Familial Communication Patterns in a Cohort of Men with Metastatic Prostate Cancer: A Cross-sectional Exploratory Analysis Using Data from the GENTleMEN Study

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Abstract

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Background – A notable subset of men with metastatic prostate cancer (mPC) may carry an inherited germline mutation in a key cancer risk gene such as *BRCA1* or *BRCA2*, predisposing them and their relatives who share the mutation to increased risk of certain types of cancer including breast, ovarian, and prostate cancer. Men with mPC could be the first members of their family to realize the presence of a cancer gene mutation and therefore have a responsibility to communicate information about hereditary cancer risk to male and female family members so that those that are carriers can participate in cancer risk management and prevention strategies. However, research thus far has not included men as central figures in the hereditary breast and ovarian cancer (HBOC) and hereditary prostate cancer risk communication process.

Methods – We used a subset of responses to the initial survey of a large cohort study known as the GENTleMEN study (n = 584) to conduct a cross-sectional exploration of communication patterns of men with mPC. We looked at three communication outcomes including the number of mPC patients reporting: (1) frequent communication with related family members, (2) difficulty communicating with family about cancer risk, and (3) satisfaction with their familial risk communication. To assess the independent effects of a variety of demographic and personal

characteristics on the three communication outcomes, we built multivariable models using multiple logistic regression.

Results – 62.9% of mPC patients frequently communicated with their biological relatives about cancer, 74.9% of mPC patients did not find familial risk communication to be difficult, and 84.4% of mPC patients were satisfied with their current level of familial risk communication. In the multivariable models, frequent communication was positively associated with cancer worry (OR = 1.68; 95%CI = 1.07-2.70) and family satisfaction (OR = 2.20; 95%CI = 1.47-3.33); while it was negatively associated with older age (OR = 0.53; 95%CI = 0.29-0.93). Difficulty communicating with family about risk was positively associated with being of a minority race (OR = 2.71; 95%CI: 1.29-5.64) and having cancer-related distress (1.71; 95%CI = 1.31-2.24); difficulty was negatively associated with family satisfaction (0.51; 95%CI = 0.29-0.89). Lastly, having more satisfaction with familial risk communication was negatively associated with more formal education (OR = 0.58; 95%CI = 0.33-0.98) and depression (OR = 0.26; 95%CI = 0.10-0.72).

Conclusion –mPC patients who are of older age and minority race, and who have underlying mental health comorbidities may have more challenges communicating to family members about cancer risk. These subgroups require more research attention and may ultimately need specialized interventions to increase familial cancer risk communication.

INTRODUCTION

Inherited Risk of Prostate Cancer

Prostate cancer is the most commonly diagnosed cancer and the second-leading cause of cancer-related death among males in the United States (US).[1] In the general US population, men face an 11.6% risk of developing prostate cancer throughout their lifetimes.[2] Despite this large burden, advances in early detection and treatment of prostate cancer have allowed for most prostate cancer patients to be diagnosed at local and regional stages with overall good prognoses, where nearly 100% of patients survive 5-year post-diagnosis.[2] However, about 6% of prostate cancer patients are still diagnosed with metastatic prostate cancer (mPC), when 5-year survival drops to 30%.[2] In this subset of mPC patients, up to 11.8% may carry an inherited germline genetic mutation in a key cancer risk gene such as *BRCA1*, *BRCA2*, *CHEK2*, *ATM*, *PALB2*, and mismatch repair genes.[3–8] These mutations are the cause of many familial hereditary cancer syndromes in which increased risk of cancer is genetically passed on through generations of a family.[5–9] The most common hereditary cancer syndrome increasing risk of prostate cancer is caused by *BRCA1* and *BRCA2* (*BRCA1/2*) gene mutations and is known as hereditary breast and ovarian cancer (HBOC) syndrome, named after its role in elevating risk of breast and ovarian cancers in females.[9] Having certain mutations in *BRCA1/2* can increase risk of breast and ovarian cancers from about 12% and 2% in the general population respectively to as much as 35-72% over the course of a female carrier's lifetime and risk of prostate cancer from 11.6% to as much as 20-30% in a male carrier's lifetime.[1,8,9]

Communication in Hereditary Cancer Families

A diagnosis of mPC can indicate a possible HBOC/*BRCA* mutation within the family.[3–6] Therefore, genetic testing of prostate cancer patients has important implications for both male and female members of the family unit. The process of cascade testing, which involves

systematically testing family members for a particular genetic variant once a primary cancer patient (a proband) has been discovered to be positive, can make a substantial difference in a family's ability to prevent cancer by implementing risk reducing interventions.[10,11] With knowledge of their mutation, cancer-free carriers can utilize screening methods such as mammography/MRI (for breast cancer) and prostate specific antigen (PSA) blood testing (for prostate cancer) to detect cancer at earlier and more treatable stages, and ultimately increase survival.[12,13] Female carriers can further opt for prophylactic surgeries including mastectomy (removal of breast tissue) or salpingo-oophorectomy (removal of ovaries and fallopian tubes) which have been shown to reduce risk of cancer by as much as 80%.[14,15]

A proband's ability to effectively communicate about genetic cancer risk to relatives is essential to opening pathways to cascade testing and cancer risk management for the rest of the family.[10,11] Historically males in HBOC/*BRCA* families have not been recognized as potential probands at elevated risk for cancer themselves by their family members, but rather as carriers who may pass the variant to vulnerable daughters.[16–18] Much of the research on the patterns of communication in HBOC/*BRCA* families therefore has concentrated on a cohort of female probands with breast or ovarian cancer and their disclosure patterns to male and female relatives.[17,19–21] In samples of women, most (91-100%) of those tested for *BRCA* mutations report speaking to at least one close relative about hereditary cancer risk and *BRCA1/2* status after receiving results.[17,19,20,22] In some studies of women, older age and being a member of a minority race (e.g. Asian) have been associated with lower likelihood to share results.[20]

The limited research on genetic results disclosure in men at higher risk of prostate cancer primarily comes from the roles they play operating within the context of female cancer risk for HBOC.[10,16,17,22] Mixed samples of men and women still show high rates of *BRCA* results

disclosure (88-100%).[10,22] Research has shown some evidence that although men with known germline mutations are equally as likely to communicate risk information to family members as women are, they are more likely to "express difficulty discussing positive" results.[22] A synthesis paper on male *BRCA* mutation carriers found that social constructs may dictate that men not only receive genetic testing for *BRCA* less often than women, but also do not as readily acknowledge the health-related vulnerabilities related to mutation status.[18] Moreover, a series of qualitative studies have reported that both men and women view *BRCA1/2* and other HBOC-related mutations as a "women's problem"[16] and tend to deprioritize informing male relatives of a positive cancer mutation within the family, often cutting chains of communication as information is passed along branches of the family tree.[10,16,17] The combination of these results suggest that the communication of cancer risk between males and their family members in HBOC/*BRCA* families might be quite different than those of female probands.

However, studies thus far have not independently examined men as probands (i.e. the first in their families to indicate a potential cancer gene mutation) or their experiences as central communicators of cancer risk. It is not currently known how male probands communicate about prostate cancer risk with their relatives or what demographic, emotional, and familial characteristics play a role in modulating the likelihood of communication in this population.[10,16–22] It is essential to learn more about the communication patterns of male members of hereditary breast, ovarian, and prostate cancer families in order to understand the flow of communication within the family unit and continue to improve the rates of cascade testing.

