk associated with a health condition may evoke anxiety and result in denial of information (Claassen et al., 2010). Nevertheless, FH has the potential to support health-related behavior changes and improve the efficacy of health education at multiple levels of disease management. Determination of the degree to which FH is associated with interest in receiving health information can be used to develop community-wide strategies focused on effective health education.

Study Purpose and Aims

It is presently unclear whether FH could be incorporated into community-based education efforts addressing chronic health conditions. In particular, the degree to which FH of chronic disease is associated with interest in community-based health education is unknown. Understanding the factors that influence interest in obtaining health education may provide insight into the likelihood of engaging with this cue to action. Therefore, this study tests the association between interest in receiving health education and FH for a range of complex, chronic health conditions (e.g., anxiety, depression, diabetes, and high blood pressure). We also test whether perceived threat for a health condition influences the relationship between FH and interest in receiving health information, since this might encourage individuals to communicate with others about a health topic (Kaphingist et al., 2016; Petty et al., 2002;).

This study assesses the role of FH within the HBM using data from a community-based sample of participants whose experiences are typically underrepresented in genetically informative research. The hypotheses of this study are: (1) there are positive associations between FH of health outcomes and interest in receiving health education and (2) the associations between FH and interest in receiving health education remain significant after

accounting for perceived threat. These hypotheses are tested across a range of physical and mental health conditions in order to explore the associations between FH and interest in receiving health education.

Methods

Participants

Data were obtained from a cross-sectional community-based survey of individuals in the East End of Richmond, VA. A total of 1,048 individuals aged 18–90 years old (average age = 46.7, SD = 15.4; 67.6% female) completed at least 75% of the survey. For analytic purposes, the sample was further restricted to individuals who had complete data for all variables included in the analysis (N = 948). There were no significant differences in the distributions of demographic characteristics (e.g., sex, age, ethnicity/race, education, and access to care) between participants with complete surveys versus those with incomplete surveys. The majority of participants identified as Black/African-American race/ethnicity (76%). Approximately 35% of participants reported having less than a high school education (Table 1).

Data Collection

Data were collected as part of a needs assessment of community residents living in or near public housing communities, in partnership with six community-serving organizational partners, including public health clinics embedded within public housing communities, churches, and area community centers. Academic and community partners agreed to jointly develop the assessment using a highly collaborative process to balance resident, organizational, and research perspectives. As such, data were collected in the following domains: (1) accessing health care services; (2) opinions on health and wellness issues affecting community residents, and interest in receiving health care information on specific health concerns; (3) demographic information; (4) lifestyle-related questions (e.g., alcohol use, cigarette use, frequency of exercise in the last week); (5) self-reported illnesses; (6) accessing child health care/educational services; and (7) community resident participation in community organization services/events. A summary of all survey questions and their summary statistics can be found at http://www.rampages.us/rvawellness.

Thirty residents living in the geographical area where the survey would take place participated in pilot testing of survey items. The demographic distribution of pilot participants was similar to that of survey participants [age range = 18–58 years (average age 35.1 years, SD = 13.5)]. Women represented 79% of the pilot sample. Verbal and anonymous written feedback from participants and resident recruiters was used to finalize the survey and ascertainment protocol. Pilot testing indicated greater understanding and response with the use of alternative nomenclature for certain items. Therefore, alternative terms to reflect conventional medical diagnoses for some conditions were used (e.g., “sugar in the blood” to refer to diabetes).

Survey participants were either individuals using services or participating in an event sponsored by a community partner, or were residents in the geographical area surrounding a

partner data collection site. Data collection teams were comprised of academic and community residents. Community resident team members had prior relationships with their neighbors and had developed the trust necessary to relay the importance of the project to their neighbors, which may have increased the likelihood of participation. After agreeing to participate, only the academic team members engaged participants in the informed consent process and facilitated survey administration in order to maintain privacy and anonymity of results. All adults (ages 18 and over) were eligible to participate. Surveys took approximately 20 minutes to complete. Upon survey completion, participants were given a small bag of gifts donated by community partner organizations which also included a resource card detailing organizational information to access health-related services. Participants who completed the survey were also invited to take part in a gift card drawing. All protocols were approved by the Virginia Commonwealth University Institutional Review Board.

