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Judging Risk for Multiple Diseases: The Role of Disease Worry

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Abstract

Risk perceptions and disease worry of 1,959 healthy adults were measured in a telephone-based survey. In the model for each of eight health conditions, people's perceived risk was related to their worry for that condition ($p < .0001$) and their worry for the other seven conditions ($p < .001$). There was also an interaction indicating that the less people were worried about a certain condition, the more their worry about the other seven conditions increased their risk perception for that condition ($p < .0001$). The results are important for preventing biased risk perceptions in multiple-disease contexts.

Keywords

Disease risk; disease worry; affect heuristic; genetic testing

Perceived risk for a disease, alongside other health beliefs, plays an important role in motivating people to engage in health protective behaviors (Aiken, West, Woodward, Reno & Reynolds, 1994; Brewer, Chapman, Gibbons, Gerrard, McCaul & Wienstein, 2007; Janz & Becker, 1984; Rogers & Prentice-Dunn, 1997; Witte, 1998). One of the important factors determining perceived risk is people's affective reactions such as fear, worry, and anger (Loewenstein, Weber, Hsee & Welch, 2001; Slovic, Finucane, Peters & MacGregor, 2004; Slovic & Peters, 2006). In a classic study, people who read sad news articles compared to those who read happy news articles were more likely to give higher risk estimates for a group of risky events, even when the events in the articles were irrelevant to the risk judgments being made (Johnson & Tversky, 1983). An extensive review of similar studies also revealed that incidental affect (i.e., affective state eliciting thoughts and emotions that are unrelated to the topic on which risk judgments are made) leads to more optimistic judgments when it is positive (e.g., being happy) and more pessimistic judgments when negative (e.g., being sad) (Waters, 2008). Other studies also attest to the pervasiveness of affective influences on risk judgments. For example, fearful people have been found to make pessimistic judgments about future events (Lerner & Keltner, 2000), and anxious individuals have been reported to choose low-risk/low-reward options, whereas angry individuals select high-risk/high-reward options and make moderately optimistic judgments (Waters, 2008;

Ragunathan & Pham, 1999). Thus, identifying factors triggering affective reactions becomes important for understanding how judgments of disease risk are formed.

The present study investigates one of the ways in which people's affective states can be heightened-- thus influencing their risk perceptions. In multiple disease contexts, people may judge their risk for a certain disease while they are influenced by their affective reactions to the other diseases. This leads us to consider that people may be affected by their worry about one disease while making a risk judgment about another. Therefore, people's judgments of risk for a particular disease may be influenced not only by their worry about that disease but also their worry related to other diseases.

To test this possibility, we examined people's reported worry and perceived risk for each of eight common health conditions (i.e., colon, skin and lung cancers, heart disease, osteoporosis, diabetes, high blood pressure, high cholesterol) among a sample of patients surveyed as part of a larger study (McBride, Hensley-Alford, Reid, Larson, Baxevis & Brody, 2009). Worry has been "characterized by (a) feelings of anxiety, tension and apprehension; (b) moderate awareness of somatic cues including muscle tension and upset stomach; and (c) concerns over future rather than past or present situations" (Borkovec, Robinson, Pruzinsky, & DePree, 1983) (p. 9). Self-reported worry, as used in this study, has been found to be associated with uncontrollability of intrusive thoughts during an attention-focusing task (Borkovec, et al. 1983). Thus, although worry can be elicited by a particular event, we hypothesized that it may affect judgments about other unrelated events when experienced at the time of making such judgments. Specifically, we hypothesized that in judging their risk for a certain condition, those participants who were relatively more worried about getting the other conditions would judge their risk for that condition as higher. Thus, the worry felt with respect to a certain health condition may not be the only affective factor influencing the risk perception for that condition. The global worry experienced with respect to a group of conditions may also have an effect.

Methods

Participants

In this study, participants were randomly selected from a pool of 350,000 members of a large Midwestern health maintenance organization (McBride et al., 2009). The sampling strategy is described in detail elsewhere (Hensley-Alford, McBride, Reid, Larson, Baxevis & Brody, 2011). Briefly, the sample included members between the ages of 25 and 40, enrolled for at least two years, assigned to a primary care physician, and who did not have any of the following 8 conditions: Colon, skin and lung cancers, heart disease, osteoporosis, diabetes, high blood pressure, high cholesterol. As can be seen in Table 1, 53% of participants were female, and 37% were white. Most of the participants (75%) had at least some college education.

Procedure

An advance letter was sent to sampled individuals explaining the study and providing a toll-free number to call to decline participation in a screening survey. In this survey, participants answered questions measuring their knowledge and beliefs about genetics, health conditions, and health habits. The present study is based on data from the screening survey completed with 1,959 participants, assessing their perceptions of risk and worry for the eight common health conditions. The study was approved by the Institutional Review Board at the National Institutes of Health in Bethesda, Maryland (USA).