Study Objective

As a secondary analysis of data from the initial survey of a large longitudinal study based in Seattle, WA known as the GENTleMEN study (Genetic Testing for Men with mPC), the present analysis aims to fill this gap. The GENTleMEN study is a prospective observational

study that provides online genetic education and mail-in germline genetic testing to men with mPC. The GENTleMEN study team is currently enrolling a cohort of men with mPC to assess whether mail-in testing is an acceptable mode of delivering genetic testing to men with mPC.[23] Using survey data collected through January 10, 2020, the present analysis aimed to describe cancer communication and risk communication patterns in a sample of GENTleMEN enrollees. The objectives of the current study were to:

1. Find the proportion of mPC patients who report regular communication with biological family members about their cancer.
2. Assess the general feelings about family risk communication of mPC patients in terms of difficulty and satisfaction-level of current communication.
3. Identify demographic, emotional, and familial covariates of more frequent communication, more difficulty communicating, and more communication satisfaction.

We hypothesized that at least half of mPC patients would report infrequent communication with relatives, feel as if conversations about risk were difficult, and feel unsatisfied with discussions about cancer risk. We predicted that increased age, being of a minority race, having less formal education, and having depression and anxiety would decrease communication frequency and satisfaction and increase difficulty; and that having a good perception of family life would increase communication frequency and satisfaction and decrease difficulty. Lastly, we hypothesized that worrying often about cancer would have a unique relationship with the communication variables by increasing overall frequency of communication, but also increasing difficulty and decreasing satisfaction.

METHODS

Study Sample and Recruitment

This analysis used a subset of all men who had been enrolled in the GENTleMEN study between October 2, 2017 and January 10, 2020. Men were eligible for the GENTleMEN study if they were 18 years or older and had a current diagnosis of mPC.[24] Multiple methods were used to recruit eligible individuals throughout Washington State including clinic-level recruitment at 7 Seattle Cancer Care Alliance (SCCA) sites and mail-out notices to all urologists and medical oncologists in the state.[24] Prostate cancer patients were also recruited via internet ad postings on the SCCA and partner websites.[24] The study expanded recruitment in April 2018 by launching several national news stories to the general public. GENTleMEN study enrollment is still taking place and is expected to continue through 2020.

Interested prostate cancer patients are able to self-enroll online via the GENTleMEN study website (www.gentlemenstudy.org). Enrollees in the present analysis were further screened for eligibility after submitting an initial questionnaire. Online genetic educational material was distributed and a saliva-based genetic test kit from Color Genomics was sent via mail to all participants after informed consent and confirmation of eligibility were complete. Those who could not provide a documented history of metastatic disease, those who did not consent to DNA testing, and those who did not fill out any sections in the initial survey were excluded from study enrollment. For the purpose of the present analysis we further excluded patients who were under 30 years of age at the time of enrollment due to the rarity of mPC diagnosis at younger ages and possible differences in tumor biology that could influence communication styles. There were two rounds of the initial survey included in our secondary analysis dataset. In the first round, 16 out of 23 men had not completed the relevant sections of the initial survey and were dropped. In the second round, 32 out 866 men did not fill out any

sections of the survey, 108 men did not meet the metastatic disease criteria, and 117 men did not consent to DNA testing. This left 611 records available for analysis, following which an additional 23 participants who did not complete the demographic portion of the survey and 2 participants who did not meet the age requirement were dropped for the present analysis. The final analysis dataset included 584 participants.

Data Collection

After signing informed consent, participants of the GENTleMEN study were asked to complete a HIPAA-compliant self-administered web-based initial survey through RedCap. The initial survey gathered information about respondents' cancer communication frequency with first- and second-degree relatives and about their general feelings regarding discussing cancer risk with family (i.e. comfort-level and satisfaction). It also included questions about family history of cancer, participant's overall health status, emotional wellbeing, degree of cancer worry, and familial satisfaction through a variety of validated health measures. Demographic variables such as age at survey, level of education, race/ethnicity, marital status, and number of biological children were also collected.

Measures

Outcome variables - This analysis examined three main outcomes to categorize communication patterns of men with mPC.

Frequency of prostate cancer communication – The first outcome was defined as the frequency of communication with first- and second-degree relatives about prostate cancer. This measure was considered a proxy for the willingness to discuss risk with related family members in the future. The outcome was assessed using a 6-item Frequency of Communication (FOC) variable which asked "within the last year, how much have you spoken about prostate cancer with each of the following family members: 1. mother, 2. father, 3. sister(s), 4. brother(s), 5.

child(ren), and 6. Grandchild(ren)?" Frequency of communication with each relative was measured on a 4-point Likert scale (1 = Not at all, 2= a little, 3= some, 4= a lot) and included an option "0" for not having the family member of interest. As defined in previous work by Bowen et al. each participant's overall FOC score was calculated by finding an average score over all living relatives.[25] "NA" responses were treated as "do not have this relative" and therefore did not count against the average. 12 participants responded "do not have this relative" for all 6 items and were excluded from all FOC analyses. This yielded a final sample size of n = 572 for the FOC outcome. FOC scores were dichotomized into two groups. Participants with FOC scores >2 were considered "frequent" communicators, while participants with FOC scores ≤2 were considered "infrequent" communicators. This cut-off is consistent with other studies on communication among hereditary cancer families.[26,27]

Risk communication difficulty/satisfaction – Difficulty and satisfaction with discussions surrounding prostate cancer risk were also assessed as outcomes. Difficulty was measured by asking respondents to rate on a 4-point Likert scale the degree to which they agree or disagree with the statement "It's hard for me to talk about my prostate cancer risk with my relatives" (1 = disagree, 2 = somewhat disagree, 3 = somewhat agree, 4 = agree). 2 participants did not respond to this item and were removed from the difficulty analyses, leaving a final sample size of n = 582 for the difficulty outcome. The final difficulty variable was then dichotomized. Participants who answered "disagree" or "somewhat disagree" were said to experience "less difficulty", while participants who answered "somewhat agree" or "agree" were said to experience "more difficulty" with risk communication.

Satisfaction was measured by asking respondents to rate on the same 4-point Likert scale as the difficulty outcome the degree to which they agree or disagree with the statement "I feel

satisfied with my communication with my family about what my prostate cancer risk means to me." 6 participants did not respond to the satisfaction item and were excluded from the satisfaction analysis, yielding a final sample size of n = 578 for the satisfaction outcome. Participant responses were dichotomized along the satisfaction variable, with participants who answered "somewhat agree" and "agree" in the "more satisfied" category, and participants who answered "somewhat disagree" and "disagree" in the "less satisfied" category.

Covariates of interest

Demographic characteristics – The demographic characteristics that were assessed as covariates included age at the time of study enrollment, age at the time of prostate cancer diagnosis, race, marital status, level of education, employment status, household income, and number of biological children. All demographic variables of interest were dichotomized. Age at survey and age at diagnosis were categorized as "<60 years" and "≥60 years" in accordance to the National Comprehensive Cancer Network (NCCN) criteria for hereditary genetic testing of prostate cancer patients.[28] Race was categorized as "White" and "Non-White"; marital status as "Married" and "Not Married (Divorced, Widowed, Never Married)"; level of education as "4-year College Degree or Higher" and "Less than 4-Year College Degree"; employment status as "Currently Working/Student" and "Not Currently Working (Retired, Unable to Work, Unemployed)"; household income as "<$50,000" and "≥$50,000"; and number of biological children as "None" and "One or More."