Measures

Personal diagnoses and family history.—Participants were asked to report on their personal health conditions as well as those of their family members. Participants were asked, “Do you think that you or any of your family members have ever been told by a doctor or other health professional that you/they have any of the following?” Participants completed a table across a variety of health conditions, including: depression, anxiety, diabetes, and high blood pressure. Participants who indicated they had received a diagnosis for an outcome were coded as 1. Those who did not indicate a diagnosis were coded as 0.

Family history was estimated using responses to the previously discussed item on health conditions. In addition to reporting on personal diagnoses, participants also reported on the affected status of relatives: their biological parents (either mother or father); any of their aunts, uncles, or grandparents; and their biological siblings. Responses for which the participant thought a family member was affected were coded as 1 for “Yes” and 0 for “No.” The response for each outcome was weighted by a measure of genetic relatedness between a relative and the respondent: 0.5 for biological parents or siblings and 0.25 for biological aunts, uncles, or grandparents. The product was then summed to create a measure of FH for a specific condition while accounting for genetic relatedness. The six-level ordinal FH variable had a range of 0 (no FH) to 1.25 (strong FH). This approach is considered appropriate for this setting because it considers the relationship of relatives, giving greater weight to relatives with closer relationships and taking density of disorder (i.e., number of family members with an outcome) into account. Density scores of FH have been reported to produce stronger FH associations than dichotomous scores and are appropriate predictors of health outcomes (Milne et al., 2008; Murad et al., 2007; Silierberg et al., 1999). Polychoric correlations of FH between conditions were moderate ($r = 0.44–0.74$, $p < 0.001$).

Interest in Receiving Health Education.—Participants were asked about their interest in receiving specific forms of health education (“What kind of health information would you like to hear about?”). Participants responded to a list of 11 health educational topics, including one on receiving general health education (“Kinds of diseases and how to prevent them”) and another on disease testing (“What tests can help detect diseases”). Responses

were measured as 3-level ordinal variables: “Yes”, “Maybe”, and “No.” Responses of “Maybe” and “No” were aggregated to create binary variables comparing yes to no/maybe. The tetrachoric correlation between these two items was strong and significant ($r = 0.77$, $p < 0.0001$, Table 4).

Perceived Threat.—Participants were asked about the degree to which they considered a specific condition to be a health concern (“How much of a problem are these health concerns for you, your family, or other people who live in the East End?”). Participants responded to a list of health conditions, including: depression, anxiety, diabetes, and high blood pressure. Responses were measured as 3-level ordinal variables: “Not at all”, “A little”, and “A lot.” This measure aligns with the HBM definition of Perceived Threat as the combination of perceived severity and perceived susceptibility. Polychoric correlations between perceived threat items across conditions were strong and significant ($r = 0.60–0.88$, $p < 0.0001$, Table 4).

Covariates.—Age, sex, and educational attainment are demographic variables that have been consistently associated with knowledge of FH and thus were included in these analyses as covariates. Previous studies report that lower levels of education, male sex, and younger age are associated with lower awareness of FH (Kaphingist et al, 2016; Lima et al., 2016; Waters et al., 2014).

Self-reported personal diagnosis of illness (depression, anxiety, diabetes, and high blood pressure) as well as access to a medical home were also included in all models as covariates. Access to a medical home was measured as a binary item (“Do you have a particular place to go for routine medical care, such as check-ups and sick visits?”). These items were included because involvement with the healthcare system either through a diagnosis or via regular visits is associated with increased health knowledge (Osborne et al., 2007) including discussion regarding FH and may act as confounders in these analyses.

Statistical Analysis

Logistic regression was performed using a logit link function to model the association between interest in receiving health education as a binary measures and FH for each condition. Variance due to site clustering during data collection estimated using a generalized estimating equations (GEE) approach, specifically via an independent working correlation structure to account for site clustering (Liang and Zeger, 1986). Analyses were also weighted to account for the variance attributable to differences by site.

Two sets of models were tested. The first set of models tested for the association between FH for each of the health conditions and interest in receiving health education (as general health education as well as information on disease testing) while adjusting for identified covariates. The second set of models tested the role of the influence of perceived threat on the relationship between between FH for each of the four health conditions. These models adjusted for identified covariates and perceived threat specific to each of the health conditions. Therefore, a total of 16 models were tested and broken down into two sets as: (1) 8 models analyzed as 2 health education outcomes across 4 conditions with adjustment for covariates only and (2) 8 models including adjustment for covariates and perceived threat

analyzed as 2 health education outcomes across 4 health conditions. Tests of significance were adjusted to account for multiple testing using Bonferonni correction (0.05/16 = 0.003). All models accounted for the influence of covariates. All analyses were performed using PROC GENMOD in SAS, version 9.4 (SAS Institute, Inc., Cary, NC).

