Why Worry? Worry, Risk Perceptions, and Willingness to Act to Reduce Medical Errors

Ellen Peters and Paul Slovic
Decision Research and University of Oregon

Judith H. Hibbard and Martin Tusler
University of Oregon

Through the domain of medical errors, the role of worry and perceived risk in precautionary behaviors was examined in a convenience sample (N = 195, mean age = 42 years, 71% female). Worry was linked to fatality estimates. A model of the antecedents and consequences of worry also was tested. Risk characteristics such as dread and preventability, negative reactivity, and vulnerability to medical errors appeared to motivate worry about medical errors. Worry about medical errors was a better predictor of intentions to take precautionary actions than were risk perceptions. An understanding of how worry influences preventive efforts will help in building communication strategies to the public and in effectively engaging patients in the role of vigilant partner in care.

Keywords: risk perception, worry, medical errors, prevention, risk communication

What’s the use of worrying? It never was worthwhile. So, pack up your troubles in your old kit-bag. And smile, smile, smile. —George Asaf (1915) (Bartlett & Kaplan, 1992, p. 641)

I’m a firm believer in anxiety and the power of negative thinking. —Gertrude Berg (1961) (Maggio, 1992, p. 16)

The present paper examines the role of worry in potential patients’ intentions to take precautionary actions. We use, as an exemplar of precautionary behavior, the prevention of medical errors in a hospital setting.

Medical Errors Represent an Important Domain of Precautionary Behaviors

Developing effective strategies for measuring, reporting, and ultimately preventing medical errors is a high priority for health-services research. The Institute of Medicine (IOM) of the National Academy of Sciences estimated that between 44,000 and 98,000 deaths each year in the United States result from medical errors occurring in hospitals (Kohn, Corrigan, & Donaldson, 2000), making medical errors the eighth leading cause of death in the United States. The scope of the problem is likely much greater when both fatal and nonfatal events are counted and when non-hospital care settings, such as physicians’ offices, nursing homes, and pharmacies, are included. Errors occurring in hospital settings alone are estimated to cost the economy from $17 to $29 billion each year (Bates et al., 1997). Moreover, there is considerable evidence that the majority of medical errors are preventable (Leape, Lawthers, Brennan, & Johnson, 1993). In the present study, we focused on public perceptions of hospital errors.

Since the release of the IOM report, “To Err is Human” (Kohn et al., 2000), awareness of the problem of medical errors has grown. More than half of Americans (51%) followed the news stories around the release of the IOM report (Henry J. Kaiser Family Foundation, 2003), making it the most closely followed health news story of 1999. Americans fear medical errors and many have had personal experience with them. A national poll conducted by the National Patient Safety Foundation found that 42% of respondents had been affected by a medical error, either personally or through a friend or relative.

Awareness and Prevention of Medical Errors

In designing interventions to encourage patients to take preventive action against some risk, it is critical to understand how the public perceives the risk and its preventability. It is particularly important to have insight into the public’s view of their own role in prevention and their willingness to engage in preventive behaviors to reduce their risks. In the domain of medical errors, two recent studies using consumer focus groups have begun to explore these questions. In one study, participants were generally aware of errors, but they were unable to identify factors critical to preventing errors in a hospital; they also could not determine whether they had received proper treatment (VHA, Inc., 2000).

Another study, focusing on Medicare beneficiaries, examined public perspectives on medical errors and willingness to take specific preventive actions (Keopke, Swift, Ferring, & Miranda, 2000). Participants reviewed 20 consumer tips on preventing medical errors and rated their usefulness. Those tips viewed as most useful were ones that involved keeping one’s physician informed and getting basic information about one’s care. Tips viewed as least useful included any behaviors that required a more active role for consumers or one that involved any challenge to professional authority (e.g., “If you are in a hospital, consider asking all health...
care workers who have direct contact with you whether they have washed their hands”). The study findings suggest that many of the recommended behaviors are not acceptable or comfortable behaviors for patients.

Although both of these studies looked at the public’s awareness of medical errors, public risk perceptions were not fully explored. It may be that willingness to take action to prevent some risk is linked to perceptions of how risky and how preventable it is. Understanding public perceptions of the level of risk posed and the degree to which that risk is preventable will be a necessary prerequisite to engaging patients as partners in the effort to prevent medical errors. In the present study, we asked participants about their intentions to engage in some of these precautionary behaviors, and we use theory and findings from the risk perception literature to guide hypotheses and study design.

