Health Psychology
2013, Vol. 32, No. 11, 1158–1169

0278-6133/13/$12.00 http://dx.doi.org/10.1037/a0031622

The Influence of Family History on Cognitive Heuristics, Risk Perceptions, and Prostate Cancer Screening Behavior

Michelle E. McDowell and Stefano Occhipinti
Griffith University

Suzanne K. Chambers
Griffith University and Cancer Council Queensland, Brisbane, Queensland, Australia

Objective: To examine how family history of prostate cancer, risk perceptions, and heuristic decision strategies influence prostate cancer screening behavior. ***Methods:*** Men with a first-degree family history of prostate cancer (FDRs; $n = 207$) and men without a family history (PM; $n = 239$) completed a Computer Assisted Telephone Interview (CATI) examining prostate cancer risk perceptions, PSA testing behaviors, perceptions of similarity to the typical man who gets prostate cancer (representativeness heuristic), and availability of information about prostate cancer (availability heuristic). A path model explored family history as influencing the availability of information about prostate cancer (number of acquaintances with prostate cancer and number of recent discussions about prostate cancer) to mediate judgments of risk and to predict PSA testing behaviors and family history as a moderator of the relationship between representativeness (perceived similarity) and risk perceptions. ***Results:*** FDRs reported greater risk perceptions and a greater number of PSA tests than did PM. Risk perceptions predicted increased PSA testing only in path models and was significant only for PM in multi-Group SEM analyses. Family history moderated the relationship between similarity perceptions and risk perceptions such that the relationship between these variables was significant only for FDRs. Recent discussions about prostate cancer mediated the relationships between family history and risk perceptions, and the number of acquaintances men knew with prostate cancer mediated the relationship between family history and PSA testing behavior. ***Conclusions:*** Family history interacts with the individuals' broader social environment to influence risk perceptions and screening behavior. Research into how risk perceptions develop and what primes behavior change is crucial to underpin psychological or public health intervention that seeks to influence health decision making.

Keywords: family history, prostate cancer testing, risk perception, cognitive heuristics

Prostate cancer is the second most common cancer in men worldwide, accounting for an estimated 13.6% of all new cancer diagnoses in men in 2008 (Ferlay et al., 2010). Over the past two decades the incidence of prostate cancer has increased markedly, an increase at least in part attributed to early and increased detection through prostate specific antigen (PSA) testing (Baade et al., 2009; Jacobsen et al., 1995). However, despite the rapid uptake of testing, there is uncertainty about the benefits of prostate cancer screening on a population level with regard to the potential costs, such as overdiagnosis, and the experience of iatrogenic side effects (Brawley, 2012). Hence, in this health context patients and health practitioners must make a complex decision where the risks, benefits, and uncertainties of screening are balanced and weighed (Chou et al., 2011; Wolf et al., 2010). In addition, competing positions and differences in formal recommendations across health authorities about the benefits prostate cancer screening adds to this uncertainty (Brawley, 2012; Catalona et al., 2012; Moyer, 2012). A recent update of the U.S. Preventive Services Task Force recommendation statement on screening for prostate cancer (Moyer, 2012) has recommended against PSA-based early detection screening for prostate cancer on the basis that the potential harms of screening outweigh the possible benefits. However, other groups disagree with these recommendations and suggest that prostate cancer screening decisions should be individualized on the basis of informed patient preferences (Catalona et al., 2012) where men weigh up information about the risks, benefits, and uncertainties of early detection screening to make a personal decision. In this context, research into effective ways to support individualized preference guided decision making is critical.

Accordingly, a clear understanding of the decision processes patients use to navigate through complex health information to reach a decision is essential to provide a framework for improving decision-making in practice (Patel et al., 2002; Ubel, 2010). The potential for cognitive biases to guide decision-making has been well documented (Shafir & LeBoeuf, 2002; Tversky & Kahneman,

This article was published Online First March 25, 2013.
Michelle E. McDowell and Stefano Occhipinti, Griffith Health Institute, School of Applied Psychology, Griffith University, Brisbane, Queensland, Australia; Suzanne K. Chambers, School of Applied Psychology, Griffith University, and Cancer Council Queensland, Brisbane, Queensland, Australia.
Suzanne K. Chambers is also at the Prostate Cancer Foundation of Australia, Sydney, New South Wales, Australia. We would like to acknowledge the Cancer Council Queensland for providing funding and research support for this study.
Correspondence concerning this article should be addressed to Michelle E. McDowell, Griffith Health Institute, School of Applied Psychology, Mt. Gravatt campus Griffith University, 176 Messines Ridge Road, Mt. Gravatt QLD 4122, Australia. E-mail: M.McDowell@griffith.edu.au

1974), and these biases are particularly problematic when they occur in the context of medical decision-making (Amsterlaw et al., 2006; Fagerlin et al., 2005). Health decisions often involve complex information, probabilistic risks, ambiguity about whether benefits outweigh harms, and uncertainties about decision outcomes that have the potential to lead to adverse personal consequences for the patient (Patel et al., 2002). Moreover, understanding these decision processes will be more critical when the decision is made under circumstances of great uncertainty.

Family History, Perceived Risk, and Health Behavior

For instance, the complexity of the decision to screen for prostate cancer is enhanced for men with a family history of the disease who must consider their heightened risk in their decision-making process. Men with a first-degree family history of prostate cancer (FDRs) are at more than double the risk of being diagnosed than men without a family history (Watkins Bruner et al., 2003; Johns & Houlston, 2003), and this information must be reconciled and integrated into a decision. However, no studies have examined the process by which risk information is attended to, interpreted, or integrated into the screening decision process in the context of a family history.

The role of risk perceptions, however, has been well studied as to how they may act as a possible catalyst for participation by FDRs in early detection screening in general (e.g., Jacobsen et al., 2004). Risk perceptions are personal beliefs or the subjective judgments people make about their risk or the probability that they will experience a specific harm (e.g., of developing cancer; Peters et al., 2006). Risk perceptions play a central role in many theories of health behavior (Protection Motivation Theory, Rogers, 1975; e.g., Health Belief Model, Rosenstock, 1966) where greater perceived risk is believed to motivate greater uptake of preventive health behaviors. The results of meta-analyses suggest that in general, risk perceptions have a small to moderate positive relationship to health behavior, with stronger relationships for health behaviors that are more controllable (e.g., vaccinations; Brewer et al., 2007; Katapodi et al., 2004). Men with a family history report greater risk perceptions than men without a family history and are also more likely to participate in prostate cancer screening (McDowell et al., 2009). However, of the six studies investigating the link between risk perceptions and prostate cancer screening behavior for FDRs, only three report that risk perceptions predict prostate cancer screening (Beebe-Dimmer et al., 2004; Cormier et al., 2003; Jacobsen et al., 2004; Miller et al., 2001; Sweetman et al., 2006; Vadaparampil et al., 2004). In a recent review of factors influencing risk perception in people at high risk of cancer, Tilburt et al. (2011) argued that future research should explore how broader social networks may influence the salience of risk perceptions and lead some people to engage or not engage with their increased risk. Further, Tilburt et al. concluded that although a variety of sociodemographic, clinical, and psychosocial factors (e.g., cognitive, affective) have been explored, more sophisticated analyses (e.g., path analyses) are needed to provide a basis for causal influences about risk perceptions to be made. The current study addresses such a gap by testing a path model of the relationships between family history, risk perceptions, and prostate cancer screening behavior and proposes how the family history context may influence the process by which these variables are associated.