Results

Approximately one-third of participants reported having been diagnosed with depression (31.2%), anxiety (33.4%), or high blood pressure (34.2%). The prevalence of participants reporting a diagnosis of diabetes was 14.5%. Prevalence of participants with a positive FH of at least one family member affected with a health condition of interest ranged from 9.1% for depression to 31.7% for high blood pressure (Table 2). The prevalence of a high degree of perceived threat ranged from 44.7% for high blood pressure to 40.1% for depression (Table 3). Most participants indicated interest in receiving general health education (62.3%) and information on disease testing (63.6%). There was a moderate association between interest in receiving general health education and interest in receiving information on disease testing ($r = 0.56$, $p < 0.001$, Table 4).

There were weak to moderate tetrachoric correlations between FH and interest in receiving general health education and information on disease testing ($r = 0.13–0.25$, $p < 0.05$). There were significant moderate associations ($r = 0.19–0.41$, $p < 0.05$) between FH and perceived threat for all conditions. There were significant moderate associations between interest in receiving health education and perceived threat across all conditions ($r = 0.36–0.44$, $p < 0.0001$, Table 4).

After adjusting for covariates, interest in receiving general health education was significantly associated with FH of depression (OR = 2.72, 95% CI = 1.74–4.25), anxiety (OR = 2.26, 95% CI = 1.45–3.52), and high blood pressure (OR = 2.54, 1.05–6.12). After Bonferonni correction for multiple testing, the associations between FH for depression and anxiety remained significant (Table 5).

Interest in receiving information on disease testing was positively associated with a FH of anxiety (OR = 1.52, 95% CI = 1.08–2.14) and high blood pressure (OR = 2.17, 95% CI = 1.25–3.79). Participants with increasing severity of FH for these conditions were more likely to be interested in receiving information on disease testing. These associations did not remain significant after Bonferroni correction for multiple testing. No significant associations were observed for FH with depression or diabetes (Table 6).

After adjustment for perceived threat of a condition, interest in receiving general health education was significantly associated with FH of depression (OR = 1.98, 95% CI = 1.25–3.15) and anxiety (OR = 1.65, 95% CI = 1.02–2.67). These associations were no longer significant after adjustment for multiple testing. Associations between perceived threat of a health condition and interest in receiving general health education were significant across all conditions except for diabetes. Further, the magnitude of the association increased for each level of increased threat. For example, among participants who indicated that depression was of little concern, the odds ratio of indicating interest in receiving health education was 2.73

(95% CI = 1.70–4.36). The magnitude increased among those who indicated depression was a major concern (OR = 3.59, 95% CI = 2.43–5.34). These associations remained significant after Bonferroni correction (Table 7).

After adjustment for perceived threat of a condition, interest in receiving information on disease testing was not significantly associated with FH for any of the health conditions. Associations between perceived threat of a condition and interest in receiving information on disease testing were significant across all conditions. Further, the magnitude of the association increased for each level of increased threat. These associations remained significant after Bonferroni correction (Table 8).

Discussion

To our knowledge, this is the first comprehensive community-based study examining the relationship between FH and interest in receiving health information in a majority African-American population across multiple health conditions (depression, anxiety, diabetes, high blood pressure). It was hypothesized that (1) there would be positive associations between FH for several health conditions and interest in receiving health education (general education or information about disease testing) and (2) the associations would remain significant after controlling for perceived threat. Significant associations were found between FH for all health conditions and interest in receiving health education. However, the magnitude of these associations were reduced after adjusting for perceived threat. Specifically, the magnitude of the associations between FH and general health education were reduced for depression and anxiety and were no longer significant for diabetes and high blood pressure. The associations between FH and interest in receiving information on disease testing were no longer significant for any condition. This underscores the importance of perceived threat as a mediator of the relationship between FH and health information seeking for complex disorders, particularly in populations that have historically remained understudied in genomics research.

Association between Family History and Interest in Receiving Health Education is Mediated by Perceived Threat.