Risk Perceptions and Worry

A common response to perceiving a risk is to worry about it. Worry is a cognitive activity that arises as we consider possible futures and realize that there are uncertainties in the dangers and benefits that may come our way. It has been characterized as the cognitive side of anxiety (Liebert & Morris, 1967). Worrying has a purpose; it is propelled by emotional factors and prepares us “for stressful situations by arousing coping strategies” (MacGregor, 1991, p. 316). MacGregor (1991) found that worry was higher for risks when the timing of consequences was predictable, when respondents had more knowledge of consequences, and when they believed they could cope with the consequences. Worry thus appears to be an adaptive mechanism learned from experience and used to manage uncertainty. As MacGregor stated, “we master or make controllable [risks] because we invest a great deal of worry in them” (p. 321). Greater risk perceptions thus should be associated with more worry.

Medical errors, of course, are but one of the many risks that consumers face. How consumers divide their limited resources to think about and develop coping strategies for one risk versus another is an important issue that will help to determine how policymakers should allocate their own time and limited resources. On the basis of past research, we believed that participants would not have a stable idea of exactly how risky a cause of death is and that they would look to cues in themselves or the environment to come up with estimates of the number of deaths from various causes (Peters, Slovic, & Gregory, 2003). One obvious external cue is a provided number (an anchor), and we expected that low versus high anchors would substantially influence the estimates. An additional cue, however, is the participant’s internal feeling of worry. We hypothesized that participants would adjust from the provided anchors more or less depending on the extent of their worry about each cause of death. Thus, worry might influence how risks are perceived and potentially prioritized.

**Hypothesis 1:** Worry helps us prioritize risks. Greater worry about possible causes of death will be associated with greater perceptions of their risk as assessed through estimated annual fatalities; this effect will be independent of provided anchors.

**Hypothesis 2:** Worry prepares us for future action. Thus, individuals who worry more about medical errors will have greater intentions to take actions to prevent those errors.

Risk Perceptions and the Psychometric Paradigm

The psychometric paradigm is described briefly in Slovic (1987) and in detail in Slovic (2000a). This paradigm encompasses a theoretical framework that assumes risk is subjectively defined by individuals who may be influenced by a wide array of psychological, social, institutional, and cultural factors. It assumes that, with appropriate design of survey instruments, many of these factors and their interrelationships can be quantified and modeled to illuminate the responses of individuals and their societies to the hazards that confront them.

More than 100 studies of risk perception have shown that perceived risk is quantifiable and predictable. Psychometric techniques seem well suited for identifying similarities and differences among groups with regard to risk perceptions and attitudes. They have also shown that the concept “risk” means different things to different people. When experts judge risk, their responses correlate highly with technical estimates of fatalities. Lay people can assess fatalities if they are asked to (and produce estimates somewhat like the technical estimates). However, their judgments of risk (generally asked as “How risky is it to you and your family?” or “How risky is it to the American public?”) are related more to other hazard characteristics (e.g., lack of control, feelings of dread, threat to future generations) and, as a result, tend to differ from their own (and experts’) estimates of annual fatalities. In the present study, we examine perceived risk characteristics of medical errors. In health-related domains, increased perceptions of dread and preventability have been related to greater perceived risk (Mazzocco, Slovic, Peters, & Hibbard, 2005; Slovic, 2000b). We hypothesized that worry, as a response to perceiving a risk, would relate in these two predictable ways to risk characteristics.

**Hypothesis 3:** Individuals who dread medical errors more and those who believe medical errors are more preventable will indicate greater worry about them.

Individual Differences in Risk Perceptions

Previous risk-perception research has indicated other factors associated with risk perceptions that should relate to worry about medical errors based on the present analysis. Flynn, Slovic, and Mertz (1994), for example, suggested that sociopolitical factors such as power, status, and vulnerability may explain some of the differences in risk perceptions. They demonstrated that White men, who presumably have more power and status, perceive fewer environmental health risks than women and non-White men (see also Satterfield, Mertz, & Slovic, 2004). Peters, Burraston, and Mertz (2004) also found that individuals who reacted more to negative events in life perceived greater risks from radiation sources.

