Published in final edited form as:
Ann Behav Med. 2011 October ; 42(2): 262–268. doi:10.1007/s12160-011-9287-8.

The Distinct Role of Comparative Risk Perceptions in a Breast Cancer Prevention Program

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Abstract

Background—Comparative risk perceptions may rival other types of information in terms of effects on health behavior decisions.

Purpose—We examined associations between comparative risk perceptions, affect, and behavior while controlling for absolute risk perceptions and actual risk.

Methods—Women at an increased risk of breast cancer participated in a program to learn about tamoxifen which can reduce the risk of breast cancer. Women reported comparative risk perceptions of breast cancer and completed measures of anxiety, knowledge, and tamoxifen-related behavior intentions. Three months later, women reported their behavior.

Results—Comparative risk perceptions were positively correlated with anxiety, knowledge, intentions, and behavior three months later. After controlling for participants' actual risk of breast

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The authors have no conflict of interest to disclose.

Portions of this research were presented to the Society for Personality and Social Psychology, Memphis, TN, January 25, 2007.

cancer and absolute risk perceptions, comparative risk perceptions predicted anxiety and knowledge, but not intentions or behavior.

Conclusions—Comparative risk perceptions can affect patient outcomes like anxiety and knowledge independently of absolute risk perceptions and actual risk information.

Keywords

comparative risk perception; breast cancer; behavioral decision-making; tamoxifen; decision aid

Risk perceptions—beliefs about the personal likelihood of some negative event occurring—play a central role in individuals' health behavior decisions (1-3). There are two distinct types of risk perceptions: absolute risk perceptions (beliefs about the risk of X from low to high, or from 0 to 100%) and comparative risk perceptions (beliefs about the risk of X compared to the risks of similar other people). Health behavior decisions may also be influenced by information about one's personal risk of a health threat which individuals sometimes have. In this study, we examined the decision to take tamoxifen, a medication that can reduce risk of breast cancer. We tested whether comparative risk perceptions would have incremental effects beyond other sources of information like absolute risk perceptions and actual risk.

According to social comparison theory, individuals desire and seek information about how they compare with other people because it provides evaluative information about the self (4,5). Research shows that when evaluating health risks, individuals may engage in social comparisons and think about risk in comparative terms (6-8). Comparative risk perceptions have also been found to influence individuals' health behavior decisions. For example, studies have found that greater comparative risk perceptions are associated with decisions to have cancer screening (9,10) as well as make other positive behavior changes (7). These associations may be moderated by worry as studies have found that as comparative risk perceptions increase, worry increases (6,11-14).

Some research on comparative risk perceptions shows they may be more likely than absolute risk perceptions to be associated with worry, knowledge, and behavior related to a health risk (6,9,11), but few studies have examined both perceptions in the context of an actual medical decision. Moreover, in these decisions, individuals are often given information about their true levels of risk. How might comparative risk perceptions influence individuals' worry, knowledge, and behavior in the context of both absolute risk perceptions and actual risk information? While there is theoretical and empirical support for the idea that comparative risk perceptions will still be predictive (6,9,10-12), few studies have examined their unique contribution (i.e., controlling for both additional sources of information) (7,15-16) and none in the medical decision making context of the present study.

To address these questions, we analyzed data drawn from an intervention study in which women at an increased risk of developing breast cancer participated in an online program to learn about tamoxifen, a medication that can reduce the likelihood of breast cancer, by almost 50%, in women at elevated risk (17). During the program, women received their estimated 5-year risks of breast cancer. Immediately after, they reported comparative and absolute breast cancer risk perceptions and their state anxiety, completed knowledge questions about tamoxifen, and reported their intentions to seek more information and take tamoxifen. Three months later, participants reported their tamoxifen-related behavior. We examined associations between comparative risk perceptions, intentions, and behavior and further tested these associations statistically controlling for absolute risk perceptions and actual risk of breast cancer.

Our hypotheses were that higher comparative risk perceptions would be associated with greater anxiety, higher knowledge scores, greater intentions to seek information about tamoxifen and take the medication, and these behaviors three months later. We further hypothesized that the predicted associations would remain strong and significant after controlling for the other sources of information, absolute risk perceptions, and objective risk levels.

Method

Procedure

This study was part of a larger intervention study that varied 5 factors (implemented in 16 different conditions) to test methods of communicating the risks and benefits of tamoxifen among women at high risk for breast cancer (18,19). None of the factors had significant consistent effects on outcomes so the data reported here have been collapsed across all factors and conditions. Participants were recruited from two large healthcare organizations in Detroit and Seattle. Based on electronic medical record data, patients who met eligibility criteria were sent letters describing the study that included a website address to learn more. Eligibility was determined using the Gail model, which uses individual factors such as age and race to estimate a numerical risk of breast cancer (20). Only women whose 5-year risk was > 1.66% (the minimal risk for which tamoxifen may be used; 21) were eligible. Women were not eligible if they had breast cancer or had taken tamoxifen or had contraindications to the medication.