Prior to adjustment for perceived threat, there were strong and significant associations between FH for mental health conditions and interest in receiving general health education. After adjustment for perceived threat, the magnitude of these associations dropped substantially, indicating the role of perceived threat as a mediator of the relationship between FH and health information seeking. These results are consistent with those of prior studies of FH and perceived susceptibility, a component of perceived threat. For example, FH of depression was significantly associated with perceived susceptibility of depression in an adult Finnish sample (Vornanen et al., 2016). Further, increased perceived susceptibility of a mental health condition was associated with increased risk awareness and health seeking behavior, including receiving general health education (Becker et al., 1977; Claassen et al., 2010, Gulliver et al., 2012, Han et al., 2006; Witte and Allen, 2000;). In regard to chronic physical conditions (high blood pressure and diabetes), perceived threat influenced interest in receiving general health education above and beyond FH.

There were significant associations between interest in receiving information on disease testing and FH of high blood pressure as well as anxiety that were substantially reduced after adjustment for perceived threat, again underscoring its mediating effect on the relationship between FH and interest in receiving information on disease testing for these disorders. Interestingly, perceived threat was significantly associated with interest in receiving information on disease testing across all conditions. These associations remained significant at the highest levels of threat after adjustment for multiple testing. Therefore, although FH is a factor for seeking care, such knowledge is likely to function through the development of perceived threat to drive interest in receiving information on disease testing.

Use of Family History and Perceived Threat in Community-Based Health Education

These results encourage careful incorporation of FH as part of a coordinated community-based health education strategy to develop awareness around effective management of personal risk for physical and mental health conditions. First, there is a high prevalence of interest in receiving health education. Over 60% of all participants indicated interest in receiving health information on general disease prevention or testing. Further, over 55% of participants indicated a level of perceived threat across all conditions. Togther, these results emphasize a community need and interest to consider discussion of this topic in a community setting. Second, there is a moderate degree of awareness of family history in this population. Approximately 14–36% of participants indicated that either of their parents were affected with any of the physical or mental health conditions. Third, the mediation of perceived threat on the association between FH and interest in receiving health education was consistent across all health conditions and suggests that these factors function similarly for mental and physical conditions.

Risk assessment that includes discussion of FH as well as perceived threat may be valuable throughout a variety of settings including community outreach and in clinical visits for physical and mental health conditions. This is already common practice for the clinical management of high blood pressure (Glynn et al., 2010; Steurer-Stey et al., 2010). Risk assessment also occurs across several venues in the community setting. Blood pressure screening in the US is ubiquitous; many grocery stores and health fairs include some means by which the lay public can gather this information. Further, individuals are asked about FH of high blood pressure during routine health exams. Therefore, as suggested in the HBM, focused discussion of FH within a given health condition is expected to affect perception of threat which in turn supports future information seeking. It is possible that similar strategies may also be successful for mental health conditions since perceived threat also mediated the relationship between FH for mental health conditions and interest in seeking health education. However, compared to physical conditions, individuals may be less knowledgeable regarding the degree to which a relative has been impacted by mental health conditions, the number of relatives affected, or perceived differences between themselves and the affected relative (Claassen et al., 2010; Gulliver et al., 2012;). This reduced awareness is expected to result from reduced health literacy and stigmatization regarding mental health conditions. Nevertheless, strategies that include discussion of FH of mental health conditions as part of a program that develops perception of risk alongside these barriers is likely to influence future health information seeking.