**Hypothesis 4a:** Women and non-White men will worry more about medical errors than White men.

**Hypothesis 4b:** Older adults will worry more about medical errors because they need more medical care on average and, thus, are more exposed and vulnerable to potential medical errors.
Hypothesis 4c: Because negative emotions propel worry, individuals who react more to negative events in general will worry more about medical errors.

Each of these hypotheses was tested individually first. Then, we developed and examined a model that included all of these antecedents and consequences of worry. We proposed that worry about medical errors is an important component of how people think about and prioritize these risks. Insight into how patients perceive the riskiness of different medical errors will help to inform communication efforts to patients and increase their likelihood of engaging in preventive actions.

Comparing Worry and Risk Likelihood

Although we expect estimates of risk likelihood and worry to be related, the findings summarized in Slovic (2000a) also suggest that risk likelihood estimates will have weaker relations than worry with perceived risk characteristics and behavioral intentions.

Hypothesis 5: Perceived likelihood of medical-error occurrence will have weaker relations than worry with dread and intentions to take preventive actions.

Method

Participants

Participants were 195 people recruited through a flyer distributed to the University of Oregon classified staff (mean age = 42 years, age range = 20 to 66 years; 71% were female). Participants were primarily White (81.5%) and college graduates (55.4%).

Procedures

Participants were paid $15 for taking approximately 45 min to complete a two-part questionnaire. Half of the participants completed the shorter Part 1 first; the other half completed Part 2 first.

Materials

In Part 1, we examined whether worry was associated with fatality estimates of various causes of death including medical errors. On the first page of a written questionnaire, participants were given as a guide or “anchor” the number of deaths per year in the U.S. from either a less common cause (appendicitis, 400 lives) or a more common cause (kidney disease, 40,000 lives) and were asked to estimate the number of deaths per year in the U.S. from a variety of other causes including medical errors, Alzheimer’s, auto accidents, cancers, diabetes, heart disease, HIV/AIDS, homicide, influenza/pneumonia, Parkinson’s disease, stroke, and suicide. On the following page, they were asked how worried or concerned they were about each cause of death on a scale from 0 (not at all worried or concerned) to 6 (very worried or concerned).

In the longer Part 2, participants first rated items concerning the likelihood they would take 14 actions to prevent medical errors (e.g., “How likely are you to make sure that someone, such as your personal doctor, is in charge of your care during your hospital stay?”); see Appendix A—reponses on the 14 items were averaged to form the Preventive Action Index, \( \alpha = .90 \). Participants then were asked to evaluate 29 specific medical errors a patient could experience in the hospital. The set of errors began with four general errors (e.g., “a medical error that occurs during surgery”) and continued with 25 more specific errors (e.g., “a patient is given unnecessary x-rays”). The set included errors of both commission and omission. See Appendix B for a complete listing of the 29 errors.

Participants were asked to rate each of the 29 errors on measures of risk similar to those found important in previous studies (e.g., Slovic, 1987). There were a total of 11 measures. Each participant rated all 29 medical errors on only five of the measures to minimize participant fatigue. In addition, all participants rated the 29 errors on the additional measure: Dread. Thus, each participant rated the 29 errors on six scales (either Worry, Likelihood of Noticing Error, Patient Preventability, Hospital Preventability, Old or New Risk, and Dread or Warning Signal, Risk Likelihood, Extent of Harm, Blame, Patient Awareness, and Dread). In the present study, we focused on the two independent measures—Dread and Patient Preventability—demonstrated to be the best representation of risk perceptions in this domain (Slovic, 2000a). We also focus on two dependent measures: Worry and Risk Likelihood. Half of the participants rated the 29 medical errors on Dread, Patient Preventability, and Worry \( (n = 97) \); the other half of the participants rated the medical errors on Dread and Risk Likelihood \( (n = 98) \). These rating scales were adapted from previous studies (Slovic, 2000a) and are shown in Table 1. For each measure, an average was calculated from participants’ responses to the 29 medical-error scenarios. The internal consistency of each scale was high (Dread \( \alpha = .93 \), Patient Preventability \( \alpha = .94 \), Worry \( \alpha = .97 \), and Risk Likelihood \( \alpha = .96 \)).