Applying Cognitive Heuristics to Health Judgments

Despite the centrality of risk perceptions to multiple health behavior theories, the process by which an individual evaluates, interprets, and integrates information from their environment to construct a risk judgment is not represented in many of these theories. The heuristics and biases approach (Tversky & Kahneman, 1974) is a theoretical framework that has been applied extensively to examine how people make judgments under uncertainty and accounts for the tendency for people to draw on salient information from their environment to guide judgments. Cognitive heuristics have previously been applied to the health decision-making context and demonstrate how personal experience with a health issue can influence the extent to which heuristic strategies are used to inform judgments (Klein & Stefanek, 2007). Specifically, the heuristics and biases approach provides a framework for understanding how prostate cancer risk judgments accrue to men beyond a mere presence or absence of family history, and similarly, how the family history context may influence decisions about engaging with a health behavior.

In particular, heuristic strategies influence how cancer or health information is understood and applied to medical decisions (Klein & Stefanek, 2007; Steginga & Occhipinti, 2004). Heuristic principles simplify judgment by reducing the complexity of tasks, and although heuristics are generally economical, reliance on heuristics can lead to systematic errors in judgment (Tversky & Kahneman, 1974). For example, making judgments based on the salience of information (e.g., the recent cancer diagnosis of a friend or relative) is indicative of the availability heuristic and explains the tendency for people to be insensitive to sample size when making probability judgments (e.g., neglecting to consider the total number of people who do not have prostate cancer in one's social network). Similarly, the representativeness heuristic captures how people make judgments based on the perceived similarity of an event or object to a known class of events or objects, such as when people report feeling more vulnerable to a disease based on their perceived similarity to an affected relative (Emery et al., 1998; Sanders et al., 2003). The current study argues that the availability and representativeness heuristics will contribute to the prediction of risk perceptions and prostate cancer testing behaviors for men. Specifically, we propose that these heuristic strategies will play different roles in how they influence judgments about risk and relate to participation in prostate cancer testing.

The availability heuristic is applied when judgments are made based on the ease with which instances or associations come to mind (Tversky & Kahneman, 1974). For instance, the greater number of friends or acquaintances one recalls as having prostate cancer may provide information to men about the prevalence of the disease and contribute to judgments of personal risk and guide participation in preventive health behavior. Both Gerend et al. (2004) and Montgomery et al. (2003) found that women incorporated information about the number of friends they knew who were affected by a disease into judgments of their personal risk for that disease, independently of medical risk factors. Discussions about prostate cancer risk and early detection screening behaviors within the family may also be more frequent for first-degree relatives after a family member's diagnosis and these may in turn lead to greater accessibility of and more salient information about prostate cancer to be available for judgments. Accordingly, it is proposed that the availability heuristic will account for relationships between family history and risk judgments, and prostate cancer testing behavior through the greater salience of information about prostate cancer that may be available to and drawn upon by men with a family history.

By contrast, the representativeness heuristic accounts for judgments that are made based on a small sample of instances that are presumed to be representative and reliable (Tversky & Kahneman, 1974), such as a judgment about cancer risk made on the basis of one's perceived similarity to a representation of the type of person with the disease (Gerend et al., 2004). The tendency for unaffected family members to make similarity comparisons with affected relatives is a consistent finding across qualitative studies exploring the understanding of risk perceptions across a variety of diseases (Walter et al., 2004). In particular, the motivation to find dissimilarities between oneself and an affected relative is a common strategy used to reduce perceptions of personal vulnerability (Sanders et al., 2003). Similarity judgments may be more pronounced in men with a family history of prostate cancer owing to the presence of comparative and more specific information available about affected relatives to make references to and to associate with representations of the type of person who gets prostate cancer. Thus, we propose that perceived similarity to the type of person to get prostate cancer will be related to judgments about risk and that this relationship would be stronger for men with a family history.

The Present Study

Accordingly, the present study examines a path model incorporating the availability and representativeness cognitive heuristic strategies into a model examining the relationships between family history, risk perceptions, and prostate cancer testing behavior (see Figure 1). Specifically, three hypotheses are proposed. First, the availability and representativeness heuristics will predict prostate cancer risk perceptions and PSA testing behaviors beyond other known contributors (sociodemographic predictors and physician discussion, for a review see McDowell et al., 2009). Second, the availability heuristic will account for the relationships between family history and risks perceptions and prostate cancer testing behavior such that men with a family history will report more salient information about prostate cancer that will in turn predict both greater risk perceptions and prostate cancer testing behavior (see Figure 1). Specifically, the availability heuristic will be a mediator of the relationship between family history and risk perceptions. As well, the availability heuristic will be a mediator of the relationship between family history and prostate cancer testing behavior. Third, family history will act as a moderator of the relationship between the representativeness heuristic and risk perceptions such that greater perceived similarity to the type of person to get prostate cancer will be associated with greater risk perceptions, and specifically, that the relationship will be stronger for men with a family history.

Method

Participants

Men with a first-degree family history of prostate cancer (FDRs) and a sample of men from the general population (PM) were recruited as part of a larger study examining how men make decisions about prostate cancer screening in Queensland, Australia. Details of the samples, recruitment process, and study protocols are described in McDowell, Occhipinti, Gardner, and Chambers (2012) and are summarized below. The current study reports on FDRs and PM who completed a Computer Assisted Telephone Interview (CATI). The FDRs were recruited from their affected relatives (probands) who were participating in the longitudinal decisional intervention RCT, ProsCan (Baade et al., 2010; Chambers et al., 2008). The PM sample was recruited by a market research firm. Ethical clearance was obtained from Griffith University Human Research

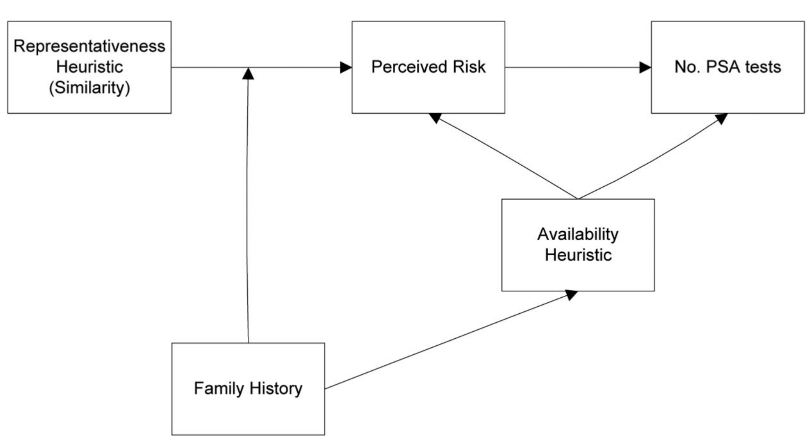

Figure 1. Proposed conceptual model of the relationships between cognitive heuristic strategies, risk perceptions, and PSA testing behavior. Family history will moderate the relationship between representativeness (similarity) and perceived risk judgements. The availability heuristic will act as a mediator of the relationship between family history and perceived risk, and family history and PSA testing behavior.

Ethics Committee, and the study was funded by the Cancer Council Queensland.

Participants were eligible for the study if they were aged between 40 and 65 years, lived within Australia, did not have a prior history of cancer, and had Basic English literacy. Of the 293 FDRs for whom permission to contact was obtained from the proband, 207 first-degree relatives participated in the CATI (70.6% consent rate). Of the 246 PM who answered the eligibility questions,[1] 239 (97.2% consent rate) completed the study, making the total sample size for the Study 446 participants.

Materials and Procedure

After the determination of eligibility criteria, participants completed the CATI guided by Research Officers. The CATI was conducted as part of a larger study and took approximately 35 minutes to complete.

Background variables. Data were collected on participants' marital status, country of birth, ethnic background, work status, education, annual income, and smoking status. Urinary symptoms were assessed using the International Prostate Symptom Score (I-PSS; Barry et al., 1992), a validated and widely used instrument developed by the American Urological Association to evaluate lower urinary tract symptoms (LUTS). The I-PSS demonstrated good internal consistency in the current study ($\alpha = .73$).

Prostate cancer screening. Participants reported whether they had ever spoken to a doctor about testing for prostate cancer and the total number of lifetime PSA blood tests.