After providing consent, women received one of 16 decision aids about tamoxifen. In the decision aid, they were given their 5-year Gail model risk estimates and received quantitative information about the risks and benefits of tamoxifen individually tailored to race and age. Following the decision aid, participants reported their absolute and comparative risk perceptions of developing breast cancer along with their anxiety, knowledge, and intentions to take tamoxifen. Three months later, participants reported whether they had taken tamoxifen. In exchange for participating, participants received $10 gift certificates.

Participants

Of the 749 individuals who came to the website and were eligible to participate, 632 (84%) completed the initial survey and 335 of those individuals (53%) completed the follow-up survey. The average age of women who participated at baseline was 59 (*SD*= 7.6). The majority were White (94%), with 2% Black or African-American, 2% Asian, and 2% reporting Other. Participants and non-respondents at the three month follow-up did not differ with respect to their age, Gail scores, and any of the risk perception variables.

Measures

Gail scores—We used the Gail model to calculate 5-year numerical risk of breast cancer for each participant (20). The Gail model incorporates risk factors such as age, race, family history, and age of menarche and first live birth to determine lifetime and 5-year probability estimates.

Absolute risk perceptions—Participants were asked, “If you chose not to take tamoxifen, how likely would you be to get breast cancer in the next 5 years?” Responses were on an 11-point scale from not likely at all to extremely likely.

Comparative risk perceptions—Participants were asked, “Compared to the average woman, your age and in your health, what do you think your chances are of developing

breast cancer in the next 5 years?" Responses were on a 7-point scale, from much less than the average woman to much higher than the average woman.

State anxiety—We used the anxiety subscale from the Profile of Mood States (22). Participants indicated how well 5 adjectives (e.g., uneasy, tense) described them *right now.* Responses were on 5-point scales, from very slightly/not at all to extremely. Items were averaged (alpha =.91).

Knowledge—Six questions were asked about who was more likely to experience each risk and benefit of tamoxifen. Response options for these questions were "women who take tamoxifen", "women who do not take tamoxifen", "both groups are equally likely", or "don't know". The six responses were scored as correct or incorrect (coded as 1 or 0) and correct responses were summed, yielding a knowledge score of 0-6.

Behavioral intentions—Three questions assessed intentions to take tamoxifen: "How likely are you to talk to your doctor about tamoxifen?", "How likely are to you to look for more information about tamoxifen (for example, use the Internet, call the numbers listed on the website, etc.)?", "Given what you know right now, how likely do you think you are to take tamoxifen in the next year?" Questions were on 5-point scales, from not at all likely (1) to extremely likely (5). Because the three variables were significantly correlated with each other (range, *r*s= .55 to .70, *p*s<.001), we combined them. Scale reliability (alpha) was .82.

Tamoxifen behavior—At the 3-month follow-up, we assessed behavior with three questions: "In the past three months, 1)…did you look for more information about tamoxifen?" 2)…did you talk to a doctor about tamoxifen?", and 3)…have you started to take tamoxifen?" Participants could respond "yes" or "no" to each question. From these three variables, we created one dichotomous variable which was coded as 0 if participants reported "no" to the three behaviors and 1 if they reported "yes" to at least one of the behaviors.

Analytic strategy

We first examined cross-sectional and longitudinal correlations between comparative risk perceptions and outcomes. Next, to determine independent effects of comparative risk perceptions, we used hierarchical regression analyses for initial outcomes and logistic regression analyses for three-month behavior. In all analyses, Gail scores and absolute risk perceptions were entered in Step 1, with comparative risk perceptions entered in Step 2.

Results

When asked how likely they were to develop breast cancer in the next 5 years, 90% of participants rated their risk at or below the midpoint of the likelihood scale. When asked about their chances compared to a similar other, 80% of participants reported about the same or less than average risk. The two types of risk perceptions were positively associated (r=.67, p<.001). After the decision aid, participants reported low levels of state anxiety (M=1.45, SD=.68) and performed fairly well on the knowledge test (M=4.06, SD=2.01). They reported moderate intentions to seek additional information about tamoxifen (M=2.59, SD=1.42) and talk to their doctor (M=2.56, SD =1.41), but low intentions for taking tamoxifen (M=1.65, SD=.95). After three months, the majority of women reported that they had not looked for additional information (95%), talked to their doctor (93%), or started to take tamoxifen (99.6%). Behavioral intentions and three-month tamoxifen behavior were significantly correlated, r=.34, p<.001.