In addition, participants rated three behavioral intention items shown in Appendix A (e.g., “How likely would you be to change hospitals if you found out that your hospital had more than an average number of medical errors?”; we calculated the average across the three items to form a Strategic Action Index, \( \alpha = .79 \)). They also answered an item about Government Regulation (“How necessary do you believe it is to have new government regulations to reduce the occurrence of medical errors?”)

At the end of the survey, participants responded to a number of items assessing their reactivity to negative events (Behavioral Inhibition System

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1 The high internal consistency could be due to participant fatigue leading to the use of a response style that attenuates the relations in the model. However, with the exception of Worry, 0%–1% of participants gave the same response to the 29 scenarios. Seven percent of the participants gave the identical response to the 29 scenarios on the Worry variable; however, deleting these participants’ data did not substantially change the results (e.g., in the model of Figure 1). The participants’ data were left in the dataset in further analysis.

Table 1

<table>
<thead>
<tr>
<th>Scales on Which Medical Errors Were Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Independent variables</td>
</tr>
<tr>
<td>Dread</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Patient Preventability</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Dependent variables</td>
</tr>
<tr>
<td>Worry</td>
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<tr>
<td></td>
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<tr>
<td>Risk Likelihood</td>
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</tbody>
</table>
scale, Carver & White, 1994, e.g., “Criticism or scolding hurts me quite a bit,” “I worry about making mistakes,” \( \alpha = .78 \) and answered demographic questions.

**Results**

**Order**

Half of the participants completed Part 1 first and estimated annual fatalities and worry about the diverse set of causes of death first; they responded to their perceptions of various medical errors second. This order was reversed for the other half of the participants. The order manipulation did not significantly impact worry about medical errors as a cause of death despite much greater exposure to such errors if Part 1 was completed second. On the scale of 0 (not at all worried) to 6 (very worried), participants responded to medical errors just below the midpoint of 3 (mean medical-error worry = 2.8 and 2.9 for participants who completed fatality estimates and worry about the causes of death first and second, respectively). We did not consider order in any further analyses.

**Risk Perceptions and Worry—Hypothesis 1: Prioritizing Risks**

On average, participants estimated the number of deaths from medical errors at 44,022, quite close to the IOM low estimate of 40,000. However, the median estimate was considerably lower (median = 8,025). The death estimates ranged from 10 to 1,000,000 with a large standard deviation (\( SD = 132,725 \)). Thus, it appears that most participants substantially underestimated deaths from medical errors. The provided anchor (400 vs. 40,000) influenced death estimates as predicted (median = 3,000 and 15,000 in low- and high-anchor conditions, respectively, \( z = -5.2, p < .001 \)).

When considering different risks (such as the ones we presented), the extent of worry about a risk may influence how it is perceived and potentially prioritized within that group of risks. Correlations between worry and estimated deaths were calculated in two ways. First, the correlation was calculated within-subject (across the causes) and then averaged over participants. This correlation was very strong and positive (\( r = .84 \)). Second, we calculated death-estimate and worry means for each of the 12 causes and then calculated correlations across these means. The overall correlation was \( r = .87 \) (\( p < .001 \)). These results were not influenced by the anchor condition.