Cancer-related stress and fears – cancer related stress and fears were defined as the participants' emotional state specific to cancer-fears and worries. We measured two different variables for cancer related emotions:

Cancer-related distress/post-traumatic – Cancer-related stress was recorded in the GENTleMEN initial survey with questions from the Impact of Events Scale (IES). The IES is a 15-item validated questionnaire assessed on a 4-point Likert scale (0 = not at all, 1 = rarely, 3 = sometimes, 5 = often). The IES questions in the initial survey asked about how often a respondent worried about cancer in the last seven days (i.e. "I thought about my cancer when I didn't mean to"). The IES is used in clinical settings to assess the degree of distress caused by a "specific event" such as a cancer diagnosis and can be viewed as a measure of post-traumatic stress disorder (PTSD).[29] In cancer trauma research, the IES has been shown to be both reliable and valid in measuring distress.[30] In the present study, the total IES score was calculated for each participant by summing the values across all 15 items (maximum score = 75). Participant scores were then categorized by clinical cut-offs of severity: subclinical (score <8), mild (score = 9-25), moderate (score = 26-43), and severe (score = 44-75).[29] 40 participants (6.8%) did not response to at least one of the IES questions and were excluded from analyses involving this variable.

Cancer worry – The GENTleMEN initial survey asked a subset of 4 questions from the Cancer Worry Scale (CWS), which we used to assess general cancer worry in everyday life. The CWS is an 8-item validated Likert measure of cancer worry as related to cancer risk and concerns.[31] The cancer worry scale has several questions focused on concerns surrounding the future development of cancer which were dropped or reworded for GENTleMEN participants since all participants already had cancer in our evaluation.[31] This left 4 questions for use in our modified scale which included items such are "during the past month, how often have thoughts about prostate cancer affected your mood?" (1 = Not at all or rarely, 2 = Sometimes, 3 = Often, 4 = A lot). To calculate an overall CWS score for each participant, values were summed across the 4

items (maximum score = 16). A categorized measure was formed by using the bottom quartile, two middle quartiles, and top quartile of overall CWS scores in the sample to form three cancer worry classification levels for our final analysis: low concern (score = 4-7), moderate concern (score = 8-12), and high concern (score = 13-16). Less than 1% of the sample of 584 did not respond to at least one CWS question and were excluded from analyses involving the CWS variable.

General emotional/psychological state – General emotional and psychological state was defined with two variables:

Depression – The initial survey used questions from the Patient Health Questionnaire-9 (PHQ-9) to assess the degree of depression in GENTleMEN participants. The PHQ-9 is a 9-item validated tool used in clinical settings to diagnose depression. The PHQ-9 asks questions on a 4-point Likert scale (0 = Not at all, 1 = Several days, 2 = More than half the days, 3 = Nearly every day) about the occurrence of events over the last two weeks such as "having little interest or pleasure in doing things," and "feeling down, depressed, or hopeless." Previous studies have reported a high sensitivity (88%) and high specificity (88%) for diagnosis of major depression.[32] Participants' overall PHQ-9 scores were calculated by summing together their responses across all 9 items (maximum score = 27). Scores were categorized according to the defined clinical cut-offs for depression: minimal (score <5), mild (score = 5-10), moderate (score = 11-15), moderately severe (score = 16-20), and severe (21-27).[32] 19 participants (3.3%) did not respond to at least one PHQ-9 item and were dropped from analyses involving this variable.

Generalized Anxiety Disorder – The initial survey used the Generalized Anxiety Disorder-7 (GAD-7) scale to assess the level of general anxiety of participants. This scale is a 7-item questionnaire analogous to the PHQ-9 which asks participants to state how often in the last two

weeks certain anxiety-related events have occurred such as "feeling nervous, anxious, or on edge" and "not being able to stop or control worrying" (0 = Not at all, 1 = Several days, 2 = More than half the days, 3 = Nearly every day). When used in clinical settings, the GAD-7 questionnaire has shown a sensitivity as high as 89% (specificity 82%).[33] An overall GAD-7 score was calculated for each participant by summing together responses for the 7 items (maximum score = 21). Participants were then categorized using the clinically defined cut-offs for generalized anxiety disorder: minimal (score <4), mild (score = 5-9), moderate (score = 10-14), and severe (score = 15-21).[33] 31 participants (5.3%) did not respond to at least one GAD-7 item and were dropped from analyses involving this variable.

Perceptions of family life – The GENTleMEN initial survey collected data on family characteristics and perceptions of family life using the Family Satisfaction Subscale (FSS) of the Family Adaptability and Cohesion Scale IV (FACES IV).[34] The FSS measures general satisfaction within the family unit with 10 items presented as 5-point Likert questions such as "how satisfied are you with the degree of closeness between family members" (1 = Very dissatisfied, 2 = Somewhat dissatisfied, 3 = Generally satisfied, 4 = Very satisfied, and 5 = Extremely satisfied)? Overall FSS scores for each participant were calculated by summing the values across all 10 items of the FSS (maximum score = 50). Participant FSS scores were then categorized by using the standard cut-offs: Very low satisfaction (score = 10-29), low satisfaction (score = 30-35), moderate satisfaction (score = 36-39), high satisfaction (score 40-44), and very high satisfaction (score = 45-50).[34,35] 32 participants (5.5%) did not respond to at least one FSS question and were excluded from analyses using the FSS variable.

Analysis

To evaluate the proportion of mPC patients who communicated with their families about cancer and to characterize mPC patients' general feelings about cancer risk communication,

descriptive statistics were performed on the marginal frequencies of the three main outcomes (frequency of communication, risk communication difficulty, and risk communication satisfaction). We developed a set of contingency tables to represent each covariate of interest versus each outcome of interest. To identify factors that may modulate familial communication, we performed bivariate statistics, testing each covariate of interest for an association with each communication variable (i.e. frequency of communication, risk communication difficulty, risk communication satisfaction). In the bivariate analyses, chi-squared tests for significance were used to evaluate the demographic covariates of interest. For all other psychological and family-related variables in the bivariate tests, we performed univariate logistic regression and reported the p-values. Significance was defined as $p < 0.05$.

Finally, to assess the independent effect of each covariate on each communication outcome, we built three multivariable models using the covariates that were significant or marginally significant in the bivariate analysis. For the multivariate analysis, all covariates including demographics, emotional/psychological state, cancer-related fears, and perception of family life were dichotomized into high/low severity categories. In order to capture all associations that could be important, covariates were used in the multivariable models if they had $p < 0.25$ in the bivariate analysis and if they did not show signs of multicollinearity with any other variable. This p-value selection criteria was described in a 2008 paper by Bursac et al. [36] We found the odds ratio (OR) for the covariates' effects on each outcome of interest. 95% confidence intervals and p-values for each association were reported in order to assess significance. Covariates in the multivariable models were considered to be significant if $p < 0.05$.