Perceived risk. The assessment of perceived risk was based on a revision of the four perceived susceptibility measures utilized by Gerend et al. (2004). Two items assessed absolute risk utilizing Likert scales: how susceptible do you think you are to prostate cancer in your lifetime (1 = *not at all susceptible* to 5 = *very susceptible*); and what do you think is the chance that you will develop prostate cancer in your lifetime (1 = *very low chance* to 5 = *very high chance*). Contrary to Gerend et al. (2004), these items were measured on 5-point rather than 6-point Likert scales for consistency across the four risk items. Consistent with Lipkus et al.'s (2007) recommendations for assessing absolute risk, the third absolute risk item used natural frequencies with the same numeric denominator (e.g., *1 in 1000* through to *100 in 1000 or greater*) to assess perceived likelihood of the participant developing prostate cancer as natural frequencies facilitates comparisons of risk with minimal cognitive effort and are more easily interpretable than percentage rating scales. Comparative risk was assessed by asking men to indicate what they thought their chances were of developing prostate cancer compared with other men their age (1 = *a lot lower* to 5 = *a lot higher*).

Consistent with Gerend et al. (2004), there was no evidence to suggest that the risk perception items tapped different aspects of perceived risk. The four risk perception items were all significantly correlated ($r = .34–.72$) and demonstrated good internal consistency ($\alpha = .72–0.74$ across imputed datasets; see treatment of missing data in the Method). Accordingly, a composite of the four risk perception items was created using the Percent of Maximum Possible (POMP) method resulting in scales ranging from 0–100 that are not sample- or population-dependent (Cohen et al., 1999). POMP scores were calculated based on imputed data.

Availability heuristic. Two items assessed different aspects of the availability of information about prostate cancer. Participants were asked to report the number of male friends or acquaintances they knew who had been diagnosed with prostate cancer and required participants to be aware of and recall available instances of prostate cancer occurring around them. To examine accessibility of prostate cancer information, participants reported the number of times the topic of prostate cancer was discussed with family or friends in the past three months. A three-month timeframe was chosen to ensure that the prostate cancer information available to participants was only that which was recently accessible by participants (Peters et al., 2006). The availability items were not highly correlated ($r = .34$), and their reliability as a composite measure was poor ($\alpha = .47$). Accordingly, the items were used as separate measures of the availability heuristic (correlations between the items were accounted for in subsequent path analyses).

Representativeness heuristic. Consistent with Gerend et al. (2004), participants were asked to rate on a 5-point Likert scale how similar they perceived themselves to be to the typical man who gets prostate cancer (1 = *very dissimilar* to 5 = *very similar*).

Statistical Methods

Treatment of missing data. The pattern of missing data was assumed to be Missing at Random (MAR), and direct ML estimation for SEM and multiple imputation was used to treat missing data for all other analyses. Whole scale scores were imputed when they met the conditions set by Graham (2009), and dummy variables were created for categorical variables with missing data before running the imputation model. Multiple imputation (using Stata version 11 *mi impute mvn*) was conducted on the complete dataset that included auxiliary variables that were not relevant to the current analyses but would contribute to the prediction of missing data on relevant variables. In total, 72% of variables (including auxiliary variables) contained no missing data or missing data for less than 5% of cases, 9% contained missing data for between 7 and 13% of cases, and the remaining 19% of variables contained missing data owing to skip patterns in the questionnaire and were included in the imputation model so as to preserve hierarchical relationships between variables. Variables conditional on skip patterns were deterministically imputed as zero for questions where a no response was consistent with a zero response for the subsequent variable. For multiple imputation in Stata, 10 imputations were run for each data file.[2]

Univariate analyses using logistic or OLS regression, where appropriate, examined group differences between FDRs and PM on sociodemographic variables, urinary symptoms, heuristic strat-

[1] Of the 440 households who could be identified as having a man within the eligible age range, men were excluded or did not participate for the following reasons: 142 were unable to participate in the study owing to communication barriers ($n = 54$) or they were away for the duration of the study recruitment period ($n = 88$), 20 had a personal history of cancer, and 32 had a first-degree family history of prostate cancer.

[2] Sample descriptives are presented using raw data. Unless otherwise specified, all other analyses are reported for imputed data.

egies, risk perceptions, and screening-related variables[3] (inclusion of potential sociodemographic covariates did not change the significance of results and therefore results are reported for analyses excluding covariates). Multivariate analyses using standard OLS regression examined predictors of risk perceptions and prostate cancer screening for FDRs and PM. Owing to the predicted moderation of a potentially large number of predictors by FDR status, and to maintain consistency with later multigroup analyses, the FDR and PM samples were treated as separate populations such that OLS regression analyses were run on each group separately to examine the contribution of predictors across each sample.

Structural Equation Modeling (SEM) was used to test the predicted model of the relationships between the heuristic decision strategies, risk perceptions, and PSA testing behavior for FDRs and PM. SEM allows for a set of regression equations to be analyzed simultaneously such that direct, indirect, and total effects of presumed causal relationships between variables can be examined. Further, multiple-group SEM can examine moderation relationships by exploring whether model parameters vary across groups and SEM can be used to examine mediational relationships as path analyses. Model fit was determined by a nonsignificant chi-square and examination of additional fit indices, the Comparative Fit Index (CFI, >.95), and the Root Mean Square Error of Approximation (RMSEA, <.06; Hu & Bentler, 1999).

Results

Sample Descriptives

The majority of participants were born in Australia compared with outside of Australia (84.3%), were in a married or de facto relationship (82.3%), were employed full-time (70.0%), had completed a trade certificate or some form of tertiary education (66.8%), and earned the equivalent or greater than $60,000 per year (53.6%). The FDRs were more likely than PM to be born in Australia, $F(1, .) = 20.43$, $p < .0001$,[4] to identify with a British/Scottish/Welsh/Irish ethnicity compared with other ethnicities, $F(1, .) = 9.28$, $p = .002$, and to be recruited from a regional location, $F(1, .) = 8.96$, $p = .003$. The FDRs ($M = 54.0$, $SD = 7.47$) were older on average than PM ($M = 52.5$, $SD = 7.37$; $F(1, 442) = 4.63$, $p = .032$). The majority of men reported experiencing only mild urinary symptoms (76.9%), and less than three percent of participants reported experiencing severe urinary symptoms.

Prostate Cancer Screening

FDRs were more likely than PM to have spoken to their doctor about testing for prostate cancer (86.0% FDRs vs. 64.4% PM; $F(1, .) = 24.96$, $p < .0001$), to report having ever had a PSA test (83.1% FDRs vs. 49.4% PM; $F(1, .) = 46.04$, $p < .0001$), and to have had a greater number of PSA tests in their lifetime ($M = 3.58$, $SD = 4.28$ vs. $M = 1.59$, $SD = 2.83$, respectively), $F(1, 432.3) = 32.05$, $p < .0001$; $R^2 = .068$.

Risk Perceptions

FDRs reported greater overall perceived risk ($M = 55.9$, $SE = 1.58$; 95% CI 52.77–59.02) compared with men from the general population ($M = 41.0$, $SE = 1.34$; 95% CI 38.31–43.60) $F(1, 408.3) = 52.90$, $p < .0001$; $R^2 = .110$.

Heuristics

FDRs reported knowing more acquaintances who had been diagnosed with prostate cancer ($M = 1.97$, $SD = 2.78$) than did PM ($M = 1.17$, $SD = 1.78$) $F(1, 442) = 13.24$, $p < .001$; $R^2 = .029$, and were more likely to have discussed prostate cancer with their family and friends more frequently within the past three months ($M = 3.86$, $SD = 4.22$ vs. $M = 1.34$, $SD = 3.04$, respectively), $F(1, 442) = 19.31$, $p < .0001$; $R^2 = .042$. There was no significant difference between ratings of perceived similarity to the typical man who gets prostate cancer between FDRs ($M = 3.57$, $SD = 0.82$) and PM ($M = 3.47$, $SD = 1.01$).