Comparative risk perceptions were significantly correlated with all outcomes. The higher the risk perception, the more anxious (r=.23, p<.001) and knowledgeable (r=.10, p<.05) women were, and the greater their tamoxifen intentions (r=.27, p<.001). The association with tamoxifen behavior three months later also was significant: Women with higher comparative risk perceptions were more likely to report having engaged in one or more behaviors (r=.16, p<.05).

Results for the hierarchical regressions are presented in Table 1. Except for knowledge, actual risk levels (i.e., Gail scores) were not significant predictors of any outcomes. Regarding anxiety, absolute risk perceptions in Step 1 were significant but their effects disappeared in Step 2 when comparative risk perceptions were entered. Women who felt their risk was higher than average were more likely to report anxiety. For knowledge, absolute perceptions in Step 1 were not significant, but in Step 2 they reversed to show a significant, negative association while comparative perceptions were positively related to knowledge. For behavioral intentions, in Step 1, absolute perceptions were significant predictors, suggesting as these perceptions increased, women had greater intentions to take tamoxifen. In Step 2, they continued to be significant predictors, and comparative perceptions were not significant.

Table 2 presents the logistic regression coefficients for tamoxifen behavior three months later. In Step 1, absolute risk perceptions were significant: the higher these perceptions, the more likely women were to report having engaged in at least one of the tamoxifen behaviors (i.e., looked for more information, talked to their doctor, or started to take tamoxifen). However, comparative risk perceptions in Step 2 were not significantly related to this behavior.

In sum, when controlling for Gail scores and absolute risk perceptions, comparative risk perceptions were significantly related to concurrent anxiety and knowledge, but not intentions; they were also not related to behavior three months later once absolute risk perceptions were controlled.

Discussion

Klein has argued that comparative risk perceptions may be more psychologically meaningful than objective risk feedback or risk perceptions based on absolute probability (1). We tested the idea that comparative risk perceptions might have a distinct effect on high risk women's decisions to take tamoxifen by examining actual risk, absolute risk perceptions, and comparative risk perceptions of breast cancer in multivariate models. Our cross-sectional data showed that after controlling for participants' actual risk (as estimated by the Gail model) and their absolute risk perceptions, comparative risk perceptions were associated with feelings of anxiety and knowledge about tamoxifen. However, they were not associated with tamoxifen related intentions (measured at the same time) or tamoxifen behavior three months later. Instead absolute risk perceptions were predictive of intentions and behavior, a finding that is consistent with Gurmankin as well as others that have failed to find consistent effects of comparative risk perceptions (15,23).

In this study, we provided participants with feedback about their actual risk of breast cancer. These tailored numerical estimates were not associated with outcomes except for knowledge and the correlations were inverse, against predictions. Actual risk was only modestly correlated with comparative and absolute risk perceptions. Together, the findings suggest that providing numerical risk feedback may not be an effective risk communication strategy (24), perhaps due to numerical comprehension problems (25). The findings also showed that

providing women who have an increased risk of breast cancer with their numerical risk estimates may not increase motivation to take tamoxifen.

Although comparative risk perceptions in our study did not predict behavior beyond absolute risk perceptions, they were associated concurrently with anxiety and knowledge. If knowledge is more likely to be influenced via increasing comparative risk perception rather than absolute risk perception or personal risk feedback, researchers and practitioners might consider influencing these risk beliefs to increase informed decision-making. Only experimental research can test the idea that comparative risk perceptions are more likely than absolute risk perceptions to produce knowledge following a risk communication (26,27). Given their unique associations with anxiety as well, one possibility is that comparative risk perceptions increase knowledge via anxiety, an idea that fits with the "affect as motivation" hypothesis (28).

Almost eighty percent of participants in this study reported low or less than average risk yet they were at higher than average risk. While the optimistic bias fits with studies of normal risk women (29-32), our study extends the bias to women at an increased risk of breast cancer. It is possible that the bias is related to the interpretation of numerical risk information. For example, the majority of participants received Gail scores between 1.7% and 4.9%, but these increased risks may not have felt high. Participants may have been accustomed to hearing lifetime risk estimates, which range from 20-26% for increased risk. Either of these explanations may have led women to interpret the 5-year estimates we gave them as normal.

Even after reading a decision aid, few women were motivated to take tamoxifen. This conclusion is evidenced by both participants' moderately low intentions immediately after learning about tamoxifen and their behavior three months later in which few of them (<1-7%) reported starting to take the medication or engaging in other behaviors consistent with an interest in it. Women's comparative risk perceptions were not associated with motivation, but absolute risk perceptions were; thus, increasing absolute risk perceptions could be effective in increasing interest in tamoxifen. Future research should explore this idea as well as other factors that could influence, or interact with risk perception to influence tamoxifen decisions. For example, women at an increased risk may not be motivated to take tamoxifen because they fear and overestimate the side effects, or because they are otherwise healthy and do not like the idea of taking a medication regularly (33). These explanations, related to barriers and attitudes, are consistent with theories of health behavior decision-making (34-35), and interventions that influence such constructs could be effective in increasing interest in and motivation to take tamoxifen.