We used two methods to assess multicollinearity. First, we performed pairwise linear regression between all covariates of interest that could be measured continuously (i.e. ages, scale scores). We used a correlation coefficient cut-off of $r \geq 0.8$ for determination of a linear relationship.[37] Although relationships between age at survey versus age at diagnosis, and depression versus anxiety showed moderate-to-strong correlations ($r = 0.72$ and $r = 0.69$ respectively), they did not reach the cutoff of $r \geq 0.8$ for removal and all covariates were retained. We also calculated variance inflation factor (VIF) scores for each variable to further assess the presence of multicollinearity after model formulation. A VIF score ≥ 5 was considered evidence of multicollinearity.[37] Since all VIF scores were less than 2, we did not consider multicollinearity to be an issue in any of our final models.

All analyses used R version 3.5.2 (The R Foundation for Statistical Programming, 2018) and RStudio (Boston, MA: RStudio Team, 2015).

RESULTS

Demographic and Personal Characteristics

Tables 1a and 1b show the demographic characteristics and personal characteristics (i.e. emotional/psychological, cancer concern, family variables) of the final GENTleMEN subset. After excluding individuals who did not report on any of the demographic variables of interest, there were a total of 584 mPC patients. Age at enrollment ranged from 41 to 93 years, with a mean age of 69.5 years. The majority of participants were 60 years of age or older at the time of study enrollment (86.8%) and at the time of cancer diagnosis (69.3%). Reflecting the older age of the sample, most men were married (75.5%), retired or not working (74%), and had at least one biological child (80.8%). Most men were white (89.6%), with racial minorities making up less than 10% of the sample and were well-educated with at least a college degree (59.2%).

Almost two-thirds (64.9%) reported an annual household income of $50,000 or more, 27.7% reported a household income of below $50,000, and 6.7% could not provide an estimate of annual income.

Over two-thirds (67.5%) of respondents had no or few symptoms of cancer-related distress or PTSD (combined subclinical and mild categories) according to their IES score, while 19.9% of the sample had moderate levels of PTSD, and 5.8% of the sample had severe levels of PTSD. About half (53.1%) of respondents reported worrying moderately about their cancer, 25.2% reported low levels of worrying, and 20.9% reported high levels of worrying according their CWS score. 12.9% and 8.2% of participants had PHQ-9 (depression) and GAD-7 (general anxiety) scores respectively which measured as moderate-to-severe. In terms of family satisfaction, nearly half (48%) of those responding had very low or low satisfaction, while 17% had moderate family satisfaction, and 29.4% had high or very high family satisfaction according to their FSS scores. No personal variables were missing more than 7% of data.

Overall Patterns of Communication

Table 2 shows the overall proportion of participants in the frequency of communication, risk communication difficulty, and risk communication satisfaction outcomes. For the frequency of communication outcome, the majority (62.9%) of mPC patients who had at least one of the six family members of interest (n = 572) communicated frequently in the past year with those family members about the topic of cancer (FOC score >2). 37.1% reported infrequent communication (FOC score $\leq$ 2). Only 3.8% of participants (n = 22) did not talk to any of the family members of interest about cancer in the past year (not represented in Table 2). For the communication difficulty outcome, overall, men in the GENTleMEN sample did not report difficulty communicating about risk with family members. Nearly three-quarters (74.9%) of the 582 participants who responded to the difficulty question answered “disagree” or “somewhat

disagree" to the statement "It's hard for me to talk about my prostate cancer risk with my relatives." About one-quarter (25.1%) of the sample somewhat agreed or agreed with this statement. For the communication satisfaction outcome, most men in the GENTleMEN sample felt satisfied with their current family discussions about cancer risk. 84.4% of the 578 participants who answered the satisfaction question said that they "agreed" or "somewhat agreed" with the statement "I feel satisfied with my communication with my family about what my prostate cancer risk means to me." 15.6% of the total sample reported that they disagreed or somewhat disagreed with the statement and were not satisfied with their current risk communication strategy.

Covariates for Frequency of Cancer Communication

Table 3 shows the results of the bivariate analysis for the association of the covariates of interest with the three family communication outcomes (1. frequency of communication, 2. risk communication difficulty, 3. risk communication satisfaction). For the frequency of communication outcome (columns 2-4 of Table 3), age at study enrollment was the only demographic variable that had a significant association with frequency of cancer communication ($p = 0.008$), with a smaller proportion of men who were 60 years or older reporting "more frequent" communication with family members compared to men who were under 60 years old (60.6% versus 76.7% respectively). In terms of personal characteristics, having more cancer worry and being more satisfied with family life were significantly associated with more frequent communication ($p = 0.0003$ and $p < 0.0001$ respectively). This can be seen in Table 3, where 50.4% of men with low cancer worry, 65% of men with moderate cancer worry, and 71.7% of men with high cancer worry reported frequent communication. For family satisfaction, 49.5% of participants with the lowest degree of family satisfaction reported frequent communication compared to 77.3% of men with the highest family satisfaction.

Table 4 shows the multivariable results for all three outcomes. The first section in Table 4 depicts the multivariable model for frequency of communication. Having reached significance in the bivariate analyses, age at study enrollment, cancer worry classification, and level of family satisfaction were included as covariates. All three covariates remained significant in the multivariable model. Worrying more about cancer was significantly associated with over a 1.5-fold increase in the odds of being a more frequent communicator when other variables in the model were held constant (OR = 1.68; 95% CI = 1.07-2.70). Having more satisfaction in family life also significantly increased the odds of being a frequent cancer communicator by more than 2 (OR = 2.20; 95% CI = 1.47 – 3.33). Older age was associated with a decrease in the odds of being a frequent communicator by about half (OR = 0.53, 95% CI = 0.30-0.93).

Covariates for Risk Communication Difficulty

In the bivariate analysis for risk communication difficulty, being of a minority race was significantly associated with more difficulty communicating ($p = 0.009$), with 40.4% of men who were non-white responding that risk communication was difficult, compared to 23.6% of white men (Table 2, columns 5-7). Household income also reached a significant association ($p = 0.047$) with men who made under $50,000 annually reporting more difficulty than men making at least $50,000 per year (30.4% versus 22% respectively). Having more cancer related distress ($p < 0.0001$), more cancer worry ($p < 0.0001$), higher levels of depression ($p < 0.0001$), and higher levels of generalized anxiety ($p < 0.0001$) were all significantly associated with more difficulty communicating. 64.7% of participants in the highest cancer distress (IES) category responded “agree/somewhat agree” to the communication difficulty question, compared to only 4.6% of participants in the lowest cancer distress category. 41.8% of those in the high cancer worry (CWS) category, compared to 23.7% in the moderate cancer worry category, and 13.6% in the low cancer worry category reported difficulty. At the high and low end of the depression

classification scores (PHQ-9), 63.6% of respondents in the most severe depression group versus only 19.1% of participants in the least severe (minimal) depression group reported more difficulty with communication. Similarly, those with the highest generalized anxiety scores reported more difficulty than those with less severe anxiety scores (at the extremes: 61.1% of those with the highest anxiety scores, versus 19.9% of those with the lowest anxiety scores reported difficulty with communication). Higher family satisfaction was significantly associated with less difficulty communicating ($p = 0.002$), with 34.8% of men in the lowest family satisfaction category reporting difficulty communicating with family members, and 18.8% of men in the higher family satisfaction category reporting difficulty. Biological children nearly reached a significant association ($p = 0.21$) according to Bursac's criteria and was included in the multivariate analysis.[36]

Race, household income, number of biological children, cancer distress (PTSD) classification, cancer worry, depression, generalized anxiety, and family satisfaction were included as covariates in the multivariable model for the risk communication difficulty outcome. The results are displayed in the second section of Table 4. Being of a minority (non-White) race caused the largest independent increase in the odds of having difficulty communicating with family about risk, increasing the odds by over 2-fold when all other variables in the model remain the same (OR = 2.71; 95% CI = 1.29 – 5.64). The presence of cancer distress (PTSD) was also significantly associated with an increase in risk communication difficulty (OR = 1.71; 95% CI = 1.31 – 2.24). Having a high level of satisfaction with family life reduced the odds of risk communication difficulty by almost half (OR =0.51, 95% CI = 0.29 – 0.89). Household income ($p = 0.49$), biological children ($p = 0.11$), level of cancer worry ($p = 0.054$), level of

depression (p = 0.99), and level of generalized anxiety (p = 0.45) did not show significant associations with communication difficulty under the multivariable model.