**Risk Perceptions and Worry—Hypothesis 2: Preparing for Future Action**

We show correlations between Worry and its possible antecedents and consequences in Table 2. As hypothesized, those participants with greater worry reported being more likely to take preventive action in the hospital, more likely to take strategic action prior to going into the hospital, and more likely to want government regulation (\( r = .41, .43, \) and .42, respectively, \( p < .001 \)).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Worry ( (n = 97; \alpha = .97) )</th>
<th>Risk Likelihood ( (n = 98; \alpha = .96) )</th>
<th>Fatality estimates for medical errors ( (N = 195) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antecedent variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.18</td>
<td>-0.05</td>
<td>-0.03</td>
</tr>
<tr>
<td>Negative reactivity (BIS; ( \alpha = .78 ))</td>
<td>0.17</td>
<td>0.16</td>
<td>0.03</td>
</tr>
<tr>
<td>White male (No = 0, Yes = 1)</td>
<td>-0.35( ** )</td>
<td>-0.20( a )</td>
<td>0.05( b )</td>
</tr>
<tr>
<td>Dread (( \alpha = .93 ))</td>
<td>0.47( ** )</td>
<td>0.34( ** )</td>
<td>-0.05( b )</td>
</tr>
<tr>
<td>Patient preventability (( \alpha = .94 ))</td>
<td>0.07</td>
<td></td>
<td>-0.04</td>
</tr>
<tr>
<td>Consequences (Precautionary Behaviors)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preventive Action Index (( \alpha = .90 ))</td>
<td>0.41( ** )</td>
<td>0.35( ** )</td>
<td>0.04( b )</td>
</tr>
<tr>
<td>Strategic Action Index (( \alpha = .79 ))</td>
<td>0.43( ** )</td>
<td>0.23( a )</td>
<td>-0.19( ab )</td>
</tr>
<tr>
<td>Government Regulation</td>
<td>0.42( ** )</td>
<td>0.16( b )</td>
<td>0.06( b )</td>
</tr>
<tr>
<td>Demographic variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (Female = 1, Male = 2)</td>
<td>-0.26( a )</td>
<td>-0.26( a )</td>
<td>0.09( b )</td>
</tr>
<tr>
<td>Race (Non-White = 0, White = 1)</td>
<td>-0.13</td>
<td>0.10</td>
<td>-0.13</td>
</tr>
<tr>
<td>Experienced error (No = 0, Yes = 1)</td>
<td>-0.03</td>
<td>0.14</td>
<td>0.04</td>
</tr>
<tr>
<td>Harmed by error (No = 0, Yes = 1)</td>
<td>0.12</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Health</td>
<td>0.04</td>
<td>-0.09</td>
<td>-0.03</td>
</tr>
<tr>
<td>Education</td>
<td>-0.08</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>Number of children at home</td>
<td>0.09( a )</td>
<td>-0.23( ab )</td>
<td>0.01( a )</td>
</tr>
</tbody>
</table>

*Note.* Correlations were Z-transformed and compared for significant differences. Those correlations marked with different letters in the same row are significantly different at the .05 level. BIS = Behavioral Inhibition System.

\* \( p < .05 \).  \*\* \( p < .01 \).  \*\*\* \( p < .001 \).
Risk Perceptions and the Psychometric Paradigm—Hypothesis 3

We examined whether greater dread of medical errors and a greater perception of their preventability by patients would be associated with greater worry, as these two characteristics have been associated with greater perceptions of risk in previous research (Slovic, 2000a). As hypothesized, individuals who dreaded medical errors more worried more about medical errors ($r = .47$, $p < .001$). Individuals who believed that patients could prevent medical errors did not worry more about them ($r = .07$, ns). As shown in the section concerning a model of worry, however, this relationship becomes significant after controlling for the other hypothesized antecedents of worry.

Individual Differences in Risk Perceptions—Hypotheses 4a–4c

Finally, older adults and those high in negative reactivity (Behavioral Inhibition System) worried marginally more ($r = .18$ and .17, respectively, $p < .10$); these relations also become significant in our model after controlling for other hypothesized antecedents of worry. The results supported the hypothesis that White men (who may feel less vulnerable to medical errors because they perceive themselves as having more power and status) would worry significantly less than others about medical errors (Worry $M_5 = 3.0$ and $4.2$, respectively), $F(3, 93) = 4.6, p < .01$, for White men vs. all others. Mean scores for Worry for White women, non-White women, and non-White men were similar to one another (4.2, 4.4, and 4.5, respectively).

A Model of Worry: Its Antecedents and Consequences

The present results are consistent with worry being derived in part from age and a tendency to react more strongly to negative events in life as well as from sociopolitical factors emerging from demographic differences in gender and race (i.e., the white-male effect). To control for shared variance among the hypothesized antecedents of worry, we included these variables with perceived dread and preventability in a single structural-equation model. The three types of precautionary behaviors were included as consequences of worry.

