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Perceived Risk and Worry About Prostate Cancer: A Proposed Conceptual Model

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Abstract

Prostate cancer is one of the most common forms of cancer among American men, and worry about the disease has psychological, behavioral, and biological consequences. To better understand prostate cancer-specific worry, the authors tested a model of the interrelationships among family history of prostate cancer, perceived risk of and worry about prostate cancer, and perceived risk of and worry about other diseases. Men who attended prostate cancer-screening appointments at a general urology practice ($n = 209$) were given a brief anonymous self-report measure. Structural equation modeling (LISREL) results indicated: (1) perceived risk of prostate cancer mediated the relationship between family history of prostate cancer and prostate cancer worry; (2) perceived risk of other diseases increased perceived risk of prostate cancer; and (3) prostate cancer worry and increased other disease worry.

Index Terms

anxiety; prostatic neoplasms; risk; risk factors

More than 230,000 American men will be diagnosed with prostate cancer this year and more than 30,000 will die of the disease.¹ Prostate cancer is the leading source of new cancer cases among men in the United States and the second leading source of cancer-related deaths.¹ One of the most important risk factors for the disease is having a family history of prostate cancer, with an estimated 5–10% of cases resulting from inherited factors.^{1–3} Men with a father or brother with prostate cancer have more than twice the age-adjusted risk for the disease, compared with men without such family histories.⁴

Therefore, it is not surprising that having a family history of prostate cancer has been linked to increased worry about the disease.² Worry about prostate cancer has been shown to be related to emotional (eg, depressive symptoms, anxiety, intrusions, and avoidance of prostate cancer-related material),² behavioral (eg, prostate cancer screening),^{5,6} and physical (eg, abnormal prostate-specific antigen [PSA] levels)⁷ outcomes. Therefore, a better understanding of the predictors of prostate cancer-related worry may help researchers to develop interventions to ameliorate these outcomes.

In addition to being related to increased worry about prostate cancer, a family history of the disease has also been found to be related to individuals' perceived risk of prostate cancer.⁸

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Although there are few studies about this, those in which researchers have examined this relationship fall into one of two categories—those focused solely on men with family histories of prostate cancer (FHP+ men) and those comparing men with and without family histories of prostate cancer (FHP+ vs. FHP– men). Results of studies in which researchers focused solely on FHP+ men have generally indicated that these men have high levels of perceived risk.^{2,9} The majority of researchers who have compared specifically recruited samples of FHP+ and FHP– men have also reported a relationship between family history status and perceived risk of prostate cancer.^{10,11} Nevertheless, with a sample recruited from the public area of a major medical center assessed anonymously, researchers found no relationship between family history and perceived risk for prostate cancer.^{12,13} Note, however, that the size of the FHP+ group in that study was small, and therefore negative findings should be interpreted with caution.

Researchers in several studies have found that men's perceived risk of prostate cancer is related to their worrying about prostate cancer.^{2,7} For example, Cohen and colleagues⁷ found a positive relationship between perceived risk of prostate cancer and level of prostate cancer-related worry. In addition, among FHP+ men, increased perceived risk of prostate cancer has been related to increased likelihood of cancer worries affecting everyday life.²

Although the evidence strongly suggests a positive relationship between perceived risk of—and worry about—prostate cancer, the causal direction of this relationship has yet to be established. On the one hand, researchers have suggested that the cognitive perception of one's risk for cancer engenders worry,¹⁴ and this directionality has been supported by statistical analyses in the context of other diseases.¹² Yet, theoretical perspectives and empirical evidence in the literature has also supported the reverse causal direction.¹⁵ That is, researchers have suggested that increased levels of worry might lead to increases in perceived risk. For example, Lerner and colleagues¹⁶ studied a sample of Americans following September 11, 2001, and found evidence that increased levels of anxiety shortly after September 11 predicted greater risk estimates 6 to 10 weeks later. Therefore, we designed the present study to provide a test of directionality between perceived risk of and worry about prostate cancer using structural equation modeling.