Covariates for Risk Communication Satisfaction

In the bivariate analysis for the communication satisfaction outcome, no demographic variables had a significant association with satisfaction (Table 3, columns 8-10). However, educational attainment was close to significant (p = 0.07), with a higher proportion of those without a college degree responding that they were satisfied with their risk communication (88.4%), compared to those with a college degree or higher (82.5%). Educational attainment was therefore included in the multivariable model. Feeling more depressed was significantly associated with reporting less satisfaction with family risk communication (p = 0.001). Only 36.4% of men in the most severe depression category said that they felt satisfied with their communication about cancer risk with family, while 86.3% of men in the least severe (minimal) depression category said that they felt satisfied. Having higher levels of generalized anxiety was significantly associated with less communication satisfaction (p = 0.043; 66.7% in the most severe anxiety category vs. 85.6% in the minimal anxiety category). Being more satisfied with family life was significantly associated with also feeling more satisfied with family risk communication (p = 0.001), with 74.3% of mPC patients in the lowest family satisfaction category reporting communication satisfaction and 89.9% of mPC patients in the highest family satisfaction category reporting communication satisfaction.

Level of education, depression, anxiety, and family satisfaction were included in the multivariable model for the outcome of risk communication satisfaction. The results are presented in the third section of Table 4. Having at least a college degree was significantly associated with being less satisfied with family risk communication (OR = 0.58; 95% = 0.33 – 0.98), as was having a moderate or severe depression score (OR = 0.26; 95% CI = 0.10 – 0.72).

Neither the anxiety classification nor the level of family satisfaction reached significance under the multivariable model for communication satisfaction ($p = 0.81$ and $p = 0.08$ respectively).

DISCUSSION

The main goal of the present analysis was to describe the familial cancer and cancer risk communication patterns in a cohort of men with mPC. This population is important to consider because of its role in the broader context of hereditary cancer families.[3–7] The communication practices of men with mPC are pivotal to their family members' understanding of cancer risk and ultimately their ability to mitigate their own aggressive cancer diagnosis via interventions. Using a subset of data from the initial survey of the GENTleMEN study, we were able to examine the proportion of mPC patients in high and low categories of three components of familial cancer communication: (1) the frequency of cancer-related communication with family members, (2) the level of difficulty with family cancer risk communication, and (3) the level of satisfaction with current family risk communication. Lastly, we looked for demographic, personal, and familial-level characteristics that might modulate these communication tendencies in men with mPC.

Overall Familial Communication Patterns

The majority of mPC patients in our sample frequently communicated with their biological relatives about cancer (62.9%). Although the proportion of men who spoke frequently to family members about their cancer was larger than expected, it was notably smaller than the 88-100% of male and female participants that report sharing *BRCA1/2* results with at least one relative post-genetic testing according to previous studies.[10,19,20,22] There are several factors which may have influenced this result. First, the frequency of family communication variable in the present analysis does not allow for interpretation of a specific motivation for the discussion

of cancer with family members. Given that this group of men had been diagnosed with aggressive metastasized cancer, it is likely that frequent communication may have taken place for reasons beyond the necessity to talk about risk. Such conversations may include receiving emotional support from family members or may involve practical matters such as getting to and from appointments. The actual proportion of men with mPC currently talking about hereditary cancer risk with family members is likely to be a smaller percentage of that observed in this analysis. Second, since previous studies consist of mostly female participants, there could also be a discrepancy between discussion of cancer risk between males and females in hereditary breast, ovarian, and prostate cancer families.[10,19,20] This seems possible given the many research studies which have found that male family members are less often included in discussions about *BRCA* results.[10,16–22] Lastly, the frequency of familial communication about cancer and hereditary cancer risk could increase after genetic testing. The initial survey of the GENTleMEN study was delivered before genetic results were returned and it is possible that participants felt that communication with family was not necessary at that time. This could change after genetic results are returned. A follow-up evaluation is necessary in order to determine whether mPC probands communicate their results to family members at the same rate as their female counterparts.

Most men in this GENTleMEN sample did not find familial risk communication to be difficult (74.9%). This finding appears to be in opposition to previous studies in HBOC and hereditary prostate cancer families.[18,22] For instance, a previous study of *BRCA1/2*-positive individuals, reported that a large majority of men (90%) had difficulty discussing their positive result with members of their family.[22] Although this difference could reflect the fact that men in our sample may have been those most intrigued by genetic testing and had increased interest in

learning and discussing cancer risk by way of enrolling in the GENTleMEN study, it may also indicate a key shift to feeling less confident with familial risk communication after learning of a positive mutation status. Men who test positive for *BRCA* or another prostate cancer mutation may therefore need additional support to aid discussions within their family unit.

Men with mPC in our sample appeared to be at least somewhat satisfied or very satisfied with their current level of familial risk communication (84.4%). To our knowledge, satisfaction with discussing hereditary cancer risk with family members before receiving genetic testing has not been reported in other studies. This analysis is therefore one of the first to find a general feeling of contentment with familial risk communication among a group of patients at elevated risk of having a cancer genetic mutation without yet knowing their mutation status. The high rate of satisfaction in this sample may reflect the fact that mPC patients had been recruited for the specific purpose of genetic testing for hereditary cancer risk and participants were likely to be more concerned with their genetic risk compared to the general population. They may have chosen to self-educate on hereditary cancer prior to their decision to enroll in the GENTleMEN study. This could skew the sample toward participants feeling more confident in topics of cancer risk. The high level of satisfaction in this sample could also indicate that mPC patients are either satisfied with few familial discussions of risk or have a level of over-confidence with the ability to discuss cancer risk. More research is warranted to find the underlying reasons why this trend appeared in our data, if it would appear in other samples, and what tools are necessary in order to better support men with mPC in effectively discussing cancer risk with family.