The structural-equation model of Figure 1 was constructed to test the plausibility of the postulated model. The program AMOS was used for estimating parameters. Model fit was assessed using the Comparative Fit Index (CFI), the Root–Mean–Square Error of Approximation (RMSEA), the Adjusted Goodness-of-Fit Index (AGFI), and the adjusted chi square. Although some disagreement exists as to cutoff criteria, the CFI and the AGFI should exceed .90, the RMSEA should be less than .05, and the adjusted chi square should be less than 3 (Bollen & Long, 1993). The sample used was 97 and included no missing data. Although this sample size is somewhat small for the proposed number of parameters (Bentler & Chou, 1987; Schumacker & Lomax, 1996), running the model in smaller pieces did not substantially change the results and thus indicated sufficient power. The model was an adequate fit to the data ($CFI = .98$, adjusted $\chi^2(21, N = 97) = 1.1$, $AGFI = .89$, $RMSEA = .04$). Furthermore, all signs associated with causal paths were in the predicted direction. The data clearly support the proposed model and are presented in Figure 1. Estimates along each path represent standardized coefficients.

Higher individual differences in negative reactivity were associated with greater worry about the 29 medical errors ($\beta = .20$, $p < .05$). Older adults worried more about these errors, whereas White men worried less ($\beta = .17$ and -.23, respectively, $p < .05$). Higher scores on both risk perception factors—patient preventability and dread—were associated with more worry as hypothesized ($\beta = .20$, $p < .05$, and $\beta = .44$, $p < .01$, respectively) so that 39% of the variance in Worry was explained. Not surprisingly, the more an individual perceived the errors as being preventable, the more likely they were to intend taking preventive actions ($\beta = .27$, $p < .05$).

The final stage of the model predicts that greater worry about medical errors will be associated with greater intentions to take precautionary behaviors. As hypothesized, greater worry led to an increase in the Strategic Intention Index (actions prior to going into the hospital, $\beta = .44$, $p < .01$) and to an increased likelihood of taking preventive actions while in the hospital (the Preventive Action Index, $\beta = .39$, $p < .01$). Finally, greater overall worry also was associated with a preference for more government regulation ($\beta = .43$, $p < .01$).

Comparing Worry and Risk Likelihood—Hypothesis 5

Emotion-related variables such as worry are generally not included in models of health behavior; these theories instead have emphasized health beliefs such as the likelihood of occurrence of a risk (McCaul & Mullens, 2003). In the present study, participants were asked to respond to the 29 medical errors on a risk likelihood

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Footnote:

2 The model has 26 parameters including the nine variables. Bentler and Chou (1987) recommend 5 cases per parameter when the data are multivariate normal (as the present data are) and 10 cases per parameter when the data are not. In addition, in sensitivity checks the model was rerun in pieces with no more than nine parameters at a time. The results did not change substantially from the full model, thus indicating sufficient power.
item “How likely is it that a patient in a hospital would experience the following?” Responses were averaged for each participant and formed the Risk Likelihood Index. We then calculated correlations of Risk Likelihood with the antecedents and consequences of worry to examine their comparative strengths (see Table 2). The white-male effect found with worry was not associated with risk likelihood (Risk Likelihood means were 2.4 for White men and 2.3, 2.9, and 2.6 for non-White men, White women, and non-White women, respectively), $F(3, 93) = 2.4$, ns (see Table 3). Risk likelihood was predicted by gender (women perceived higher likelihoods, $r = -0.26, p < .05$). Of most interest, the correlations of Risk Likelihood with Dread and precautionary actions were all smaller than the correlations of Worry with Dread and precautionary actions ($r = -0.34, p < .001$; $r = -0.35, p < .001$; $r = -0.23, p < .05$; and $r = -0.16, ns$ for Risk Likelihood with Dread, the Preventive Action Index, Strategic Action Index, and Government Regulation item, respectively).3 Correlations between estimates of the number of fatalities from medical errors and these precautionary actions were considerably smaller (see Table 2 for a comparison of correlations).

### Discussion

In the present study participants considerably underestimated the number of annual deaths from medical errors. This finding is consistent with previous findings that the IOM estimates of deaths per year are not completely believed by patients or professionals (Blendon et al., 2002). In fact, these estimates have been disputed (McDonald, Weiner, & Hui, 2000). A strong correlation existed between worry and estimated deaths from a diverse set of possible causes of death such that participants estimated higher fatalities for possible causes about which they worried more. Worry may matter because it organizes and focuses thoughts and actions concerning risks. It may help, for example, to prioritize among very different potential risks. Of course, the cross-sectional nature of the study design leaves open the question of direction. It may be instead that we worry more about risks that we know are more likely to be fatal. The malleability of the present estimates to the provided anchor, however, suggests that participants do not have stable numerical knowledge about fatalities (but they could still have knowledge of the relative numerical differences between the possible causes).