Limitations

The present study had several limitations. First, the absolute and comparative risk perception measures were not perfectly matched. The absolute measure included the conditional "if you chose not to take tamoxifen" but the comparative measure did not, possibly making this measure more ambiguous. However, because few women intended to take tamoxifen, it is likely that participants were responding to the comparative question also as if they chose not to take the medication. Second, women at an increased risk of breast cancer reported low risk perception across both measures and although we speculated explanations, our data did not test them. The low risk perception may not be representative of all women at increased risk. Similarly, there was a floor effect for this decision – few women chose to take tamoxifen or reported behaviors consistent with an interest in the medication. Thus, the findings may be different for a more common health behavior decision. Fourth, we took steps to obtain a racially diverse sample, but participants were still relatively homogenous, which may have been related to the online nature of the study (36). The recruitment rates,

however, were similar to other studies conducted in heterogeneous geographical locations (17,21). Fifth, only 53% of participants completed the three-month follow-up survey, and these women had higher knowledge scores and tamoxifen intentions as measured in the initial survey. How the greater knowledge and behavioral intentions influenced the longitudinal associations is not clear – if participants were already motivated to take tamoxifen, risk perception may have played less of a role at the three month time point, which could mean the associations of risk perceptions with behavior were underestimated. Finally, the tamoxifen behaviors were self-reported, making them vulnerable to recall bias and other problems associated with this methodology (37,38).

Conclusion

In a study of women at high risk of developing breast cancer, comparative risk perceptions played an important role in women's affect and knowledge related to the decision to take tamoxifen to decrease their breast cancer risk. Even after controlling for actual breast cancer risk and absolute risk perceptions of the disease, comparative risk perceptions had significant and unique correlations with both state anxiety and factual knowledge. However, comparative risk perceptions did not predict behavior beyond these other sources of information.

Acknowledgments

Financial support for this study was provided by a Center of Excellence for Cancer Communication Research grant from the National Institutes for Health (P50 CA101451). During data collection and analyses, Dr. Dillard was supported by an HSR&D postdoctoral fellowship from the U.S. Department of Veterans Affairs. Drs. Fagerlin and Smith were supported by Merit Review Entry Program awards from the Department of Veterans Affairs, and Dr. Zikmund-Fisher was supported by a career development award from the American Cancer Society.

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Table 1

Initial outcomes as a function of Gail scores, absolute risk perceptions, and comparative risk perceptions

Variable	State anxiety		Knowledge		Intentions	
	B	SE	B	SE	B	SE
Step 1						
Gail scores	−.01	.02	−.08	.06	.02	.10
Absolute risk perceptions	**.07** **	.01	−.01	.04	**.62** **	.06
	R^2 = .04		R^2 = .00		R^2 = .14	
Step 2						
Gail scores	−.02	.02	**−.12** *	.06	.01	.10
Absolute risk perceptions	.03	.02	**−.14** **	.05	**.58** **	.08
Comparative risk perceptions	**.09** **	.03	**.29** **	.07	.09	.12
	Δ R^2 = .02		Δ R^2 = .03		Δ R^2 = .00	
	$F = 10.50$ **		$F = 16.69$ **		$F < 1$	

* *Note*. $p < .05$;

** $p < .01$.

Gail scores represent actual risk of breast cancer as determined by the Gail model. Absolute risk perceptions represent beliefs about the likelihood of developing breast cancer on a scale from not at all likely to extremely likely, and comparative risk perceptions represent beliefs on a scale from much less than average to much higher than average.

Table 2

Three month follow-up behavior as a function of Gail scores, absolute risk perceptions, and comparative risk perceptions

	Variable	*B*	Wald statistic	Odds ratio	95% CI	
					Lower	Upper
Have you looked for more information, talked to your doctor, or started to take tamoxifen?[a,b]						
Step 1	Gail scores	.29	2.96	1.34	.96	1.87
	Absolute risk perceptions	**.36** **	10.01	1.43	1.15	1.79
Step 2	Gail scores	.29	2.79	1.33	.95	1.87
	Absolute risk perceptions	**.31** *	4.32	1.36	1.02	1.82
	Comparative risk perceptions	.12	.25	1.13	.71	1.80

Note. For this dichotomous variable, if participants said no to all three behaviors, we coded the variable as 0. If they said yes to at least one behavior, we coded the variable as 1.

* $p < .05$;

** $p < .01$.

[a] When intentions are statistically controlled in examining behavior, absolute risk perceptions become nonsignificant, $p > .10$.

[b] The three behaviors were also analyzed as a continuous measure in which number of behaviors participants responded yes to were counted (range= 0 to 3). The pattern of results was the same as when using the dichotomous variable described above.