Short Communication

Communicating Breast Cancer Risks to Women Using Different Formats[1]

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Abstract

Using a pre-post test design with a baseline, laboratory, and a 6-month follow-up, we communicated women's objective breast cancer risks, based on the Gail Model, using two formats: (*a*) range of risks (*e.g.*, risk of breast cancer can be as low as 1% and as high as 5%); and (*b*) as a point estimate (*e.g.*, your risk of breast cancer is 3%). We examined how these presentations individually and jointly affected women's perceived lifetime breast cancer risks. Overall, providing risk estimates either as a range of risks or as a point estimate lowered women's perceived lifetime risks compared with women who did not get information presented this way shortly after receipt of this information relative to baseline. At the 6-month follow-up, perceptions of lifetime risks generally returned to their baseline values. Overall, women viewed their risk feedback, whether presented as a point estimate or as a range of risks, as equally credible, trustworthy, accurate, and personally relevant. These results suggest that women evaluate risk feedback containing either point estimates or range of risks as equally acceptable. Both formats lead to short-term reductions in perceived risk (*i.e.*, greater accuracy).

Introduction

Breast cancer is one of the few diseases that has quantitative models, such as the Gail Model (1), to predict women's risk. Women typically overestimate their breast cancer risks (2–4). How can breast cancer risk be communicated to increase women's accuracy of their perceived risks? Absolute risk can be communicated as a point estimate (*e.g.*, your risk is 3%), as a range (*e.g.*, your risk can be as low as 1% and as high as 5%), and as a point estimate plus range. We report how women's perceived breast cancer risks were affected by these presentational variations.

Reactions Toward Information about Personal Breast Cancer Risk. According to Prospect Theory (5), people evaluate information based on a modifiable reference point. Outcomes above and below the reference point can be viewed as gains (benefits) and losses (costs), respectively (6). If a woman's subjective risk of getting breast cancer serves as one reference point, outcomes below this point, representing less risk, should be viewed as a gain; outcomes above this point, representing greater risk, should be viewed as a loss (*e.g.*, a woman who believes her lifetime risk is 20% and is told her risk is 3% should interpret this information as a gain).

The interpretation of risk feedback as a gain or loss should interact with presentation format. People generally prefer precision to lack of precision or uncertainty, especially when precise information conveys good news (7, 8). Unlike a range of risks, a point estimate reflects greater precision and should be preferred, especially for women informed their risk is below their subjective risk estimates (gain). That is, obtaining precise information that their risk is lower than expected should be strongly accepted. Conversely, women informed their risks are higher than their subjective risk estimates (loss) should prefer a range of risks, because a range can represent vagueness (*i.e.*, less precision; Refs. 9 and 10). Vague probabilities may imply that the true probabilities can be better or worse. For women who view their breast cancer risk feedback as conveying a loss, a range of risk values offers the hope that their actual risk may be at the lower end of the range (*i.e.*, risk is not as bad as it seems; Ref. 10).

Perceived Breast Cancer Risks as a Function of Combining a Point Estimate with Range of Risks. How should a woman view her risks when presented with a point estimate and a range of risks? We hypothesize that when people are presented with a range of risks, they try to gather and/or use information to improve precision. Because of people's propensity to see themselves at lower than at higher risk (11, 12), they will tend to place themselves at the lower end of the continuum, representing less risk. A point estimate provides an anchor to solidify the location of risk (13). When a point estimate and a range of risks are given, a woman should view her risk somewhere in between the point estimate and the lower bound of risk.

Hypotheses. We tested the following predictions.[3]

H1. Providing any form of risk feedback (point estimate or range of risks) will lower women's perceived risks more than not providing any risk feedback.

H2. Women who get a point estimate plus a range of risks will report the lowest perceived risks pre-post compared with women who only get a point estimate, a range, or no risk feedback.

Received 9/15/00; revised 5/25/01; accepted 6/1/01.
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[3] Because the majority of women in our study overestimated their breast cancer risks, we did not have sufficient power to detect if those who overestimated and underestimated their risks had differential responses to risk feedback information.