Regression Analyses

Table 1 presents the results for OLS regression analyses examining predictors of perceived risk and PSA testing behavior for FDRs and PM.

Predictors of perceived risk. Men who experienced greater urinary symptoms and men who perceived greater similarity between themselves and the typical man who gets prostate cancer reported greater risk perceptions for FDRs and PM. In addition, for the FDRs, men with tertiary education reported greater risk perceptions than did men who were educated to junior high school. In contrast to previous research, increasing age was associated with decreasing risk perceptions for FDRs. Risk perceptions for FDRs and PM were influenced by different availability items. For FDRs, reporting a greater number of recent discussions about prostate cancer with family and friends was associated with higher risk perceptions. However, for PM men, knowing more acquaintances with prostate cancer was associated with higher risk perceptions. For PM, the overall model was significant, $F(17, 210.8) = 2.55$, $p < .001$ and explained 19.0% of the variance in risk perceptions. For FDRs, the model explained 28.1% of the variance in risk perceptions and was also significant, $F(17, 185.5) = 4.10$, $p < .0001$.

Predictors of prostate cancer screening. Predictors of greater lifetime PSA testing were similar for FDRs and PM. Consistent with previous research, PSA testing increased with age for both FDRs and PM, and knowing a greater number of acquaintances with prostate cancer was associated with greater PSA tests. For PM, having spoken to a doctor about prostate cancer was associated with increased PSA testing behavior. Perceived risk was not a significant predictor of PSA testing for either sample. The overall model for the PM sample explained 27.9% of the variance in screening behavior and significant, $F(18, 212.1) = 4.17$, $p < .0001$. For FDRs, the model explained 30.9% of the variance in PSA testing behavior and was significant, $F(18, 184.1) = 4.33$, $p < .0001$.

[3] One to three respondents indicated extreme values on continuous items (e.g., total number of lifetime PSA tests) and these values were right-censored at the highest value that fell within the range of the majority of responses for these items to reduce the influence of extreme values on the normality of distributions.

[4] Owing to multiple imputation, degrees of freedom for error are not always available for F statistics (in such cases a decimal point is included in the reporting of degrees of freedom).

Table 1
Predictors of Risk Perception and Screening (by Group)

	Risk				Screening			
	FDR		GP		FDR		GP	
Variable	Coef (*SE*)	95% CI	Coef (*SE*)	95% CI	Coef (*SE*)	95% CI	Coef (*SE*)	95% CI
Constant	9.24 (12.60)	[−15.65–34.13]	16.58 (9.15)	[−1.52–34.68]	−1.02 (2.38)	[−5.72–3.67]	−.14 (1.21)	[−2.54–2.25]
Socio-demographics								
Age[‡]	−.69 (0.21)**	[−1.11–−.27]	.08 (0.21)	[−.34–.50]	.26 (0.04)***	[.18–.34]	.09 (0.03)**	[.03–.14]
Marital status[a]	−2.17 (3.82)	[−9.72–5.38]	−.54 (3.85)	[−8.14–7.07]	.48 (0.70)	[−.90–1.87]	−.53 (0.52)	[−1.55–.49]
Ethnicity (non-British)	.89 (4.59)	[−8.23–10.01]	−.50 (3.21)	[−6.83–5.83]	−.31 (1.00)	[−2.34–1.71]	−.06 (0.43)	[−.91–.78]
Education – Senior high[b]	9.85 (6.77)	[−3.51–23.21]	−1.43 (4.49)	[−10.30–7.44]	−1.04 (1.28)	[−3.55–1.48]	−.09 (0.59)	[−1.24–1.07]
Education – Trade Cert[b]	7.20 (3.77)	[−.23–14.63]	−3.39 (3.74)	[−10.77–3.99]	.10 (0.71)	[−1.31–1.51]	−.74 (0.51)	[−1.75–.28]
Education – Tertiary[b]	13.58 (4.22)**	[5.24–21.92]	.47 (4.41)	[−8.27–9.22]	1.30 (0.81)	[−.29–2.89]	.22 (0.59)	[−.94–1.38]
Income $20–39,999[c]	−1.85 (6.66)	[−15.00–11.30]	−1.02 (6.03)	[−12.97–10.92]	1.69 (1.24)	[−.77–4.14]	.25 (0.80)	[−1.34–1.84]
Income $40–59,999[c]	−.35 (6.28)	[−12.74–12.04]	4.11 (6.14)	[−8.05–16.28]	1.22 (1.18)	[−1.11–3.55]	−.03 (0.85)	[−1.71–1.66]
Income $60–79,999[c]	.57 (6.73)	[−12.71–13.86]	2.67 (6.21)	[−9.68–15.02]	.77 (1.26)	[−1.71–3.26]	.88 (0.83)	[−.77–2.53]
Income $80,000 + [c]	1.24 (6.54)	[−11.66–14.15]	7.94 (5.95)	[−3.86–19.73]	1.39 (1.21)	[−1.01–3.79]	.97 (0.80)	[−.62–2.56]
Urinary Symptom total	1.13 (0.29)***	[.56–1.71]	.73 (0.26)**	[.20–1.25]	.03 (0.06)	[−.08–.14]	.05 (0.04)	[−.02–.12]
Smoke (no)	−3.26 (4.08)	[−11.30–4.79]	.10 (3.53)	[−6.87–7.08]	.50 (0.77)	[−1.01–2.01]	−.49 (0.46)	[−1.40–.42]
COB (not Australia)	3.35 (6.46)	[−9.39–16.10]	−1.42 (3.54)	[−8.44–5.61]	.21 (1.20)	[−2.15–2.57]	.05 (0.44)	[−.82–.93]
Spoken to doctor PSA (no)	3.66 (4.40)	[−5.03–12.35]	4.31 (2.90)	[−1.41–10.03]	.87 (0.82)	[−.74–2.48]	1.04 (0.43)*	[.19–1.89]
Representativeness heuristic								
Similar to typical PCa	7.39 (1.82)***	[3.81–10.98]	4.27 (1.52)**	[1.24–7.31]	−.01 (0.36)	[−.72–.71]	.05 (0.19)	[−.32–.43]
Availability heuristic items								
No. acquaintances with PCa	−.32 (0.61)	[−1.52–.88]	1.82 (0.78)*	[.27–3.37]	.30 (0.11)**	[.08–.52]	.35 (0.11)**	[.13–.56]
No. discussions about PCa	1.04 (0.38)**	[.29–1.80]	.18 (0.45)	[−.72–1.08]	−.06 (0.07)	[−.21–.08]	.01 (0.06)	[−.10–.13]
Perceived risk					.02 (0.01)	[.00–.05]	.01 (0.01)	[−.01–.03]
Model	R^2 = .281		R^2 = .190		R^2 = .309		R^2 = .279	

Note. Reference category for binary variables shown in parentheses.
[a] Reference category is never married/divorced/widowed. [b] Reference category is no greater than junior high school. [c] Reference category is < $20,000.
[‡] To facilitate interpretation, participant age was centered at the mean for each analysis. * $p < .05$. ** $p < .01$. *** $p < .001$.

Structural Equation Models

Owing to significant differences between the FDR and PM samples on age, country of birth, and recruitment location, preliminary analyses examined these variables as potential covariates for the structural models. Age was the only characteristic of the men that both differentiated the groups and predicted the relevant outcomes and was therefore controlled in the SEM analyses by accounting for the effects of age on the perceived risk and prostate cancer testing outcomes (paths not shown). To facilitate interpretation, age was centered at the mean before analyses.

Moderation using multiple-group SEM. Correlations between model variables are presented in Table 2. Multiple-group SEM using Mplus (version 6) (Muthén & Muthén, 1998-2010) compared the relationships between heuristic decision strategies, risk perceptions, and screening behavior across FDRs and PM men (see Figure 2). Specifically, the constrained model (Model A, not shown), whereby the path coefficient between perceived similarity and risk perceptions was constrained to be equal across FDR and PM groups was compared with the unrestricted model (Model B) where all paths could vary across groups. In both models, covariances between the heuristic strategies were included to account for effects of these variables on one another.