Measures

For each of the 8 health conditions in the study (i.e., colon, skin and lung cancers, heart disease, osteoporosis, diabetes, high blood pressure, high cholesterol), participants were asked to report *how worried* they were about developing the disease in their lifetime on a 1-to-7 scale, 1 meaning “not at all worried” and 7 meaning “very worried.” For each condition, they were also asked to report *how likely* they think it is that they will develop the disease in their lifetime on a 7-point scale, 1 meaning “certain not to happen” and 7 meaning “certain to happen.” Participants also reported their age, sex, race, marital status and educational attainment.

Analysis

During data analysis, an additional variable called “remaining disease worry” was created based on participants’ reported disease worry for seven of the eight conditions. More specifically, for each condition, “remaining disease worry” was the average of the reported disease worry scores for the seven other conditions. For example, “remaining disease worry” for colon cancer was the average of worry scores reported for skin cancer, lung cancer, heart disease, osteoporosis, diabetes, high blood pressure and high cholesterol. To differentiate remaining disease worry from the worry score for a single health condition, the latter was called “single disease worry.”

First, we examined the bivariate correlations between single disease worry, remaining disease worry and perceived risk for each condition. To investigate the effects of single and remaining disease worry controlling for socio-demographic factors, we first ran eight separate ordinary least square regression models, one for each condition, with perceived risk as the dependent variable, single disease worry, remaining disease worry and an interaction term between single disease worry and remaining disease worry as the independent variables, and with participants’ age, sex, race, marital status and educational attainment as the covariates. Then, we combined these 8 models into one random intercept model to test the overall effects across all of the health conditions.

Results

The means and standard deviations of disease worry and perceived risk for each disease can be seen in Table 2. Disease worry and risk perception scores were generally close to the mid-points of the scales. We used $p = .05$ as the significance level to test the hypothesized effects. We did not use Bonferroni correction to adjust the significance level because our predictions primarily concerned the overall random intercept model that combines all the specific models for each disease rather than each of these specific models per se. However, we should also note that even if Bonferroni adjustment is used, our results obtained in the overall intercept model do not change since, as presented below, all the effects are significant at $p = .001$, which is below the Bonferroni adjusted cut-off point.

As can be seen in Table 3, the bivariate correlation analysis showed that for all of the health conditions, perceived disease risk was significantly and positively associated with both single disease worry and remaining disease worry. For example, the worry for getting colon cancer was significantly associated with the perceived risk for colon cancer, $r = 0.54$, $p < .001$. The level of worry for the other 7 diseases on the survey was also significantly associated with perceived colon cancer risk, $r = .36$, $p < .001$. Similar results were obtained for the other conditions.

In the regression model analyses, it can be seen from Table 4 that the interaction between single disease worry and remaining disease worry predicted perceived disease risk in all of the 8 single disease models as well as the overall random intercept model, $\beta = 0.03$, $p < .$

001. As illustrated for colon cancer in Figure 1, the less people were worried about a certain disease, the more their remaining disease worry increased their risk perception for that disease, $\beta = 0.03$, $p < .01$.

Discussion

The findings presented here show that risk judgment for a single health condition is associated with worry about other conditions that people may have in mind. Although bivariate correlations showed that both the worry for a single condition and the worry for the other conditions were associated with perceived risk, there was a significant interaction between the two types of worry in multivariate models predicting perceived disease risk, for both the single- and the combined-disease models. Thus, individuals' worry for a specific disease and worry for other diseases jointly affect how people judge their risk for that specific disease.

Specifically, as the level of worry felt with respect to a single disease decreased, the perceived risk for that single disease was affected more by how much the participants worried about the other diseases. For example, the less they were worried about colon cancer, the more their feelings of worry about the other seven diseases had an effect on their risk perception for colon cancer. The more people are worried about the other diseases in a context, the higher their perceived risk for a certain disease becomes, particularly when their worry about a single disease is relatively low.

The results have important implications for how people form their risk judgments in contexts that may lead them to think about several diseases simultaneously such as when people receive genetic testing for multiple diseases or when they receive interventions targeting multiple health outcomes. Many genetics experts believe that genetic testing and risk communication for multiple diseases will become increasingly common (Collins & McKusick, 2001; Guttmacher & Collins, 2005; Gollust, Wilfond & Hull, 2003). Once formed, perceptions of disease risk also become quite resistant to change even in the face of receiving objective risk information (Cull, Anderson, Campbell, Mackay, Smyth & Steel, 1999; Senay & Kaphingst, 2009). For example, people who initially over- or under-estimate their risk for a disease such as heart disease or cancer tend to continue over- or under-estimating it even after they receive objective risk information from healthcare providers. Thus, it becomes especially important to prevent biased risk perceptions before people receive objective risk information as part of a health behavior change intervention or through testing for their genetic susceptibility for various diseases.