H3. Women will view point estimates of risk as more accurate, trustworthy, and credible than a range of risks.

Materials and Methods

Participants. The participants were 169 women aged ≥39 recruited from newspaper advertisements asking them to participate in a study on women's health issues (65% were White, 33% were African-American, and 2% were other). The average age was 53 (SD = 9.5); 74% had some college education or higher. Among women 40–49 and those ≥50, 25.3% and 49.4%, respectively, were on schedule for having mammograms. The mean lifetime Gail score, a measure of absolute risk, was 7.78% (SD = 1.13; range, 0.5–31.3%), with a mean upper bound 95% confidence interval risk of 9.75% (SD = 7.06; range, 0.7–45%) and a lower bound 95% confidence interval risk of 6.22% (SD = 3.46; range, 0.4–20.2%). The mean Gail score and the upper and lower bound risks did not differ significantly by experimental conditions.

Design and Procedures. Women interested in participating were asked to call the Duke Medical Center's RCL.[4] They were told that the purpose of the study was to learn about women's reactions to individualized breast cancer risk information. Women were asked to come to the RCL to obtain their risk estimates and provide their reactions to the information. Women who agreed to participate completed a baseline interview. After completing the baseline interview, they were scheduled to come to the RCL, usually within a week or two of the call.

When women arrived at the RCL, a trained undergraduate research assistant reviewed the study's purpose and procedures and obtained written consent. Women were randomized to one of four conditions of a 2 (point risk estimate given: no/yes) × 2 (range of risks given: no/yes) between-subjects factorial design. There were 39–43 women/condition. They received $20 for their help. Participants were contacted 6–8 months later to reassess the psychosocial outcomes related to risk perceptions. Overall, 151 women were reached: 37–40 participants/condition. Loss to follow-up was attributable primarily to the inability to reach participants (*e.g.*, moved without any forwarding number).

Communicating Breast Cancer Risk Information. With the exception of women who served as controls (received no point estimate nor range of risks), all women received a one to two page handout that described the Gail Model. This included the components of the model and their own lifetime risk of getting breast cancer as a percentage in a pie chart. Women who received a point estimate only were informed that the percentage represented the best estimate of their lifetime risk. Women who received a range were given two risk estimates, derived from the 95% confidence interval, to communicate the upper and lower bound risks. Women who received a point estimate plus a range were told that the percentage was the best estimate of their lifetime risk. They also were given their upper and lower risk bounds. The research assistant did not discuss potential weaknesses in the Gail Model and how the risk estimate(s) may have lacked precision. After reviewing the material, women completed a follow-up questionnaire almost identical to the baseline questions. They were then debriefed (*e.g.*, told about the purpose of the study and asked about their assessed reactions to the information, which were almost always positive).

[4] The abbreviation used is: RCL, Risk Communication Lab.

Table 1 Accuracy of stating Gail score risk estimates and reactions toward the risk estimate(s) by experimental group[a]

Outcome	Point estimate	Range	Range plus point estimates
Accuracy of estimate (% accurate)			
Point estimate	90.7		97.7
Upper bound estimate		87.2	100.0
Lower bound estimate		90.2	93.0
Reactions toward feedback (point estimate)			
Accurate	5.11		5.21
Credible	5.37		5.23
Trustworthy	5.21		5.12
Personal relevance	3.53		3.51
Expectations (%)			
Above	2.33		19.05
As expected	44.19		45.24
Below	53.49		35.71
Reactions toward feedback (lower bound estimate)			
Accurate		5.05	5.09
Credible		5.10	5.05
Trustworthy		4.89	5.12
Personal relevance		3.34	3.51
Expectations (%)			
Above		24.40	23.26
As expected		48.78	55.81
Below		26.83	20.93
Reactions toward feedback (higher bound estimate)			
Accurate		5.13	5.09
Credible		5.23	5.25
Trustworthy		4.82	5.09
Personal relevance		3.31	3.51
Expectations (%)			
Above		25.64	26.19
As expected		48.72	47.62
Below		25.64	26.19

[a] The scores range from 1 to 7 for all outcomes except to what extent the feedback was above, below, or as expected.