Prostate cancer-specific risk and worry do not exist in isolation. Rather, they exist in the broader context of concerns about disease in general. DiLorenzo et al.¹² recently published the first study, to our knowledge, examining the interrelationships among disease-specific and more general risk and worry. Using SEM, those authors found that in the cases of breast cancer, colon cancer, heart disease, and diabetes, both family history of a specific disease and higher perceived risk of other diseases predicted heightened disease-specific perceived risk. In turn, they found that higher disease-specific perceived risk was related to higher disease-specific worry and to less worry about other diseases, and disease-specific worry in turn was related to increased worry about other diseases. In addition, higher perceived risk of other diseases was related to heightened worry about other diseases.

DiLorenzo et al.'s¹² findings are largely congruent with previous findings in the literature. For example, their finding that perceived risk of other diseases predicted disease-specific perceived risk is consistent with a recent study by McGregor and colleagues,¹⁷ in which the authors found that generalized expectancy for risk was related to specific expectancy for risk (ie, perceived risk of breast cancer). DiLorenzo et al.'s finding of a positive relationship between perceived risk of other diseases and disease-specific worry is similarly consistent with McGregor and colleagues'¹⁷ finding that generalized risk expectancies were related to breast cancer worry.

As DiLorenzo et al.'s work¹² was the first in the literature to specifically examine the interrelationships among disease-specific and other disease-related perceived risk and worry, our goal in the present study was to determine whether their findings would be replicated in the context of prostate cancer. On the basis of the literature, we proposed to test the model shown in Figure 1.

METHOD

Participants

Study personnel approached men who came for a prostate cancer-screening appointment to the general urology practice of a large urban medical center in the New York metropolitan area and invited them to participate in the study. We recruited those indicating an interest if they were aged more than 18 years; we excluded them if they were unable to read and understand English. All eligible individuals who were approached consented to participate in the study. There were 253 men recruited for the study, and they completed a brief paper-and-pencil self-report measure. We excluded 4 participants from the analyses because of a personal history of prostate cancer, and we excluded 40 participants (15.8%) because they were missing data on 1 or more of the study items (ie, family history of prostate cancer; perceived risk of prostate cancer; worry about prostate cancer; perceived risk of other diseases such as, colon cancer, diabetes, or heart disease; or worry about other diseases, such as colon cancer, diabetes, or heart disease). These 40 participants did not differ significantly from the sample used in the study analyses in terms of marital status, ethnicity, education, or age (all $p > .05$). The final sample size was 209 participants.

The mean age was 57.6 years ($SD = 15.4$ years). Out of the men in the sample, 54.5% were currently married, 21.3% were never married, and 24.3% had been married and were now single (eg, divorced); 30.8% were Hispanic, 41.7% were Caucasian, 11.8% were African American, 5.4% were Asian/Indian, and 4.9% were Asian/Pacific Islander; 38.4% had attained a college degree. In addition, 15.8% reported a family history of prostate cancer (ie, had a first-degree relative with prostate cancer), and 84.2% reported no family history of prostate cancer.

Measures

We administered a very brief survey called the Health Assessment Personal Protocol Inventory (HAPPI)¹³ to the study participants. The HAPPI queried participants about demographic information as well as perceived risk of, personal history of, worry about, and family history of (1) prostate cancer, (2) colon cancer, (3) heart disease, and (4) diabetes.¹³ We used a brief scale to both reduce participant burden and to minimize interference with clinic flow. We assessed perceived risk of prostate cancer with the question "How likely do you think it is that you will develop prostate cancer in your lifetime?" We asked participants to respond on a scale of 0% (not at all) to 100% (extremely). This approach to the measurement of perceived risk has been used in previous studies^{12,13,18-22} of perceived risk of various illnesses, including prostate cancer.¹³ The measure has good test-retest reliability (.85) and construct validity.²² We defined *perceived risk of other diseases*, as was done in DiLorenzo et al.'s study,¹² as the mean of participants' perceived risk assessments for colon cancer, heart disease, and diabetes.

We assessed perceived worry about prostate cancer with the question "How much do you worry about developing prostate cancer in your lifetime?" Respondents scored their answers on a scale from 0% (not at all) to 100% (extremely). We selected this metric, which matches that of the perceived-risk items, to prevent measurement bias. In addition, we selected this worry measure because it was the one used by DiLorenzo et al.,¹² on whose study we designed the current study to apply to men facing the threat of prostate cancer. For the purpose of this study,

we defined *worry about other diseases* as the mean of participants' worry reports for colon cancer, heart disease, and diabetes.