Covariates to Familial Cancer Communication and Risk Communication

This analysis also identified several key demographic, psychological, and familial characteristics that might modulate positive and negative feelings toward familial risk communication and the likelihood of discussing cancer with family members in the mPC

population. Our results aligned with our original hypotheses that age and race are important factors in determining the familial risk communication patterns of men with mPC. We found that older age was associated with less frequent communication (OR = 0.53; 95% CI = 0.29-0.93) and minority race was associated with more difficulty communicating about risk (OR = 2.71; 95% CI = 1.29-5.64) in an mPC population. The covariates associated with family communication for men with mPC appear to be largely consistent with those of females in HBOC families based on the findings of a least one previous study by Cheung et al.[20] Equitable distribution of genetic testing and genetic knowledge has been a consistent issue across cancer types in the US as genetic testing has expanded in the last two decades.[38–40] The importance of ensuring equity in genetic resources is elevated by the fact that certain racial minority groups including Black Americans already experience large disparities in outcomes from both prostate and breast cancer.[2,41,42] The specific contribution of race and ethnicity in familial communication difficulty for mPC patients therefore needs careful exploration beyond this analysis so that genetic technology does not further exacerbate these outcome disparities. Identifying facilitators and barriers to hereditary familial communication for men from racial and ethnic minority backgrounds through both qualitative and quantitative methods should be a priority of future work.

Interestingly, contradicting our original hypothesis, having more education was significantly associated with less satisfaction with risk communication (OR = 0.59, 95% 0.33-0.99). The present analysis appears to be the first to explore the relationship between familial risk communication satisfaction and educational attainment in cancer patients. The reasons for the negative relationship between education and satisfaction seen in this analysis require further evaluation, as it was only modestly significant (p = 0.047). It is possible that more educated men

might better understand their own lack of expertise. A deeper understanding of the complexities of genetic risk through classroom learning could therefore lead to more uncertainty about whether hereditary risks are being appropriately explained to family members.

Income and biological children did not show significant independent associations with any pattern of communication in the multivariable analyses despite being included in two out of the three models (communication difficulty and communication satisfaction). This result is similar to previous studies conducted on *BRCA1/2* carriers which found that SES did not affect likelihood of disseminating genetic test results to family members.[10,20] However, some data shows that lower SES can decrease uptake of genetic testing among cancer patients and specifically the cascade testing of a proband's relatives.[20,43] Providing additional support for familial communication to low income mPC patients that test positive for a hereditary cancer mutation could therefore still be worthwhile to aid in encouragement of the cascade testing process. Although the association between having biological children and risk communication difficulty was not significant in the multivariable model, our bivariate analysis suggests that it may be important to continue research into whether fathers with mPC need further resources to talk to their children about cancer risk.

Family satisfaction was the only variable which affected more than one communication outcome by both increasing frequency of communication (OR = 2.20; 95% CI = 1.47-3.33) and decreasing communication difficulty (OR = 0.51; 95% CI = 0.29-0.89) in our GENTleMEN analysis. Although more research is needed to confirm this relationship, this finding could indicate that family dynamics are especially important in determining the degree and comfort-level of familial communication for men with mPC. Our results support the findings of previous studies of HBOC family structure that have reported that family norms and culture often dictate

the decision to speak about hereditary risk and a positive test result.[10,16,17,22] Several studies have reported a sense of urgency among *BRCA1/2*- carriers to disseminate results to family members they perceive as benefiting the most in terms of cancer risk management.[16,17] This often excludes men from familial risk discussions because of the underlying the assumption that men are less affected by *BRCA* and other breast, ovarian, and prostate cancer-causing mutations.[16,18] If replicated, the results of the present analysis suggest that utilizing current family dynamics and structures might not only be useful in encouraging risk communication, but also in establishing men as beneficiaries of genetic information so that information about hereditary cancer risk moves uninterrupted through the family tree.

As predicted, psychological factors such as depression and cancer-related PTSD were also shown to be important modifiers contributing to more difficulty and less satisfaction with family risk communication. To our knowledge, there have not been other studies conducted in families at elevated risk for HBOC and hereditary prostate cancer that report on a similarly wide range of psychological factors in terms of their effect on discussions of familial cancer risk with relatives. A study using a sample consisting of mostly Ashkenazi Jewish women and some Ashkenazi Jewish men who had received genetic testing for *BRCA1/2* reported no significant relationship between IES score (i.e. PTSD) and likelihood of informing relatives about genetic test results, suggesting that the effects of at least some psychological factors on familial risk communication may be specific to men with mPC before they know their test results.[10] Research has shown that men with mPC have unique mental health challenges that require them to balance fear of negative cancer outcomes with a culture that values stoicism in masculinity.[44] If our results are replicated in other studies, tailoring mental health support to men with mPC may

prove to be especially important to improving the risk communication processes of HBOC families.

Some psychological factors in the present analysis appear to function in opposition to others in terms of determining familial communication patterns for men with mPC. For instance, in alignment with our hypothesis, frequency of cancer communication with family was significantly associated with the presence of more cancer worry, while communication difficulty and dissatisfaction were associated with more depression and PTSD. If this pattern persists in other samples, this could have implications for interventions in the future. For example, how should clinicians foster appropriate risk perceptions around cancer without causing anxiety that could limit family communication? There does not appear to be an existing framework to approach this problem, however, research shows that having more knowledge of cancer screening and prevention increases dissemination of genetic test results at least in *BRCA1/2*-positive women.[20] Therefore, a potential hypothesis is to focus on improving health literacy and genetic literacy in all members hereditary breast, ovarian, and prostate cancer families.

Limitations

This analysis has several limitations. First, this was an exploratory analysis and as such, examined the association between many possible covariates with respect to frequency of communication, risk communication difficulty, and risk communication satisfaction. It is possible that a significant p-value occurred by chance as a result of including many variables. Second, as a cross-sectional analysis, we cannot determine the direction of causality in the relationship between the covariates and the communication measures. Third, because the present analysis was a secondary analysis, there is the potential for selection bias. The men who enrolled in the GENTleMEN study had agreed to genetic testing prior to completing the initial survey and may therefore be more interested in understanding their hereditary cancer risk than mPC patients

in the general population. This could limit generalizability and explain the high proportion of men with mPC who reported frequent communication, little to no difficulty, and at least some satisfaction with risk communication. Fourth, despite the fact that less than 10% of values were missing for each variable, there remains the potential for non-response bias.

Finally, the three main communication variables (frequency of communication, risk communication difficulty, and risk communication satisfaction) were proxy measures for various dimensions of family risk communication. The frequency of communication measure in particular is not risk-specific, but rather measures the frequency of communication with family members about the general topic of cancer. This measure may reflect the degree of openness of men with mPC to discuss important cancer issues with related family members, as well as represent the future willingness to talk about cancer risk after receiving results, but it does not represent the current level of cancer risk-related discussions occurring within a family. In this regard, this analysis cannot interpret whether or not mPC patients recognize their potential role in unveiling the presence of a mutation in a cancer risk gene within their family or if they currently communicate directly about that potential. The communication satisfaction measure also requires careful interpretation because men may have answered "agree" or "somewhat agree" to the satisfaction statement because they are satisfied with rarely discussing the topic of risk. It is necessary to view this measure as representing a general confidence in discussing risk rather than a measure of frequency or accuracy in these discussions.