A full 6–8 months later, participants were recontacted and completed a 15–20 min follow-up phone interview. With few exceptions, women responded to the same baseline and laboratory questions. They were paid $10 for the 6-month follow-up interviews.

Measures. In addition to collecting information on demographics (age, race, and education) and the components needed to calculate a women's absolute breast cancer risk using the Gail *et al.* (1) algorithm, women completed, unless otherwise indicated, the following measures assessed at baseline, during the laboratory session, and at the 6-month follow-up.

Reactions toward Objective Risk Feedback. After getting their breast cancer risk feedback, all women, except those in the control group, were asked to write their Gail Model risk estimate(s). Using seven-point Likert scales, women evaluated the estimate(s) with respect to being accurate (not at all/completely), credible (not at all/very), and trustworthy (not at all/very), and on a five-point Likert scale, whether the estimate(s) was not at all to very personally relevant (1 = not at all relevant to 5 = extremely relevant). Participants also were asked if their risk estimate(s) were higher, lower, or about what they expected. These measures were collected during the laboratory session only.

Perceptions of Absolute Risk. Absolute perceived lifetime risk was assessed using numerical and verbal anchors. Women rated their lifetime risks of getting breast cancer on a 0–100% point scale where 0% = no chance and 100% = certain to

Table 2 Mean perceived breast cancer risk at baseline and at the laboratory and 6-month follow-up by experimental group[a]

Experimental group		Gail Score (lifetime)	Time of assessment		
Point estimate given	Range estimates given		Baseline	Follow-up	6-month follow-up
Absolute risk (numerical 0–100)					
No	No	6.96 (3.84)	31.6 (25.9)	32.1 (26.1)	37.2 (22.7)
No	Yes	7.60 (4.64)	36.7 (22.5)	21.9 (19.3)	30.7 (23.6)
Yes	No	7.95 (5.07)	39.5 (24.5)	24.2 (22.1)	34.7 (24.2)
Yes	Yes	8.57 (6.00)	39.2 (22.5)	16.6 (17.5)	36.2 (21.2)
Point estimate provided (collapsing across range condition)[b]					
No		7.28 (4.24)	34.3 (24.1)	27.2 (23.5)	33.8 (23.3)
Yes		8.27 (5.52)	39.2 (23.5)	20.2 (19.9)	35.4 (22.6)
Range provided (collapsing across point condition)[c]					
	No	7.46 (4.50)	35.8 (25.2)	27.8 (24.3)	36.0 (23.3)
	Yes	8.10 (5.53)	37.8 (22.5)	19.4 (18.6)	33.3 (22.6)

[a] Numbers in parentheses represent SD. The means for the baseline and laboratory follow-up are based on a sample size of 169; means for the 6-month follow-up are based on 151 women.
[b] Significant pre-post by point estimate interaction [$F(1164) = 19.36$, $P < 0.0001$] comparing baseline and the laboratory follow-up.
[c] Significant pre-post by range interaction [$F(1164) = 18.01$, $P < 0.0001$] comparing baseline and the laboratory follow-up.

happen. This measure was used as women's best estimates of their lifetime risks. A verbal measure of perceived risk based on a six-point Likert scale (anchors: no chance/certain to happen) produced results that mirrored those of the numerical results and will not be discussed further.[5]

Results

Accuracy of Women's Gail Risk Score Estimate(s). The accuracy with which women stated their Gail score estimates is shown at the top of Table 1. Accuracy was high, ranging from 87 to 100%. However, women in the range plus point estimate condition were more accurate on the upper bound risk than women in the range estimates condition only ($X_{(1)}^2 = 5.87$, $P < 0.02$). No other significant group differences emerged.