Limitations

These results should be evaluated in light of the following limitations. First, this is a relatively homogenous sample of mostly African-American adults in an urban community. Therefore, results from our study may not generalize to other populations. However, this area of research has yet to be fully studied in predominantly African-American communities (Harrison, 2003). Further, genomic advances may exacerbate health disparities (Frank, 2007) and it is therefore important to develop strategies to reduce this potential gap with currently available data in community settings. Second, these exploratory analyses did not include all conceptual dimensions involved in the HBM. In particular, this study did not specifically account for the influence of disease susceptibility and disease severity, which contribute to perceived threat. We also did not determine whether information seeking actually occurred, rather interest in receiving information. These items were not incorporated as the study was completed as part of a community needs assessment and required careful inclusion of items to manage the time burden of completing the survey. Future studies are encouraged to include such items to understand the process of information seeking and behavior change. Nevertheless, this study identified the importance of perceived threat and its role in creating interest in engaging with health information. A key starting point for effective communication is to identify the beliefs an audience has prior to engagement (Lanie et al., 2004; Hesse, Cameron et al., 2012; Richards, Ponder and Lay, 1996). Such knowledge informs the types of behaviors indviduals are likely to adopt and is expected to improve the individualization of health education strategies (Mareau and Weinman, 2006; Leventhal, Brisette, and Leventhal, 2003; Costanzo, Lutgendorf, and Roeder, 2011). Third, awareness of familial affected status may have been under-reported across conditions. For example, a qualitative study on health beliefs among African-American women reported that depression and other mental illnesses were thought of as a “mind thing” that could be controlled and often not discussed among family members (Waite, 2008). The reliability of self report for FH often receives considerable scrutiny and is subject to moderate sensitivity resulting in a high degree of false-negative reports (Andreasen et al., 1977, 1986; Gallagher et al., 1982; Gershon and Guroff, 1984; Kendler et al., 2015). Therefore, the magnitude of the associations between FH and interest in receiving health information may be attenuated in these analyses rather than over-estimated. Fourth, these analyses were conducted in a cross-sectional sample and as such directionality of these associations cannot be tested with this study design. Consequently, it is possible that those who are interested in health know their family history better than others, and hence report more FH. Fifth, we adjusted for multiple testing in this exploratory study using Bonferroni correction, a highly conservative approach. Therefore, associations that were no longer significant after correction for multiple testing may benefit from additional study. Finally, our sample had little variability in potentially significant confounders, such as access to a medical home. Future studies of larger sample sizes are expected to successfully address this issue.

Conclusions and Future Directions

Our study results support existing evidence that FH is an important genetically-informative tool that supports health information seeking but that its influence is mediated through the perceived threat of a health condition. Accordingly, we have noted several possibilities for how FH can be incorporated into public health strategies as well as future research

applications. Notably, our study suggests that incorporating FH into local health education programs would probably be well-received by participants since such knowledge is associated with their interest in receiving this type of health information. Further, FH is expected to inform perceived threat which is likely to influence engagement with health education. This should be done in a coordinated fashion across multiple programming levels and community health partners (community, family, individual) to better leverage the HBM "cues to action." We also encourage input from community residents in order to ensure clear communication around these topics. Our findings also encourage clinicians to discuss FH across a range of conditions and encourage patients to talk to their families about current or potential illness in order to develop additional opportunities for cues to action.

The results presented here also prompt additional research to study the differences found in the association between FH of disease and health education across health outcome type, such as mental health versus physical conditions. The effect of other important factors also remains to be elucidated, e.g., rural versus suburban populations or populations in which other racial/ethnic groups are dominant.

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Table 1.

Characteristics of Study Participants (N = 948)

Variable	N	%
Sex		
Male	302	31.9
Female	646	68.1
Ethnicity		
American Indian	15	1.6
Asian/ Native Hawaiian/ Pacific Islander	1	0.1
Black/ African American	718	75.8
Hispanic/Latino	6	0.6
More than one race	30	3.2
White	31	3.3
Choose not to answer	148	15.7
Education		
Less than high school	334	35.2
High school graduate or GED	284	30.0
Some college	172	18.1
Bachelors degree and above	158	16.7
Needed health services in the past year but did not receive due to inability to cover cost	416	43.9
Access to Medical Home	770	81.2

Table 2.

Distribution of Individual and Family History by Condition (N = 948)

	N	%
Depression		
Self	296	31.2
Biological Parents	129	13.6
Biological Siblings	97	10.2
Aunts, Uncles, Grandparents	86	9.1
Anxiety		
Self	317	33.4
Biological Parents	150	15.8
Biological Siblings	91	9.6
Aunts, Uncles, Grandparents	89	9.4
Diabetes		
Self	137	14.5
Biological Parents	234	24.7
Biological Siblings	106	11.2
Aunts, Uncles, Grandparents	226	23.8
High Blood Pressure		
Self	324	34.2
Biological Parents	318	33.5
Biological Siblings	117	12.3
Aunts, Uncles, Grandparents	208	21.9

Table 3.