We measured family and personal prostate cancer history by participants' self-report about whether they or any of their first-degree relatives ever had prostate cancer.

Procedures

The Institutional Review Board of the Mount Sinai School of Medicine approved the present study. We asked study participants to read a summary of the study. We allowed them to ask questions about the study and, if they gave verbal assent, we requested that they complete the brief health survey. Written consent was not required, as we did not obtain personally identifiable information. Because we collected personal health or disease history information, participants completed their questionnaires in a private area. If they had any questions, the urology clinic staff members were available for consultation. Upon completion of their questionnaires, participants returned them to us. We were blind to participants' family history status.

Analytic Strategy

Figure 1 is a representation of the conceptual model that we tested. It is a path model with observed variables. Estimation of the parameters for these models, as well as tests of model fit, involved the use of the SEM approach implemented in the program LISREL 8.30.²³ We conducted preliminary analyses following standard procedures in SAS 9.1²⁴ to explore the possible contributions of other variables to the model (eg, demographics).

RESULTS

We list descriptive statistics for the study variables in Table 1.

We conducted preliminary analyses to determine whether demographic variables were significantly related to the outcome variables (for these analyses, we set p at $< .10$ to better capture any possible influence of the demographic factors on the outcomes). Our results indicated that there was no significant relationship between any demographic factor and any of the outcome variables (all $p > .10$).

Prior to conducting tests of the full model, we investigated a key subset of the model, namely those 3 variables specifically related to prostate cancer (prostate cancer risk, prostate cancer worry, and family history of prostate cancer). For this subset, we tested the hypothesis that the relationship between family history and worry about prostate cancer would be mediated by perceived risk of prostate cancer, using Baron and Kenny's²⁵ guidelines for demonstrating mediation. We present the results of those tests in Table 2 (steps 1–3).

In step 1, we found a direct relationship between family history of prostate cancer and prostate cancer worry, $z = 2.69$; $p < .05$, satisfying Baron and Kenny's²⁵ first criterion. Nevertheless, a model with these 2 variables alone represented a poor overall fit to the data (Table 2–step 1). In step 2, we found a significant relationship between family history of prostate cancer and perceived risk of prostate cancer, $z = 3.46$; $p < .05$, satisfying Baron and Kenny's second criterion. Once again, a model with these 2 variables alone represented a poor fit to the data (Table 2–step 2). In step 3, we tested the full mediation model. With perceived risk of prostate cancer in the model, family history of prostate cancer was no longer a significant predictor of prostate cancer-specific worry, parameter estimate = .01; $z = .15$; $p = .99$; however, the parameter estimate for perceived risk of prostate cancer as a predictor of prostate cancer worry was highly significant, parameter estimate = .76; $z = 16.17$; $p < .0001$, consistent with the hypothesis that the relationship between family history and prostate cancer worry was mediated

by perceived prostate cancer risk. We compared the fit of the hypothesized model described above with a model in which the path from perceived risk of prostate cancer to prostate cancer worry was reversed; that is, in which worry leads to increased perceived risk. To permit a test of model fit, we first removed the nonsignificant path from family history of prostate cancer to prostate cancer worry, providing the 1 degree of freedom needed to test model fit. With that path removed, we found that the originally hypothesized model fit the data extremely well (Table 2—step 3). On the other hand, the reverse-causation model represented a poor fit to the data (Table 2—reverse-causation model), despite the fact that the path from worry about prostate cancer to perceived risk of prostate cancer was significant, $z = 16.45$; $p < .05$, in that model. When we compared the 2 models (step 3 and reverse-causation model) using the Akaike Information Criterion (AIC), we found that the hypothesized mediation model (step 3) was a better fit to the data. We next tested the full proposed model using LISREL. We found it was a good fit to the data (Figure 2). The findings for the full model can be summarized as follows: Family history of prostate cancer and perceived risk of other diseases predicted greater perceived risk of prostate cancer, which in turn predicted greater worry about prostate cancer. Worry about diseases other than prostate cancer was predicted by lower levels of perceived risk for prostate cancer, higher levels of perceived risk of the other diseases, and higher levels of worry about prostate cancer.