Reactions toward Risk Feedback. Women's reactions to the risk feedback are presented in Table 1. Perceived accuracy, credibility, trustworthiness, and personal relevance of the point estimate did not differ if it was presented alone or when accompanied by an upper and lower risk estimate (*i.e.*, point estimate *versus* range plus point estimate; all ts < 1). The same was true for the lower and upper bound risk estimates which did not differ if they were presented alone or when accompanied by a point estimate (*i.e.*, range *versus* range plus point estimate; all ts < 1). The most powerful test of whether the three estimates (point, upper, and lower bound) are differentially perceived occurs within the group of women who received a range plus a point estimate. However, none of the evaluative criteria differed within this group (Fs < 1).

Across conditions, most women perceived their risk estimates to be as they expected. However, women who received a point estimate only perceived it to be significantly lower than expected compared with women who received a point estimate plus range of risks (Mantel-Haenszel $X_{(1)}^2 = 4.85$, $P < 0.03$).

Perceptions of Absolute Risk. Table 2 presents the mean perceived numerical risks by condition. We performed mixed ANOVAs using perceived risk at baseline and at the laboratory follow-up as the within-subject variable and the point estimate (no/yes) and range of risks (no/yes) as the between-subjects variables. Baseline and laboratory follow-up responses were compared first to maximize our sample size and, hence, power to detect the manipulation effects.

Overall, perceived risk decreased from baseline to the laboratory follow-up [$F(1164) = 95.83$, $P < 0.0001$], although the magnitude of this decrease depended on if a woman received a point estimate [$F(1164) = 19.36$, $P < 0.0001$] or a range of risks [$F(1164) = 18.01$, $P < 0.0001$]. The magnitude of the decrease was greater among women who did *versus* did not receive a point estimate (see Table 2 results collapsing across range condition) and among those women who did *versus* did not get range estimates (see Table 2 results collapsing across point estimate condition).[6] The results did not differ by race.

Only one significant difference emerged when we contrasted perceived risk between the 6-month follow-up and the baseline and laboratory follow-up. Relative to the laboratory follow-up, perceived risk at the 6-month follow-up was significantly higher [$F(1146) = 31.21$, $P < 0.0001$]. In sum, at 6 months, with the exception of women in the control group, women's best estimates of their absolute risk returned to baseline values.

Discussion

Presenting breast cancer risks as either a point estimate or range produces a reduction in women's risk estimates in the short term, although women continued to overestimate their risks relative to their Gail scores. By 6 months, women's estimates reverted to baseline levels, suggesting that individualized risk feedback produced ephemeral effects.

Compared with providing no risk feedback, giving a point estimate and range was the most effective format to lower women's perceived risks.[6] If sustained change is the goal, additional communication strategies probably are needed.

In another study, we showed that women who received a combination of tailored print communications (including individualized Gail Model scores) and a call from a telephone

[5] We also assessed across all times points perceptions of comparative risk (self *versus* other). There were no pre-post differences at any time point, nor any mean differences by experimental conditions. These results are available from the first author upon request.

[6] For exploratory purposes, we collapsed across the experimental main effects to assess if any of the four experimental cells differed from each other. Women who got a point estimate plus a range had significantly lower perceptions of their numerical lifetime risks at the laboratory follow-up than women in the control group (See Table 2; $P < 0.05$). No other significant effects were found.

counselor (who reinforced women's Gail scores) significantly reduced their breast cancer risk perceptions and became more accurate compared with women who received either tailored printed information alone or no information. These changes persisted 12 and 24 months after the intervention (14). From a clinical perspective, it is likely that the risk communication formats we tested would have to be combined with some other intervention, such as telephone counseling or an in-person counseling session, if more accurate breast cancer risks are to be sustained.

There is increased focus today on informed health decision making (15) in areas such as testing for breast cancer genetic mutations, screening, and prevention (*e.g.*, tamoxifen). Helping women become more accurate in their breast cancer risks should be a high priority. Communication of risks also is an important area of study beyond any one risk factor or disease because it is likely that, over time, there will be more quantitative risk estimates available (16, 17). The challenge will be in learning how to communicate the estimates in ways that are meaningful to people.

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Cancer Epidemiol Biomarkers Prev 2001;10:895-898.