CONCLUSION

This analysis is one of the first studies to consider mPC patients as potential probands within their family units who may be the first family members to realize that a hereditary

germline mutation is present. These men have a responsibility to discuss cancer risk with closely related family members so that members of their family may also receive genetic testing and participate in cancer risk management. Yet, until the present analysis, it has been relatively unknown if men with mPC talk about their cancer and cancer risk with related family members or how comfortable they feel about having these conversations. This analysis found that most men with mPC communicate frequently about cancer with their first- and second- degree relatives, do not find risk communication to be difficult, and feel generally satisfied with current risk discussions. However, a notable subset (37.1%) of mPC patients still report infrequent communication about cancer, and may also tend to view their risk communication efforts less positively. This subset represents an important group to consider in future research. The present analysis also found that many factors may modulate frequency of cancer communication and feelings about risk communication for mPC patients including age, race, education, degree of cancer worry, overall satisfaction with family life, and levels of depression and cancer-related anxiety. These covariates may indicate areas where interventions should be focused to improve familial communication in hereditary breast, ovarian, and prostate cancer families.

Further research is required to assess these associations beyond our exploratory analysis. Future studies should fill the gaps of our current evaluation using longitudinal methodologies and primary data sources. Evaluation procedures should include direct measures of the frequency of risk communication, and should assess difficulty and satisfaction along various dimensions of risk (i.e. genetic risk, personal risk, familial risk, population-level risk). Lastly, further evaluations should consider following-up with participants post-genetic testing to assess whether feelings regarding risk communication change for mPC patients after genetic results are known. Expanding the effort to better understand familial cancer risk communication for mPC

patients can provide insights into building interventions that encourage cascade genetic testing within the family unit and can ultimately improve the implementation of cancer prevention strategies for those at the highest risk of cancer.

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Table 1a. Demographics of the GENTleMEN sample.

Characteristic	N (%)[a]
Total	584 (100)
Age at Study Enrollment (years)	
Mean (SD)	69.5 (8.4)
Range, years	41-93
<60	73 (12.5)
≥ 60	507 (86.8)
Age at Diagnosis (years)	
Mean (SD)	63.4 (8.6)
Range, years	33-88
<60	172 (29.5)
≥ 60	405 (69.3)
Race	
White/Caucasian	523 (89.6)
Other (including mixed race)	58 (9.9)
Marital Status	
Married or in a domestic partnership	441 (75.5)
Not married (never married, divorced, widowed)	140 (24.0)
Educational Attainment	
< College degree	228 (39.0)
≥ College degree	346 (59.2)
Employment Status	
Currently employed or self-employed	148 (25.3)
Not currently working (retired, out-of-work)	432 (74.0)
Household Income	
< $50,000	162 (27.7)
≥ $50,000	379 (64.9)
Not Sure	39 (6.7)
Biological Children	
None	111 (19.0)
At least one	472 (80.8)

[a] Values are expressed as number of participants (%) unless indicated; percentages may not add to 100 due to missing responses and rounding

Table 1b. Emotional, psychological, and familial characteristics of the GENTleMEN sample.

Characteristic	N (%)[a]
Total	584 (100)
Cancer-related stress and fears	
Cancer-related distress (IES)	
Subclinical	151 (25.9)
Mild	243 (41.6)
Moderate	116 (19.9)
Severe	34 (5.8)
NA	40 (6.9)
Cancer-related worry (CWS)	
Low	147 (25.2)
Moderate	310 (53.1)
High	122 (20.9)
NA	5 (0.9)
Emotional/psychological state	
Feelings of depression (PHQ-9)	
Minimal	351 (60.1)
Mild	139 (23.8)
Moderate	43 (7.4)
Moderately severe	21 (3.6)
Severe	11 (1.9)
NA	19 (3.3)
Generalized anxiety (GAD-7)	
Minimal	420 (71.9)
Mild	85 (14.6)
Moderate	30 (5.1)
Severe	18 (3.1)
NA	31 (5.3)
Perception of family-life	
Family satisfaction (FSS)	
Very low	116 (19.9)
Low	164 (28.1)
Moderate	99 (17.0)
High	104 (17.8)
Very high	69 (11.8)
NA	32 (5.5)

[a] Values are expressed as number of participants (%); percentages may not add to 100 due to rounding

Table 2. Number and proportion of GENTleMEN participants in each of the outcome categories (1) frequency of communication about prostate cancer with family members, (2) difficulty communicating with family members about cancer risk, and (3) satisfaction with current level of communication with family members about cancer risk.

(1) Frequency of communication about prostate cancer with family members (N = 572)	
	n (%)
Frequent (FOC score >2)	360 (62.9)
Infrequent (FOC score ≤2)	212 (37.1)
(2) Difficulty communicating with family members about cancer risk (N = 582)	
	n (%)
More Difficulty (score of 3 or 4)	146 (25.1)
Less Difficulty (score of 1 or 2)	436 (74.9)
(3) Satisfaction with level of communication with family members about cancer risk (N = 578)	
	n (%)
More satisfaction (score of 3 or 4)	488 (84.4)
Less satisfaction (score 1 or 2)	90 (15.6)

Table 3. Results from chi-squared tests for bivariate associations between patient demographic characteristics and the communication outcomes: (1) frequency of communication about prostate cancer with family members, (2) difficulty communicating with family members about cancer risk, and (3) satisfaction with current level of communication with family members about cancer risk.

	(1) Frequency of Cancer Communication (N = 572)†			**(2) Risk Communication Difficulty (N = 582)††**			**(3) Risk Communication Satisfaction (N = 578)††**		
	Frequent (FOC score >2)	Infrequent (FOC score ≤ 2)	p-value	More difficulty (score of 3 or 4)	Less Difficulty (score of 1 or 2)	p-value	More satisfied (score of 3 or 4)	Less Satisfied (score of 1 or 2)	p-value
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Age at Study Enrollment (years)									
<60	56 (76.7)	17 (23.3)		19 (26.0)	54 (74.0)		57 (79.2)	15 (20.8)	
60+	300 (60.6)	195 (39.4)	0.008*	126 (25.0)	379 (75.0)	0.96	428 (85.3)	74 (14.7)	0.25
Age at Diagnosis (years)									
<60	104 (61.5)	65 (38.5)		43 (25.1)	128 (74.9)		142 (83.5)	28 (16.5)	
60+	253 (63.7)	144 (36.3)	0.69	100 (24.8)	304 (75.2)	0.92	340 (84.8)	61 (15.2)	0.80
Race									
White/Caucasian	320 (62.6)	191 (37.4)		123 (23.6)	399 (76.4)		439 (84.4)	81 (15.6)	
Other (including mixed race)	38 (65.5)	20 (34.5)	0.77	23 (40.4)	34 (59.6)	0.009*	46 (83.6)	9 (16.4)	0.85
Marital Status									
Currently married or in a domestic partnership	275 (63.4)	159 (36.6)		115 (26.1)	326 (73.9)		367 (83.6)	72 (16.4)	
Single (never married)/Divorced/Widowed	82 (60.7)	53 (39.3)	0.65	31 (22.1)	107 (76.4)	0.46	118 (86.8)	18 (13.2)	0.45
Educational Attainment									
No college degree	138 (61.9)	85 (38.1)		62 (27.4)	164 (72.6)		199 (88.4)	26 (11.6)	
College degree or higher	218 (64.3)	121 (35.7)	0.62	81 (23.4)	265 (76.6)	0.32	283 (82.5)	60 (17.5)	0.07
Employment Status									
Employed/self-employed, student	95 (64.6)	52 (35.4)		39 (26.4)	109 (73.6)		126 (85.7)	21 (14.3)	
Not currently working (retired, unable to work)	262 (62.2)	159 (37.8)	0.68	107 (24.9)	323 (75.1)	0.81	358 (83.8)	69 (16.2)	0.68
Household Income									
< $50,000	106 (66.7)	53 (33.3)		49 (30.4)	112 (69.6)		137 (86.7)	21 (13.3)	
$50,000 or over	230 (61.8)	142 (38.2)	0.34	83 (22.0)	295 (78.0)	0.047*	316 (83.8)	61 (16.2)	0.63
Biological Children									
None	58 (58.0)	42 (42.0)		22 (20.0)	88 (80.0)		90 (83.3)	18 (16.7)	
At least one	301 (63.9)	170 (36.1)	0.32	124 (26.3)	347 (73.7)	0.21	397 (84.6)	72 (15.4)	0.84