Model A was already a good fit to the data, indicated by a nonsignificant chi-square ($\chi^2 = 4.92$, $df = 3$, $p = .177$) and according to other fit indices (CFI = .99; RMSEA = .05). However, the improvement in model fit by allowing the path coefficient for similarity perceptions and perceived risk to vary across FDR and PM groups (χ^2 difference test = 4.73, $df = 1$, $p = .030$) suggest that this relationship is moderated by FDR status (see Figure 2). The path coefficient for the relationship between similarity perceptions and perceived risk was significant only in the FDR model. The variables explained 15.5% and 9.7% of the variance in perceived risk, and 19.9% and 26.9% of the variance in PSA testing behavior for FDRs and PM, respectively.

Not all paths for Model B were significant for the FDR or PM group. Specifically, the relationship between risk perceptions and screening behavior was only significant in the PM model. The only other significant predictor of screening behavior was the number of acquaintances men knew with prostate cancer predicting screening behavior for both FDR and PM models. Further, whereas the number of discussions with family and friends predicted risk perceptions for FDRs, for PM greater perceived risk was associated with a greater number of acquaintances PM knew with prostate cancer.

Mediation analysis. A structural equation model incorporating the two mediator variables regressed on FDR status as an independent variable was conducted. The predicted moderation of similarity and perceived risk by FDR status was incorporated in the analysis to account for its variance by using the product term, however specific results pertaining to this analysis are not reported in detail because they were described in the previous analysis. Consistent with the multiple-group SEM, the effects of age on risk and PSA testing, as well as residual correlations between heuristic variables (and the product term) were incorporated in the analysis. A nonsignificant chi-square ($\chi^2 = 10.35$, $df = 6$, $p = .111$) and other fit indices (CFI = .98; RMSEA = .04) indicated better model fit compared with the independence model. The model explained 19.0% of the variance in risk perceptions and 25.5% of the variance in screening behavior. As recommended by Preacher and Hayes (2008), mediation was tested using bias corrected bootstrapping (5000 samples) to obtain estimates of parameters and confidence intervals.

Direct effects for perceived risk. Perceived risk was predicted by greater similarity to the typical man who gets prostate cancer (estimate = 2.93, $p = .051$) and the greater number of recent discussion about prostate cancer (estimate = .81, $p = .006$). The interaction between FDR status and similarity on perceived risk was significant (estimate = 4.65, $p = .050$). This shows, consistent with results of the multiple-group SEM, that there was a stronger relationship between similarity and perceived risk for FDRs over PM. No other effects were significant.

Indirect effects for perceived risk. First-degree relatives reported having significantly more acquaintances with prostate cancer (estimate = .80, $p < .000$) and having had a greater quantity of recent discussions about prostate cancer (estimate = 1.52, $p < .000$). In relation to mediation relationships, the total indirect effect of FDR status on perceived risk was significant (estimate = 1.81, $p = .001$). This effect was explained by the significant specific indirect effect of FDR status on recent discussions about prostate cancer (estimate = 1.22, $p = .019$). The specific indirect effect of FDR status and the number of acquaintances with prostate cancer on risk perceptions was not significant.

Direct effects for screening behavior. Consistent with the multiple-group SEM, PSA testing behavior was predicted by the greater number of acquaintances with prostate cancer (estimate = .34, $p = .001$) as well as FDR status (estimate = 1.15, $p = .002$). Risk perceptions predicted screening behavior (estimate = .02, $p = .021$), however this effect was small.

Indirect effects for screening behavior. For the relationship between FDR status and screening behavior, the total indirect effect of FDR status on PSA testing behavior was significant (estimate = .25, $p = .021$) and was explained by the significant specific indirect effect of FDR status on the number of acquaintances with prostate cancer (estimate = .27, $p = .006$). The specific indirect effect of FDR status and the number of discussions about prostate cancer on PSA testing behavior was not significant.

Table 2
Correlations Matrix for Variables Used in SEM

Item	1	2	3	4	5
1. FDR					
2. Perceived risk	.31				
3. No. PSA tests	.27	.19			
4. No. acquaintance PC	.17	.18	.31		
5. No. discussions PC	.20	.23	.14	.34	
6. Similarity	.06	.24	.07	.12	.12

Discussion

The aim of the current study was to examine the contribution of heuristic strategies to the prediction of risk perceptions and prostate cancer screening behavior in a path model that considered the influence of family history on these relationships. The proposed model (see Figure 2) was largely supported such that the relationship between similarity perceptions (representativeness) and per-

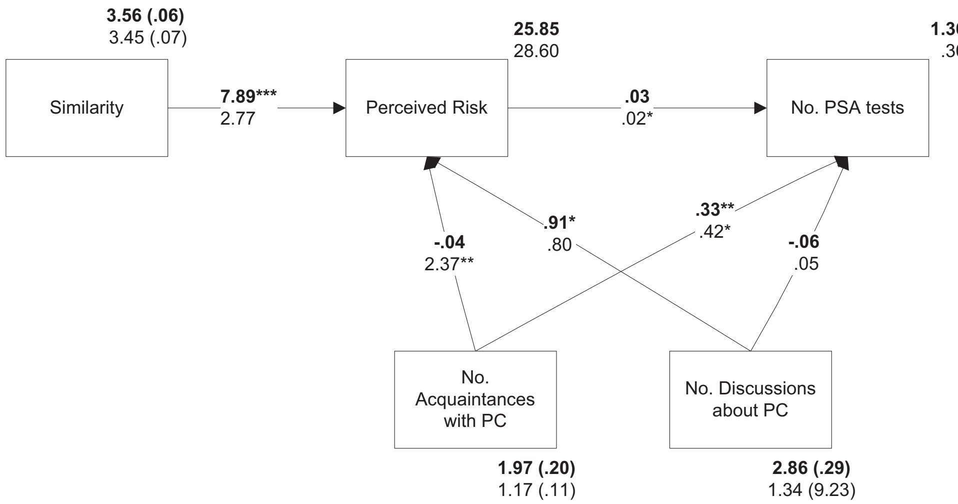

Figure 2. Multi-Group SEM parameter estimates for the unconstrained model (Model B) for FDRs (in bold) and PM. Paths for age and correlations between predictor variables are not shown. Fit indices: $\chi^2 = .19$, df = 2, $p = .911$, CFI = 1.00; RMSEA = .00.

ceived risk was found only for FDRs and not for PM. The number of acquaintances men knew who had been diagnosed with prostate cancer predicted PSA testing for both groups, although a relationship with risk perceptions was found only for PM. Rather, the number of discussions men had had with family and friends within the past three months predicted risk perceptions only for FDRs. Further, the number of acquaintances with prostate cancer mediated the relationship between family history and PSA testing behavior but not risk perceptions, whereas the number of recent discussions about prostate cancer mediated the relationship between family history and risk perceptions but not PSA testing behavior. Although risk perceptions predicted PSA testing in path models, the effect was small and was found only for PM in the multiple-group SEM analysis.

Availability and Representativeness Heuristics in Judgments About Prostate Cancer

Availability heuristic. The number of acquaintances FDRs knew with prostate cancer was related to their PSA testing behavior but did not influence judgments of risk. Rather, the number of discussions about prostate cancer FDRs had with their family and friends over the past three months was related to their risk perceptions. The mediation of the relationship between family history and risk perceptions by recent discussions about prostate cancer suggests that men with a family history may have had greater accessibility of discussions about prostate cancer which contributed to their judgments about personal risk.