DISCUSSION

We designed this study to examine the relationships among family history of prostate cancer, perceived risk of worry about prostate cancer and other disease-related risk and worry. As we hypothesized: (1) men with family histories of prostate cancer had significantly higher perceived risk of prostate cancer than did those without family histories; (2) higher levels of perceived risk of prostate cancer were related to heightened levels of worry about prostate cancer and decreased levels of worry about other diseases; (3) perceived risk of prostate cancer mediated relationships between family history of prostate cancer and worry about prostate cancer, and perceived risk of prostate cancer as a cause of worry about prostate cancer was a better fit to the model than vice versa; (4) higher levels of worry about prostate cancer predicted heightened worry about other diseases; (5) family history of prostate cancer was not significantly related to perceived risk of other diseases; and (6) higher levels of perceived risk for other diseases predicted heightened levels of other disease-related worry, as well as higher perceived risk of prostate cancer, but were not significantly related to worry about prostate cancer specifically. Overall, these results support the generalizability of the DiLorenzo et al.¹² findings with a sample of men and women recruited from the public area of a medical center to men attending a urology appointment for prostate cancer screening. One notable difference is that in the present study we found a significant relationship between family history and perceived risk of prostate cancer, whereas DiLorenzo et al. did not. This discrepancy is most likely a result of the larger sample size of FHP+ men in the present study, which allowed for a more powerful test of these relationships.

On the basis of the present results and previous literature, we propose the following conceptual understanding of the relationships between perceived risk, worry, and family history. Before encountering a major stressful event (eg, a diagnosis of cancer in the family), most individuals have an “assumption of invulnerability.”²⁶ After experiencing the event however, this assumption is violated, and individuals may be left feeling insecure.²⁶ As applied to prostate cancer, we tentatively hypothesize that the stressor of having a family history of the disease may lead one to cognitively overemphasize one’s risk of developing prostate cancer, and in turn, this perceived risk may be sufficient to shatter one’s assumption of physical invulnerability, thus increasing worry about prostate cancer, as well as other diseases. That is, a heightened perceived risk of prostate cancer, grounded in an objective increase in risk secondary to family history, may lead one to develop a new schema of oneself as a person

whose overall health is in jeopardy, which may result in increased worrying not only about prostate cancer but also about a variety of other diseases. We feel that additional research on this possibility is warranted.

LIMITATIONS AND FUTURE DIRECTIONS

When interpreting the results of the present study, certain limitations must be taken into account. First, although SEM provides a strong indication about the directionality of relationships, it is important to remember that we applied SEM to cross-sectional data in this study, and thus no definitive conclusions about causality can be drawn. We statistically tested the direction of the relationship between perceived risk of prostate cancer and prostate cancer worry and found, however, that the reverse causation model did not fit the data as well as the model with risk predicting worry.

A second limitation is that the set of variables included in this model is by no means exhaustive. For example, the presence of urinary symptoms, age, and media publicity have been found to relate to worry about prostate cancer,⁵ and higher levels of self-reported prostate cancer-related symptoms⁷ have been related to perceived risk of and worry about prostate cancer. To develop a more comprehensive model of worry about prostate cancer, we recommend that future research expand our model to encompass some of these additional factors. In addition, future research should explore the extent to which the present model may facilitate the prediction of outcomes previously reported to be related to worry about prostate cancer (psychological, behavioral, or biological variables).

Third, there are certain limitations related to our measures. Although the measure of worry about prostate cancer used in this study is face valid and has been used in previous research,¹² this study lacks psychometric information (eg, test-retest reliability, convergent or discriminant validity). The use of this measure in the present study allowed replication of the DiLorenzo et al. approach (our primary aim in the study), and preservation of the identical metric between the risk and worry measures. On a similar note, although our measures of risk of and worry about other diseases have strong face and predictive validity, they were devised specifically for this study, and again, psychometric data has not yet been collected.