(Continued)

Table 3 (continued). Results from logistic regression for bivariate associations between patient psychological and family characteristics and the communication outcomes: (1) frequency of communication about prostate cancer with family members, (2) difficulty communicating with family members about cancer risk, and (3) satisfaction with current level of communication with family members about cancer risk. characteristics

	(1) Frequency of Cancer Communication (N = 572)†			(2) Risk Communication Difficulty (N = 582)††			(3) Risk Communication Satisfaction (N = 578)††		
	Frequent (FOC score >2)	Infrequent (FOC score ≤ 2)	p-value	More difficulty (score of 3 or 4)	Less Difficulty (score of 1 or 2)	p-value	More satisfied (score of 3 or 4)	Less Satisfied (score of 1 or 2)	p-value
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Cancer-related stress									
Cancer-related distress (IES)			0.72			<0.0001*			0.288
Subclinical	91 (61.9)	56 (38.1)		7 (4.6)	144 (95.4)		127 (84.1)	24 (15.9)	
Mild	153 (64.6)	84 (35.4)		59 (24.4)	183 (75.6)		206 (86.2)	33 (13.8)	
Moderate	77 (66.4)	39 (33.6)		43 (37.4)	72 (62.6)		102 (87.9)	14 (12.1)	
Severe	17 (50.0)	17 (50.0)		22 (64.7)	12 (35.3)		21 (65.6)	11 (34.4)	
Cancer-related worry (CWS)			0.0003*			<0.0001*			0.31
Low	71 (50.4)	70 (49.6)		20 (13.6)	127 (86.4)		119 (81.5)	27 (18.5)	
Moderate	199 (65.0)	107 (35.0)		73 (23.7)	235 (76.3)		274 (89.3)	33 (10.7)	
High	86 (71.7)	34 (28.3)		51 (41.8)	71 (58.2)		91 (75.8)	29 (24.2)	
Emotional/psychological									
Feelings of depression (PHQ-9)			0.42			<0.0001*			0.001*
Minimal	216 (62.6)	129 (37.4)		67 (19.1)	283 (80.9)		302 (86.3)	48 (13.7)	
Mild	90 (66.7)	45 (33.3)		40 (29.0)	98 (71.0)		120 (88.2)	16 (11.8)	
Moderate	26 (63.4)	15 (36.6)		18 (41.9)	25 (58.1)		33 (80.5)	8 (19.5)	
Moderately severe	14 (66.7)	7 (33.3)		10 (47.6)	11 (52.4)		16 (76.2)	5 (23.8)	
Severe	3 (27.3)	8 (72.7)		7 (63.6)	4 (36.4)		4 (36.4)	7 (63.6)	
Generalized anxiety (GAD-7)			0.87			<0.0001*			0.043*
Minimal	256 (62.4)	154 (37.6)		83 (19.9)	335 (80.1)		357 (85.6)	60 (14.4)	
Mild	57 (67.1)	28 (32.9)		29 (34.1)	56 (65.9)		66 (80.5)	16 (19.5)	
Moderate	20 (66.7)	10 (33.3)		14 (46.7)	16 (53.3)		25 (83.3)	5 (66.7)	
Severe	9 (50.0)	9 (50.0)		11 (61.1)	7 (38.9)		12 (66.7)	6 (33.3)	
Perception of family-life									
Family satisfaction (FSS)			<0.0001*			0.0001*			0.001*
Very low	55 (49.5)	56 (50.5)		40 (34.8)	75 (65.2)		84 (74.3)	29 (25.7)	
Low	96 (58.5)	68 (41.5)		49 (30.1)	114 (69.9)		136 (83.4)	27 (16.6)	
Moderate	67 (68.4)	31 (31.6)		22 (22.2)	77 (77.8)		86 (86.9)	13 (13.1)	
High	73 (71.6)	29 (28.4)		14 (13.5)	90 (86.5)		92 (89.3)	11 (10.7)	
Very high	51 (77.3)	15 (22.7)		13 (18.8)	56 (81.2)		62 (89.9)	7 (10.1)	

† 12 missing (2%)
†† < 2% missing
* Association is significant (p-value < 0.05)

Table 4. Odds Ratios (OR), 95% confidence intervals (95% CI) and p-values for variables in the 3 multivariate models

Model #1: Talking frequently with family members about prostate cancer			
Characteristic	**OR**	**95% CI**	**p-value**
Age at Study Enrollment			
<60	1.00	--	--
≥ 60	0.53	(0.29 – 0.93)	0.034*
Cancer Worry (CWS)			
Low/Moderate	1.00	--	--
High	1.68	(1.07 – 2.70)	0.027*
Family satisfaction (FSS)			
Low/Moderate	1.00	--	--
High	2.20	(1.47 – 3.33)	0.0002*
Model #2: Having difficulty discussing cancer risk with family			
Characteristic	**OR**	**95% CI**	**p-value**
Race			
White	1.00	--	--
Other (including mixed race)	2.71	(1.29 – 5.64)	0.008*
Household Income			
< $50,000	1.00	--	--
≥ $ 50,000	0.83	(0.49 – 1.42)	0.49
Biological Children			
None	1.00		--
≥1	1.74	(0.90 – 3.59)	0.11
Cancer distress (IES)			
Subclinical/Mild	1.00	--	--
Moderate/Severe	1.71	(1.31 – 2.24)	<0.001*
Cancer Worry (CWS)			
Low/Moderate	1.00	--	--
High	1.75	(0.98 – 3.08)	0.054
Depression (PHQ-9)			
Minimal - Mild	1.00	--	--
Moderate - Severe	1.01	(0.36 – 2.68)	0.99
Anxiety (GAD-7)			
Minimal – Mild	1.00	--	--
Moderate - Severe	1.42	(0.57 – 3.49)	0.45
Family Satisfaction (FSS)			
Low/Moderate	1.00	--	--
High	0.51	(0.29 – 0.89)	0.02*
Model #3: Satisfied with current discussions of cancer risk with family			
Characteristic	**OR**	**95% CI**	**p-value**
Education			
< College degree	1.00	--	--
≥ College degree	0.58	(0.33 – 0.98)	0.047*
Depression (PHQ-9)			
Minimal - Mild	1.00	--	--
Moderate - Severe	0.26	(0.10 – 0.72)	0.009*
Anxiety (GAD-7)			
Minimal – Mild	1.00	--	--
Moderate - Severe	1.13	(0.44 – 3.26)	0.81
Family satisfaction (FSS)			
Low/Moderate	1.00	--	--
High	1.69	(0.95 – 3.11)	0.08

* Association is significant (p-value < 0.05)