Distibution of Health-Related Beliefs and Opinions (N = 948)

Variable	N	%
Interest in Receiving Information on Disease Prevention		
No	284	30.0
Maybe	73	7.7
Yes	591	62.3
Interest in Receiving Information on Disease Testing		
No	265	28.0
Maybe	80	8.4
Yes	603	63.6
Perceived threat- Depression		
Not at all	335	35.3
A little	233	24.6
A lot	380	40.1
Perceived threat- Anxiety		
Not at all	308	32.5
A little	227	23.9
A lot	413	43.6
Perceived threat- Diabetes		
Not at all	353	37.2
A little	192	20.3
A lot	403	42.5
Perceived threat- High Blood Pressure		
Not at all	289	30.5
A little	235	24.8
A lot	424	44.7

Table 4.

Correlations of Interest in Receiving Health Education and Self-Report Diagnoses, Family History, and Perceived Threat of Health Outcomes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Depression - Self	1													
2. Anxiety - Self	**0.82*****	1												
3. Diabetes - Self	**0.20***	0.11	1											
4. HBP - Self	**0.17***	0.08	**0.51*****	1										
5. Depression - FH	**0.40*****	**0.37*****	0.11	0.00	1									
6. Anxiety - FH	**0.31*****	**0.40*****	0.00	−0.11	**0.74*****	1								
7. Diabetes - FH	0.09	**0.22****	**0.25*****	**0.15*****	**0.45*****	**0.44*****	1							
8. HBP - FH	**0.15***	**0.21*****	**0.06**	**0.13*****	**0.50*****	**0.52*****	**0.61*****	1						
9. Depression - PT	**0.54*****	**0.52*****	**0.12**	0.04	**0.39*****	**0.37*****	**0.21*****	**0.28*****	1					
10. Anxiety - PT	**0.50*****	**0.56*****	0.11	0.02	**0.37*****	**0.41*****	**0.20*****	**0.26*****	**0.88*****	1				
11. Diabetes - PT	0.09	**0.24*****	**0.47*****	**0.16***	**0.28*****	**0.21****	**0.39*****	**0.32*****	**0.60*****	**0.62*****	1			
12. HBP - PT	0.11	**0.13**	**0.17**	**0.41*****	**0.19****	**0.15**	**0.28*****	**0.37*****	**0.57*****	**0.55*****	**0.70*****	1		
13. Health Education	0.11	**0.20****	−0.02	0.07	**0.24****	**0.21***	**0.13**	**0.25*****	**0.36*****	**0.40*****	**0.42*****	**0.38*****	1	
14. Disease Testing	**0.13**	**0.17****	0.06	−0.02	0.12	0.16	**0.19**	**0.22**	**0.38*****	**0.37*****	**0.44*****	**0.41*****	**0.77*****	1

Bolded values indicate significant estimate at $p < 0.05$

* significant estimate at $p < 0.01$

** significant estimate at $p < 0.001$

*** significant estimate at $p < 0.0001$

Table 5.

Associations between Family History and Interest in Receiving General Health Education Adjusted by Covariates

	Depression		Anxiety		Diabetes		High Blood Pressure	
	β	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**
Family History	***1.00***	***2.72 (1.74–4.25)***	***0.81***	***2.26 (1.45–3.52)***	0.42	1.52 (0.88–2.62)	**0.93**	**2.54 (1.05–6.12)**
Personal Diagnosis								
No		Reference		Reference		Reference		Reference
Yes	**−0.36**	**0.70 (0.55–0.89)**	−0.55	**0.58 (0.40–0.83)**	0.03	1.03 (0.71–1.51)	0.17	1.19(0.71–1.97)
Sex								
Female		Reference		Reference		Reference		Reference
Male	**0.32**	**1.37 (1.01–1.86)**	**0.32**	**1.37 (1.02–1.84)**	**0.30**	**1.35 (1.01–1.80)**	**0.33**	**1.40 (1.05–1.87)**
Age	−0.003	0.99 (0.98–1.01)	−0.007	0.99 (0.98–1.01)	−0.006	0.99 (0.98–1.01)	−0.007	0.99 (0.98–1.01)
Education								
Bachelors or higher		Reference		Reference		Reference		Reference
Less than HS	***−0.70***	***0.48 (0.33–0.74)***	***−0.65***	***0.51 (0.36–0.77)***	**−0.55**	**0.57 (0.37–0.89)**	**−0.50**	**0.61 (0.41–0.91)**
HS graduate/ GED	**−0.56**	**0.54 (0.40–0.81)**	***−0.51***	***0.57 (0.44–0.81)***	**−0.44**	**0.65 (0.48–0.87)**	**−0.40**	**0.67 (0.48–0.93)**
Some college	0.003	1.00 (0.55–1.84)	0.02	1.02 (0.58–1.81)	0.12	1.13 (0.65–1.94)	0.12	1.13 (0.63–2.02)
Access to a Medical Home								
No		Reference		Reference		Reference		Reference
Yes	−0.02	0.98 (0.67–1.45)	0.003	1.00 (0.66–1.52)	−0.02	0.98 (0.68–1.46)	−0.09	0.91 (0.61–1.36)