By contrast, men from the general population who reported knowing a greater number of acquaintances with prostate cancer also reported greater risk judgments and PSA testing behavior, and PSA testing was also predicted by having previously discussed prostate cancer with a physician for this group. Unable to draw on experiences of affected family members, PM could have only made use of information about the instances of prostate cancer occurring around them in their social network or in reference to other sources, such as from a health professional or the media, to apply to judgments about prostate cancer risk and health behaviors. FDRs also showed greater PSA testing behavior associated with the greater number of prostate cancer diagnoses occurring outside their immediate family suggesting that social relationships predict participation in screening behavior independent of family history. Although FDRs report increased personal risk of developing prostate cancer suggesting an awareness of familial risk, they may refer to the behaviors of those in their social network to influence their personal health behaviors. Christakis and Fowler (2007) examined the person-to-person spread of obesity and found that there was a 57% increase in the chance that an individual would become obese if they had a friend who became obese within a given interval. Family members are not necessarily in greater contact with one another, whereas one's social group generally contains those people who the individual seeks contact with, for example through having similar interests. In this regard, social group members may be considered more similar to an individual in terms of their lifestyle, and greater contact with social group members may therefore exert greater influence on the beliefs, attitudes, and behaviors of the individual. Further, peer pressure to participate in prostate cancer screening after the diagnosis of a friend or acquaintance may be greater in social groups where there is greater contact with and exposure to the circumstances of a friend's cancer experience. The influence of social networks on the health behaviors of its members may be an important avenue for future research.

Representativeness heuristic. Greater perceived similarity to the typical person who gets prostate cancer was associated with increased risk perceptions for all men, but this relationship was greater for FDRs. Consistent with results of qualitative studies examining the construction of risk perceptions in people with a family history of cancer (Walter et al., 2004), FDRs may see an affected relative as a representation of the type of person who gets prostate cancer and consequently judgments of vulnerability could more clearly reference this relative. Alternatively, as discussed above, men may make similarity judgments based on a friend or acquaintance with prostate cancer to use as a referent. However, the moderation of similarity and risk perceptions by family history suggests that whether or not the family or social network is being used as a basis for risk judgments, this information appears to relate to risk perceptions more for FDRs than PM.

Risk Perceptions as a Predictor of Prostate Cancer Screening

In support of previous research, FDRs reported greater risk perceptions than did PM (McDowell et al., 2009). However, adding to the already mixed results for the role of risk perceptions as a predictor of prostate cancer screening found in previous studies (Beebe-Dimmer et al., 2004; Cormier et al., 2003; Jacobsen et al., 2004; Miller et al., 2001; Sweetman et al., 2006; Vadaparampil et al., 2004), a small but significant relationship between perceived risk and PSA testing was found only in path analyses and specifically, in the PM model. This finding is inconsistent with health behavior theories (e.g., Health Belief Model, Rosenstock, 1966) that would suggest men with higher risk perceptions would be more likely to participate in prostate cancer testing independently of family history (and perhaps more so for men with a family history who report higher risk perceptions than PM). Rather, these results suggests that alternative decision processes, such as the salience of information about peers with prostate cancer, are more robust predictors of PSA testing behavior and these processes may occur independently of risk perceptions. Further, although the presence of objective risk factors (e.g., family history) appears to influence both perceived risk judgments and PSA testing behavior, considering oneself to be at heightened risk for a disease may not be a sufficient condition for prompting preventive health behaviors in the absence of broader evaluative decisional processes. Health behavior theories would benefit from incorporating such processes into models that elucidate how risk perceptions accrue and suggest what factors predict whether an individual will engage with perceptions of risk when deciding whether or not to pursue preventive health behaviors.

Consistent with previous studies, greater PSA testing behavior was also associated with older age (Cormier et al., 2003; Jacobsen et al., 2004; Miller et al., 2001; Sweetman et al., 2006). However, although older age predicted greater risk perceptions for PM, risk perceptions *decreased* with age for FDRs, suggesting that men with a family history may judge their likelihood of developing prostate cancer to be lower for each year they remain undiagnosed. Two potential explanations for these findings are discussed.

First, as suggested by Weinstein (2007), the relationship between risk perceptions and behavior is likely to be complementary such that risk perceptions are shaped by previous behavior. It is possible that participation in prostate cancer screening informs subsequent risk perceptions such that the receipt of a negative PSA test result provides feedback to men about their prostate cancer risk. For men with a family history, PSA test results may provide a sense of reassurance that one does not have prostate cancer, information that reduces personal feelings of vulnerability. Further, receiving a negative PSA test result at older ages may lead to a more marked decrease in risk perceptions as the participant judges the test outcome to indicate a lower likelihood of prostate cancer.

An alternative account for why screening behavior increased with age for FDRs while risk perceptions decreased relates to research on insurance, risk, and magical thinking in judgments of probability (Risen & Gilovich, 2008). In a series of experiments that examined the effects of insurance status on probability judgments, Tykocinski (2008) found that the knowledge that one had insurance (e.g., health, travel, or car) was associated with lower judgments of probability, particularly when judgments were based on intuition or past experience. Specifically, an insurance policy was considered to provide a sense of safety or a feeling of coverage from the negative consequences associated with not having insurance or, as the author suggests, of *tempting fate*. Further, the tempting fate account extends explanations provided by research associated with anticipated regret (Miller & Taylor, 2002) because the effect of insurance on subsequent probability judgments was greater when insurance status was decided without the participant's control (Tykocinski, 2008).

People attribute more negative outcomes to behaviors that are considered to tempt fate (e.g., swapping a lottery ticket), and this effect is mediated by the higher accessibility of negative outcomes (e.g., that the swapped lottery ticket is therefore more likely to win; Risen & Gilovich, 2008). In relation to men considering prostate cancer screening, hearing about a friend or relative's misfortune (e.g., the diagnosis of prostate cancer) can lead to the awareness that one is not covered against this misfortune (e.g., not seeking early detection screening) and the potential negative outcomes that result from this realization are more accessible (e.g., being diagnosed with later stage prostate cancer). Like an insurance policy, early detection screening may offer peace of mind to men by reducing the anxiety associated with the perceived negative outcomes of not screening (or of tempting fate). It could be argued that the negative consequences of not screening for prostate cancer are more accessible to first-degree relatives of men with prostate cancer owing to their family member's diagnosis, and so these men seek peace of mind through early detection. This in turn results in the consideration of screening as a form of a preventive or protective strategy against the likelihood of negative outcomes. Greater investigation of the reasons men provide for participating in prostate cancer screening should shed light on whether this strategy is being used.

Limitations

There are a number of limitations inherent in the present study. First, the study was retrospective and cross-sectional, and the majority of FDRs had already had a PSA test. Although a number of predictors of risk perception and PSA testing behavior were identified, what actually instigated prostate cancer screening behavior cannot be determined. Second, recruitment of FDRs from their probands would likely result in a selection bias such that only those relatives whose proband provided consent to contact were approached. Accordingly, the current sample may be more likely to be those FDRs who interact with their affected relative, and this may bias results toward an increased awareness of prostate cancer risk and encouragement of PSA testing behavior. This aspect of the current study presents a possible caveat to the generalizability of the results. Further, although the results of the study are promising, the current study was limited to examining specific instances of the availability and representativeness heuristics and could not account for the variety of ways in which men may apply these strategies. Future research should investigate the actual reasons men provide for their prostate cancer screening decisions, which may shed light on the information that is salient and important to men when making decisions about screening.

Further, owing to the marked increase in prostate cancer incidence following the widespread availability of the PSA test (Baade et al., 2009), the present study focused on the examination of prostate cancer screening behavior as determined by the PSA test. Current prostate cancer screening guidelines recommend that men who choose to be screened should consider screening with the PSA test with or without a digital rectal examination (DRE; e.g., see Wolf et al., 2010) or recommendations focus on screening with the PSA test (e.g., Moyer, 2012). Further, the prevalence of PSA testing is greater than for DRE, and there is evidence to suggest that the mechanisms underlying participation in DRE differ from those for PSA testing, such as masculinity and sexuality concerns, that may be influenced by ethnicity and cultural issues (e.g., Consedine et al., 2007; Harvey & Alston, 2011). Accordingly, the results of the present study would be unlikely to generalize to the DRE, and thus examination of decision processes that influence DRE testing merits further research.