Fourth, this study is also limited in terms of external validity, in that the sample consisted entirely of men who were attending a prostate cancer-screening appointment at a general urology practice/clinic. These men may have been more concerned about their risk for prostate cancer, more motivated to confront their possible risk, or more educated about the benefits of prostate screening than were men not attending such a clinic. Any one of these factors could potentially limit the generalizability of these results, and therefore the procedures should be repeated in other samples. Given the broad guidelines for prostate screening and its common use (over 41% of men aged ≥ 50 years)³¹ these results would seem to apply to a significant proportion of men.

CONCLUSION

To our knowledge, this is one of the first studies in the literature to concurrently assess risk of and worry about prostate cancer specifically, as well as risk of and worry about other diseases. As such, the article makes several important contributions to the prostate cancer literature. On a theoretical level, the results of this study: (1) provide empirical evidence for the mediating role of perceived risk of prostate cancer in the relationship between family history of prostate cancer and worry about prostate cancer; (2) provide direct support for the view that cancer-specific risk predicts cancer-specific worry rather than vice versa; and (3) provide seminal evidence of the influence of perceived risk of other diseases on perceived risk of prostate cancer, as well as the effect of prostate-specific variables and other disease-related risk on

worry about other diseases. On a more clinical level, the results of the present study suggest that family history of prostate cancer, perceived risk of prostate cancer, and perceived risk of other diseases all contribute to one's level of worry about prostate cancer, and that an intervention targeting these 3 factors might be particularly effective in decreasing worry about prostate cancer.

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FIGURE 1.

Proposed model of the relationships among study variables. + = hypothesized positive relationship; - = hypothesized inverse relationship; NS = hypothesized non-significant relationship.

FIGURE 2.

Final model of the relationships among study variables as indicated by LISREL. * $p < .05$. Fit Indicators for the Model: $\chi^2 (4, N = 209) = 3.69, p = .45$; root mean square error of approximation ($RMSEA$) = .0, 90% Confidence Interval- $RMSEA$ = .00-.10, $p = .68$; Normed Fit Index = .99; Comparative Fit Index = 1.00; standardized root mean square residual = .03; Akaike Information Criterion = 35.69.

TABLE 1

Descriptive Statistics for Study Variables

Variable	<i>M</i>	<i>SD</i>	Range
Perceived risk of prostate cancer	36.4	30.9	0.0–100.0
Worry about prostate cancer	34.4	31.9	0.0–100.0
Perceived risk of other diseases	27.0	23.1	0.0–100.0
Worry about other diseases	27.2	26.7	0.0–100.0

TABLE 2

Fit Indicators for the Prostate Cancer Submodel

Indicators	Baron/Kenny			Reverse-Causation Model
	Step 1	Step 2	Step 3	
$\chi^2(df)^*$	121.14(2)	119.21(2)	.023(1)	7.03(1)
<i>p</i> value χ^2	< .0001	< .0001	.88	.008
<i>RMSEA</i>	.54	.53	.0	.17
90% CI— <i>RMSEA</i>	.46, .52	.45, .62	.00, .09	.07, .30
<i>p</i> value <i>RMSEA</i>	< .0001	< .0001	.91	.03
NFI	.038	.062	1.00	.96
CFI	.033	.058	1.00	.97
<i>SRMR</i>	.32	.32	.003	.10
AIC	135.14	133.21	16.02	23.03

Note. Fit Indexes: χ^2 test indicates if there is a difference between a hypothesized model and the data.²³ A good fit between the hypothesized model and the observed data is indicated when the χ^2 for the overall model is nonsignificant. For the root mean square error of approximation (*RMSEA*),²⁷ the smaller the number the better the fit, and the *p* value should be nonsignificant. We considered a *RMSEA* between .00 and .08 to indicate good fit. Values for the Normed Fit Index (NFI)²⁸ and the Comparative Fix Index (CFI)²⁹ range between 0.0 and 1.0, and the closer the measure was to 1.00, the better the model fits. In the present study, we took values equal to or greater than .90 to indicate good fit. We took a standardized root mean square residual (*SRMR*) less than or equal to .05 (23) to indicate good fit. For the Akaike Information Criterion (AIC),³⁰ the model with the smaller AIC is considered better.

* *N* = 209.