Bolded values indicate significant estimate at $p < 0.05$

Italicized values indicate significant estimate after Bonferroni correction

Table 6.

Associations between Family History and Interest in Receiving Information on Disease Testing Adjusted by Covariates

	Depression		Anxiety		Diabetes		High Blood Pressure	
	β	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**
Family History	0.33	1.39 (0.80–2.39)	**0.42**	**1.52 (1.08–2.14)**	0.41	1.50 (0.82–2.75)	**0.78**	**2.17 (1.25–3.79)**
Personal Diagnosis								
No		Reference		Reference		Reference		Reference
Yes	**−0.44**	**0.65 (0.49–0.86)**	**−0.44**	**0.65 (0.52–0.80)**	0.17	1.18 (0.72–1.96)	−0.09	0.91 (0.66–1.25)
Sex								
Female		Reference		Reference		Reference		Reference
Male	0.06	1.05 (0.79–1.41)	0.07	1.06 (0.80–1.43)	0.05	1.05 (0.78–1.41)	0.08	1.08 (0.83–1.41)
Age	−0.004	0.99 (0.98–1.01)	−0.003	0.99 (0.98–1.01)	−0.01	0.99 (0.98–1.01)	−0.01	0.99 (0.98–1.01)
Education								
Bachelors or higher		Reference		Reference		Reference		Reference
Less than HS	***−0.73***	***0.48 (0.34–0.69)***	**−0.66**	**0.49 (0.37–0.71)**	**−0.57**	**0.55 (0.44–0.73)**	***−0.52***	***0.59 (0.42–0.83)***
HS graduate/ GED	−0.64	0.61 (0.40–1.04)	−0.38	0.64 (0.43–1.09)	−0.31	0.70 (0.50–1.07)	−0.27	0.76 (0.50–1.13)
Some college	0.07	1.07 (0.71–1.61)	0.09	1.09 (0.72–1.67)	0.18	1.20 (0.90–1.61)	0.19	1.21 (0.82–1.80)
Access to a Medical Home								
No		Reference		Reference		Reference		Reference
Yes	−0.02	0.99 (0.68–1.47)	0.006	1.01 (0.68–1.50)	−0.01	0.99 (0.68–1.45)	−0.06	0.95 (0.66–1.36)

Bolded values indicates significant estimate at $p < 0.05$

Italicized values indicate significant estimate after Bonferroni correction

Table 7.

Associations between Family History and Interest in Receiving General Health Education Adjusted for Perceived Threat of Disease and Covariates