Conclusions

The present study elegantly shows how interactions within the individuals' broader social context influence risk perceptions and screening behaviors, and this is an important contribution to better understanding these relationships. In particular, it demonstrates how a man's judgments about risk and participation in preventative health behaviors are intermingled with and affected by his prevailing social network. Preventative health programs (both primary and secondary) typically apply social marketing campaigns with simple messages to discourage harmful health behaviors (e.g., smoking, sun exposure) or to encourage screening uptake (e.g., mammography, blood pressure checks), and will frequently use risk messaging. However, an approach that is not based on a clear understanding of how risk perceptions develop and what primes behavior change may be ineffective or at worst counterproductive for individual and community health outcomes. Indeed the steady increase in PSA uptake across the developed world (Baade et al., 2009) in the absence of clear public health directive or policy to support this is a case in point. The influence of cognitive heuristics in this particular context brings into focus the importance of examining the decision process that may guide whether or not a man engages with information about prostate cancer from his broader social environment and, in particular, how he integrates the information into judgments about health behaviors. For instance, the finding that similarity perceptions are associated with risk judgments specifically for men with a family history has implications for how familial risk should be communicated to men who may be judging their risk in relation to the similarities and dissimilarities they perceive between themselves and an affected relative.

Finally, the present research demonstrates how men judge their risk of prostate cancer and consider screening with respect to cognitive heuristic strategies that make use of salient information drawn from their environment. Prostate cancer screening is currently an uncertain health decisional context for men, and additional research to explore the ways that men understand and process information to make judgments about screening is warranted. Further, the view that informed decision making is needed for screening decisions is now extending to contexts previously held to be noncontroversial ("The controversy over mammograms,"). Accordingly, more research is needed to underpin public health activity in these fields.

References

Amsterlaw, J., Zikmund-Fisher, B. J., Fagerlin, A., & Ubel, P. A. (2006). Can avoidance of complications lead to biased healthcare decisions? *Judgment and Decision Making, 1,* 64–75.

Baade, P. D., Aitken, J., Ferguson, M., Gardiner, R., & Chambers, S. (2010). Diagnostic and treatment pathways for men with prostate cancer in Queensland: Investigating spatial and demographic inequalities. *BMC Cancer, 10,* 452. doi:10.1186/1471-2407-10-452

Baade, P. D., Youlden, D. R., & Krnjacki, L. J. (2009). International epidemiology of prostate cancer: Geographical distribution and secular trends. *Molecular Nutrition & Food Research, 53,* 171–184. doi:10.1002/mnfr.200700511

Barry, M. J., Fowler, F. J., Jr., O'Leary, M. P., Bruskewitz, R. C., Holtgrewe, H. L., Mebust, W. K., & Cockett, A. T. (1992). The American Urological Association symptom index for benign prostatic hyperplasia. *Journal of Urology, 148,* 1549–1557.

Beebe-Dimmer, J. L., Wood, D. P., Gruber, S. B., Chilson, D. M., Zuhlke, K. A., Claeys, G. B., & Cooney, K. A. (2004). Risk perception and concern among brothers of men with prostate carcinoma. *Cancer, 100,* 1537–1544. doi:10.1002/cncr.20121

Brawley, O. W. (2012). Prostate cancer screening: What we know, don't know, and believe. *Annals of Internal Medicine, 157,* 135–136. doi:10.7326/0003-4819-157-2-201207170-00460

Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., & McCaul, K. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology, 26,* 136–145. doi:10.1037/0278-6133.26.2.136

Catalona, W. J., D'Amico, A. V., Fitzgibbons, W. F., Kosoko-Lasaki, O., Leslie, S. W., Lynch, H. T., . . . Walsh, P. C. (2012). What the U.S. preventive services task force missed in its prostate cancer screening recommendation. *Annals of Internal Medicine, 157,* 137–138. doi:10.1059/0003-4819-157-2-201207170-00463

Chambers, S. K., Ferguson, M., Gardiner, R. A., Nicol, D., Gordon, L., Occhipinti, S., & Aitken, J. (2008). ProsCan for Men: Randomised controlled trial of a decision support intervention for men with localised prostate cancer. *BMC Cancer, 8,* 207. doi:10.1186/1471-2407-8-207

Chou, R., Croswell, J. M., Dana, T., Bougatsos, C., Blazina, I., Fu, R., . . . Lin, K. (2011). Screening for prostate cancer: A review of the evidence for the U.S. Preventive Services Task Force. *Annals of Internal Medicine, 155,* 762–771. doi:10.1059/0003-4819-155-11-201112060-00375

Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *The New England Journal of Medicine, 357,* 370–379. doi:10.1056/NEJMsa066082

Cohen, P., Cohen, J., Aiken, L. S., & West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behavioral Research, 34,* 315–346. doi:10.1207/S15327906MBR3403_2

Consedine, N. S., Horton, D., Ungar, T., Joe, A. K., Ramirez, P., & Borrell, L. (2007). Fear, knowledge, and efficacy beliefs differentially predict the frequency of digital rectal examination versus prostate specific antigen screening in ethnically diverse samples of older men. *American Journal of Men's Health, 1,* 29–43. doi:10.1177/1557988306293495

Cormier, L., Reid, K., Kwan, L., & Litwin, M. S. (2003). Screening behavior in brothers and sons of men with prostate cancer. *Journal of Urology, 169,* 1715–1719. doi:10.1097/01.ju.0000057527.02290.5e

Emery, J., Kumar, S., & Smith, H. (1998). Patient understanding of genetic principles and their expectations of genetic services within the NHS: A qualitative study. *Community Genetics, 1,* 78. doi:10.1159/000016141

Fagerlin, A., Zikmund-Fisher, B. J., & Ubel, P. A. (2005). Cure me even if it kills me: Preferences for invasive cancer treatment. *Medical Decision Making, 25,* 614–619. doi:10.1177/0272989X05282639

Ferlay, J., Shin, H. R., Bray, F., Forman, D., Mathers, C., & Parkin, D. M. (2010). GLOBOCAN 2008, cancer incidence and mortality worldwide: IARC CancerBase No. 10. Retrieved 22 March 2011, from International Agency for Research on Cancer; 2010 from http://globocan.iarc.fr

Gerend, M. A., Aiken, L. S., West, S. G., & Erchull, M. J. (2004). Beyond medical risk: Investigating the psychological factors underlying women's perceptions of susceptibility to breast cancer, heart disease, and osteoporosis. *Health Psychology, 23,* 247–258. doi:10.1037/0278-6133.23.3.247

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60,* 549–576. doi:10.1146/annurev.psych.58.110405.085530

Harvey, I. S., & Alston, R. J. (2011). Understanding preventive behaviors among mid-Western African-American men: A pilot qualitative study of prostate screening. *Journal of Men's Health, 8,* 140–151. doi:10.1016/j.jomh.2011.03.005

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6,* 1–55. doi:10.1080/10705519909540118

Jacobsen, P. B., Lamonde, L. A., Honour, M., Kash, K., Hudson, P. B., & Pow-Sang, J. (2004). Relation of family history of prostate cancer to perceived vulnerability and screening behavior. *Psycho-Oncology, 13,* 80–85. doi:10.1002/pon.760

Jacobsen, S. J., Katusic, S. K., Bergstralh, E. J., Oesterling, J. E., Ohrt, D., Klee, G. G., . . . Lieber, M. M. (1995). Incidence of prostate cancer diagnosis in the eras before and after serum prostate-specific antigen testing. *Journal of the American Medical Association, 274,* 1445–1449. doi:10.1001/jama.1995.03530180039027