Different strategies can be useful in this regard. For example, limiting the number of health conditions on which people receive risk feedback at a time and providing testing and feedback for different diseases at different time points may decrease the likelihood that people will think about multiple diseases simultaneously, thus, reducing individuals' biased perceptions of risk that may persist later. Related intervention research has some supporting evidence for the efficacy of sequential rather than simultaneous counseling on multiple health behaviors. In one study (Spring, Doran, Pagoto, Schneider, Pingitore & Hedeker, 2004), people receiving counseling on multiple health behaviors (i.e., diet, exercise and smoking) were better able to limit weight gain when counseling on diet and exercise was introduced at a later time rather than simultaneously with smoking cessation counseling. Other studies have also reported either an adverse or no effect when exercise and dietetic counseling were presented simultaneously with smoking cessation counseling (Hall, Tuskell, Vila & Duffy, 1992). However, more research is certainly needed to determine the optimal number of health outcomes on which individuals should be tested and counseled at a given

time point, and this has been identified as a priority area for research (Prochaska & Sallis, 2004).

There are limitations of the present study to consider in interpreting the results. The order of questions about perceived risk and disease worry was not counterbalanced across participants and this might have biased our results. Also, it is likely that some people may not tend to think about a group of diseases simultaneously, producing a weaker association between global disease worry and perceived risk for a single disease for those people. Individual differences in these processes are important areas for future investigation. Finally, disease worry and perceived risk were measured in this study by one item in line with common practice in public health. However, such one-item measures may not capture all the dimensions of the measured constructs.

In sum, the present study identifies an important role for affective contexts in impacting people's perceptions of risk for a particular condition based on worry for multiple health conditions simultaneously. Future studies can investigate how the effects reported here for misperceptions of disease risk can also influence people's subsequent health information seeking and health behavior change.

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Figure 1. Single vs. global disease worry interaction for colon cancer. Worry_cc denotes worry for colon cancer.

Table 1

Sample characteristics

Characteristics	Sample (n=1,959)	
	N (%)	Mean (SD)
Age	-----	34.59 (4.2)
Gender		
Male	925 (47)	-----
Female	1,034 (53)	-----
Race		
White	732 (37)	-----
Black	1,040 (53)	-----
Other	187 (10)	
Marital Status		
Married/unmarried couple	1,230 (63)	-----
Single/divorced/widowed	726 (37)	-----
Education		
High school or less	480 (25)	-----
Some college	747 (38)	-----
College degree or higher	728 (37)	-----

Table 2

Means and SDs of disease worry and perceived risk for each single disease

Variable	Mean	SD
Single disease worry		
colon cancer	3.89	2.11
skin cancer	3.28	2.02
lung cancer	3.64	2.21
heart disease	4.62	1.96
osteoporosis	3.24	2.00
diabetes	4.26	2.10
high blood pressure	4.59	2.03
high cholesterol	4.33	1.99
Risk perception		
colon cancer	2.67	1.53
skin cancer	2.50	1.60
lung cancer	2.79	1.75
heart disease	3.77	1.75
osteoporosis	2.53	1.58
diabetes	3.62	1.90
high blood pressure	4.20	1.97
high cholesterol	3.96	1.91

Bi-variate correlations between perceived risk and single vs. remaining disease worry

Disease worry	Perceived risk							
	Colon cancer	Skin cancer	Lung cancer	Heart disease	Osteoporosis	Diabetes	High blood pressure	High cholesterol
Single	.54***	.62***	.67***	.64***	.62***	.70***	.72***	.70***
Remaining	.36***	.22***	.36***	.44***	.33***	.39***	.41***	.36***

Table 4

Model coefficients predicting perceived disease risk after controlling for age, sex, race, marital status, and educational attainment.

Independent Variables	Colon Cancer	Skin cancer	Lung Cancer	Heart Disease	Osteoporosis	Diabetes	High Blood Pressure	High Cholesterol	Overall (Random Intercept Model)
	β (S.E.)	β (S.E.)	β (S.E.)	β (S.E.)	β (S.E.)	β (S.E.)	β (S.E.)	β (S.E.)	β (S.E.)
Single disease worry	.49 ^{*****} (.04)	.75 ^{*****} (.04)	.82 ^{*****} (.04)	.80 ^{*****} (.04)	.90 ^{*****} (.05)	.96 ^{*****} (.04)	.88 ^{*****} (.04)	1.0 ^{*****} (.04)	.80 ^{*****} (.02)
Remaining disease worry	.16 ^{***} (.04)	.10 ^{**} (.03)	.07 (.04)	.14 [*] (.07)	.18 ^{*****} (.04)	.11 [*] (.06)	.02 (.06)	.13 ^{**} (.05)	.06 ^{***} (.02)
Single $\times$ remaining disease worry	.03 ^{**} (.01)	.06 ^{*****} (.01)	.06 ^{*****} (.01)	.04 ^{*****} (.01)	.09 ^{*****} (.01)	.07 ^{*****} (.01)	.03 ^{**} (.01)	.07 ^{*****} (.01)	.03 ^{*****} (.00)

*
p < .05;

**
p < .01;

p < .001;

p < .0001.