	Depression		Anxiety		Diabetes		High Blood Pressure	
	β	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**
Family History	**0.69**	**1.98 (1.25–3.15)**	**0.50**	**1.65 (1.02–2.67)**	−0.04	0.96 (0.56–1.64)	0.65	1.92 (0.78–4.74)
Age	−0.001	0.99 (0.98–1.01)	0	1 (0.99–1.01)	−0.004	0.99 (0.98–1.01)	−0.01	0.99 (0.98–1.01)
Personal Diagnosis								
No		Reference		Reference		Reference		Reference
Yes	0.8	1.08 (0.83–1.42)	−0.19	0.83 (0.61–1.11)	−0.48	0.62 (0.39–1.001)	−0.08	0.92 (0.59–1.43)
Sex								
Female		Reference		Reference		Reference		Reference
Male	0.31	1.37 (0.98–1.92)	**0.33**	**1.39 (1.04–1.87)**	0.23	1.26 (0.92–1.73)	0.33	**1.40 (1.01–1.94)**
Education								
Bachelors or higher		Reference		Reference		Reference		Reference
Less than HS	**−0.55**	**0.58 (0.37–0.89)**	**−0.57**	**0.57 (0.39–0.83)**	−0.25	0.81 (0.47–1.27)	−0.38	0.69 (0.44–1.06)
HS graduate/ GED	**−0.44**	**0.64 (0.46–0.89)**	**−0.47**	**0.62 (0.45–0.87)**	−0.23	0.78 (0.62–1.01)	**−0.32**	**0.72 (0.54–0.98)**
Some college	0.18	1.20 (0.62–2.33)	0.14	1.16 (0.59–2.26)	0.37	1.45 (0.80–2.59)	0.21	1.24 (0.68–2.24)
Access to a Medical Home								
No		Reference		Reference		Reference		Reference
Yes	0.02	1.02 (0.69–1.52)	0.11	1.12 (0.75–1.66)	−0.07	0.93 (0.67–1.30)	−0.09	0.92 (0.63–1.33)
Disease-Specific Perceived Threat								
Not at all		Reference		Reference		Reference		Reference
A little	***1.002***	***2.73 (1.70–4.36)***	***0.76***	***2.14 (1.56–2.92)***	***1.32***	***3.74 (1.74–8.02)***	***0.75***	***2.11 (1.43–3.10)***
A lot	***1.28***	***3.59 (2.43–5.31)***	***1.23***	***3.43 (2.53–4.63)***	***1.63***	***5.10 (3.67–7.07)***	***1.23***	***3.41 (2.65–4.39)***

Bolded values indicates significant estimate at $p < 0.05$

Italicized values indicate significant estimate after Bonferroni correction

Table 8.

Associations between Family History and Interest in Receiving Information on Disease Testing Adjusted for Perceived Threat of Disease and Covariates

	Depression		Anxiety		Diabetes		High Blood Pressure	
	β	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**	**β**	**OR 95% CI**
Family History	−0.02	0.97 (0.59–1.62)	0.16	1.18 (0.78–1.78)	−0.01	0.99 (0.57–1.71)	0.47	1.60 (0.95–2.69)
Age	−0.003	0.99 (0.98–1.01)	−0.002	0.99 (0.98–1.01)	−0.007	0.99 (0.98–1.01)	−0.004	0.99 (0.98–1.01)
Personal Diagnosis								
No		Reference		Reference		Reference		Reference
Yes	−0.04	0.96 (0.68–1.37)	−0.14	0.87 (0.68–1.10)	−0.29	0.75 (0.45–1.25)	**−0.40**	**0.67 (0.47–0.96)**
Sex								
Female		Reference		Reference		Reference		Reference
Male	−0.003	1.00 (0.73–1.36)	0.06	1.07 (0.80–1.44)	−0.03	0.97 (0.72–1.30)	0.07	1.07 (0.80–1.43)
Education								
Bachelors or higher		Reference		Reference		Reference		Reference
Less than HS	−0.58	**0.56 (0.37–0.84)**	−0.60	**0.54 (0.38–0.80)**	−0.31	**0.74 (0.55–0.97)**	−0.41	**0.66 (0.46–0.95)**
HS graduate/ GED	−0.32	0.72 (0.43–1.23)	−0.34	0.66 (0.42–1.18)	−0.11	0.90 (0.58–1.39)	−0.18	0.79 (0.51–1.36)
Some college	0.27	1.31 (0.87–1.98)	0.20	1.22 (0.79–1.89)	0.41	**1.51 (1.10–2.07)**	0.30	1.35 (0.94–1.93)
Access to a Medical Home								
No		Reference		Reference		Reference		Reference
Yes	0.03	1.03 (0.71–1.50)	0.09	1.09 (0.75–1.60)	−0.06	0.94 (0.66–1.34)	−0.05	0.96 (0.66–1.38)
Disease-Specific Perceived Threat								
Not at all		Reference		Reference		Reference		Reference
A little	**0.75**	**2.14 (1.31–3.46)**	**0.52**	**1.73 (1.18–2.37)**	***1.05***	***3.10 (1.80–4.51)***	***0.67***	***1.95 (1.42–2.69)***
A lot	***1.30***	***3.68 (2.38–5.70)***	***1.03***	***2.80 (1.85–4.24)***	***1.50***	***4.50 (3.08 – 6.57)***	***1.35***	***3.84 (2.51–5.88)***

Bolded values indicates significant estimate at $p < 0.05$

Italicized values indicate significant estimate after Bonferroni correction