Johns, L. E., & Houlston, R. S. (2003). A systematic review and meta-analysis of familial prostate cancer risk. *BJU International, 91,* 789–794. doi:10.1046/j.1464-410X.2003.04232.x

Katapodi, M. C., Lee, K. A., Facione, N. C., & Dodd, M. J. (2004). Predictors of perceived breast cancer risk and the relation between perceived risk and breast cancer screening: A meta-analytic review. *Preventive Medicine, 38,* 388–402. doi:10.1016/j.ypmed.2003.11.012

Klein, W. M. P., & Stefanek, M. E. (2007). Cancer risk elicitation and communication: Lessons from the psychology of risk perception. *CA: A Cancer Journal for Clinicians, 57,* 147–167. doi:10.3322/canjclin.57.3.147

Lipkus, I. M. (2007). Numeric, verbal, and visual formats of conveying health risks: Suggested best practices and future recommendations. *Medical Decision Making, 27,* 696–713. doi:10.1177/0272989X07307271

McDowell, M. E., Occhipinti, S., Gardiner, R. A., Baade, P. D., & Chambers, S. K. (2009). A review of prostate-specific antigen screening prevalence and risk perceptions for first-degree relatives of men with prostate cancer. *European Journal of Cancer Care, 18,* 545–555. doi:10.1111/j.1365-2354.2008.01046.x

McDowell, M. E., Occhipinti, S., Gardiner, R. A., & Chambers, S. K. (2012). Patterns of PSA testing in Australian men: The influence of family history. *British Journal of Urology International, 109,* S64–S70. doi:10.1111/j.1464-410X.2012.11050.x

Miller, D. T., & Taylor, B. R. (2002). Counterfactual thought, regret, and superstition: How to avoid kicking yourself. In T. Gilovich, D. Griffin & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 367–378). New York, NY: Cambridge University Press. doi:10.1017/CBO9780511808098.023

Miller, S. M., Diefenbach, M. A., Kruus, L. K., Watkins-Bruner, D., Hanks, G. E., & Engstrom, P. F. (2001). Psychological and screening profiles of first-degree relatives of prostate cancer patients. *Journal of Behavioral Medicine, 24,* 247–258. doi:10.1023/A:1010766706914

Montgomery, G. H., Erblich, J., DiLorenzo, T., & Bovbjerg, D. H. (2003). Family and friends with disease: Their impact on perceived risk. *Preventive Medicine, 37,* 242–249. doi:10.1016/S0091-7435(03)00120-8

Moyer, V. A. (2012). Screening for prostate cancer: U.S. preventive services task force recommendation statement. *Annals of Internal Medicine, 157,* 120–134. doi:10.1059/0003-4819-157-2-201207170-00459

Muthén, L. K., & Muthén, B. O. (1998–2010). *Mplus user's guide* (Sixth Edition, Version 6). Los Angeles, CA: Muthén & Muthén.

Patel, V. L., Kaufman, D. R., & Arocha, J. F. (2002). Emerging paradigms of cognition in medical decision-making. *Journal of Biomedical Informatics, 35,* 52–75. doi:10.1016/S1532-0464(02)00009-6

Peters, E., McCaul, K., Stefanek, M., & Nelson, W. (2006). A heuristics approach to understanding cancer risk perception: Contributions from judgment and decision-making research. *Annals of Behavioral Medicine, 31,* 45–52. doi:10.1207/s15324796abm3101_8

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891. doi:10.3758/BRM.40.3.879

Risen, J. L., & Gilovich, T. (2008). Why people are reluctant to tempt fate. *Journal of Personality and Social Psychology, 95,* 293–307. doi:10.1037/0022-3514.95.2.293

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology: Interdisciplinary and Applied, 91,* 93–114. doi:10.1080/00223980.1975.9915803

Rosenstock, I. M. (1966). Why people use health services. *The Milbank Memorial Fund Quarterly, 44,* 94–127. doi:10.2307/3348967

Sanders, T., Campbell, R., Sharp, D., & Donovan, J. (2003). Risk constructions among people who have a first-degree relative with cancer. *Health, Risk & Society, 5,* 53–69. doi:10.1080/1369857031000066005

Shafir, E., & LeBoeuf, R. A. (2002). Rationality. *Annual Review of Psychology, 53,* 491–517. doi:10.1146/annurev.psych.53.100901.135213

Steginga, S. K., & Occhipinti, S. (2004). The application of the Heuristic-Systematic Processing Model to treatment decision making about prostate cancer. *Medical Decision Making, 24,* 573–583. doi:10.1177/0272989X04271044

Sweetman, J., Watson, M., Norman, A., Bunstead, Z., Hopwood, P., Melia, J., . . . Moynihan, C. (2006). Feasibility of familial PSA screening: Psychosocial issues and screening adherence. *British Journal of Cancer, 94,* 507–512. doi:10.1038/sj.bjc.6602959

The controversy over mammograms. (November 20, 2009). *The New York Times,* p. A34.

Tilburt, J., James, K., Sinicrope, P., Eton, D., Costello, B., Carey, J., . . . Murad, M. (2011). Factors Influencing Cancer Risk Perception in High Risk Populations: A Systematic Review. *Hereditary Cancer in Clinical Practice, 9,* 2. doi:10.1186/1897-4287-9-2

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185,* 1124–1131. doi:10.1126/science.185.4157.1124

Tykocinski, O. E. (2008). Insurance, risk, and magical thinking. *Personality and Social Psychology Bulletin, 34,* 1346–1356. doi:10.1177/0146167208320556

Ubel, P. A. (2010). Beyond costs and benefits: Understanding how patients make health care decisions. *Oncologist, 15,* 5–10. doi:10.1634/theoncologist.2010-S1-5

Vadaparampil, S. T., Jacobsen, P. B., Kash, K., Watson, I. S., Saloup, R., & Pow-Sang, J. (2004). Factors predicting prostate specific antigen testing among first-degree relatives of prostate cancer patients. *Cancer Epidemiology Biomarkers & Prevention, 13,* 753–758.

Walter, F. M., Emery, J., Braithwaite, D., & Marteau, T. M. (2004). Lay understanding of familial risk of common chronic diseases: A systematic review and synthesis of qualitative research. *Annals of Family Medicine, 2,* 583–594. doi:10.1370/afm.242

Watkins Bruner, D. W., Moore, D., Parlanti, A., Dorgan, J., & Engstrom, P. (2003). Relative risk of prostate cancer for men with affected relatives: Systematic review and meta-analysis. *International Journal of Cancer, 107,* 797–803. doi:10.1002/ijc.11466

Weinstein, N. D. (2007). Misleading tests of health behavior theories. *Annals of Behavioral Medicine, 33,* 1–10. doi:10.1207/s15324796abm3301_1

Wolf, A. M. D., Wender, R. C., Etzioni, R. B., Thompson, I. M., D'Amico, A. V., Volk, R. J., . . . Smith, R. A. (2010). American Cancer Society guideline for the early detection of prostate cancer: Update 2010. *CA: A Cancer Journal for Clinicians, 60,* 70. doi:10.3322/caac.20066

Received February 16, 2012
Revision received August 24, 2012
Accepted September 20, 2012 ■

Correction to Niza, Tung, and Marteau (2013)

The article "Incentivizing Blood Donation: Systematic Review and Meta-Analysis to Test Titmuss' Hypotheses" by Claudia Niza, Burcu Tung, and Theresa M. Marteau (*Health Psychology*, Vol. 32, No. 9, pp. 941–949. doi: 10.1037/ a0032740), was published with the incorrect copyright line. The copyright line should have read ©2013 The Author(s). Additionally, the Author Note should have stated, "This article has been published under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. Copyright for this article is retained by the author(s). Author(s) grant(s) the American Psychological Association the exclusive right to publish the article and identify itself as the original publisher." The online version of this article has been corrected.

http://dx.doi.org/10.1037/hea0000035