Greater worry about medical errors was associated with each hypothesized antecedent factor after controlling for the other antecedent factors. These factors include sociopolitical factors (not being a White male), higher negative reactivity, older age, greater feelings of dread, and higher perceptions of preventability. The extent of worry about medical errors also related to behavioral intentions to take strategic or preventive actions with respect to medical errors. The more an individual worried about medical errors, the greater was his or her intention to take strategic or preventive actions and to want government regulation. These relations of intentions with worry were stronger than relations between subjective estimates of how likely medical errors are or how many fatalities are caused by medical errors. Although these between-subjects comparisons should be studied further within subject, the findings suggest that risk communication to encourage preventive or strategic action around medical errors would work most effectively by increasing worry directly or indirectly through one of its antecedent factors. For example, although most health-belief models focus on cognitive rather than affective or emotional factors, it may be more effective to focus on feeling-based factors such as dread and negative reactivity. These emotional factors have been shown to be critical to the quality and efficiency of good decision making (Damasio, 1994). Targeting White males in particular with risk-communication efforts also could influence their precautionary efforts (which tend to be lower) as well as error-management policy (as White males may be more prevalent in groups with the power to influence policies affecting medical errors).

Any conclusions we draw from these data must be tempered by the size and nature of our convenience sample. The true causal direction of the effects is currently unknown because of our correlational rather than experimental design. For example, do feelings of dread lead to greater worry or does worrying lead to feeling that something is more dreadful? We hypothesized the

### Table 3

<table>
<thead>
<tr>
<th>Participant</th>
<th>Worry mean</th>
<th>Risk Likelihood mean</th>
<th>Medical-error fatality estimate median</th>
</tr>
</thead>
<tbody>
<tr>
<td>White men</td>
<td>3.0</td>
<td>2.4</td>
<td>5,000</td>
</tr>
<tr>
<td>Non-White men</td>
<td>4.5</td>
<td>2.3</td>
<td>10,000</td>
</tr>
<tr>
<td>White women</td>
<td>4.2</td>
<td>2.9</td>
<td>10,000</td>
</tr>
<tr>
<td>Non-White women</td>
<td>4.4</td>
<td>2.6</td>
<td>9,000</td>
</tr>
<tr>
<td>ANOVA (White men vs. all others)</td>
<td>$F(3, 93) = 4.6, p &lt; .01$</td>
<td>$F(3, 93) = 2.4, ns$</td>
<td>Mann-Whitney U = 2378, $z = -1.49, ns$</td>
</tr>
</tbody>
</table>

3 It does not appear that worry is simply a stand-in for risk perception on the basis of the correlations. In addition, the structural equation model of Figure 1 was reran with Risk Likelihood in place of Worry. The Patient Preventability variable was not answered by this half of the sample, and thus was excluded from the model. The model did not fit well according to the overall model statistics (e.g., the $\chi^2$ value was less than .05), and the endogenous variables were not explained as well ($R^2 = .05$ to .16 with Risk Likelihood compared with .18 to .39 with Worry). We also reran the model of Figure 1 with Worry residuals after controlling for the fatality estimates for medical errors from Part 1 of the survey. Rather than decreasing the strength of this model, controlling for risk perception in this manner actually increased model strength (the $R^2$ of the endogenous variables increased by a few percent each). Thus, worry appears to make an important contribution to our understanding of precautionary behaviors independent of risk perception.
former on the basis of previous research suggesting that the dread-risk factor is based in emotions and worry is the cognitive result of emotions (Liebert & Morris, 1967; MacGregor, 1991; Peters & Slovic, 1996), but experimental tests are necessary. Concerns about generalizability are somewhat less in studies such as the present one in which relationships among factors are the primary focus (e.g., the dread risk—unknown risk findings; Slovic, 1987) because these relationships are less likely to vary by sample characteristics than are other data (e.g., sample means). Nonetheless, it will be important to replicate this study with a larger and more representative sample in the future and to conduct experimental tests to examine issues of causality.

Two findings, in particular, are worth highlighting. First, the present results do not support the notion that greater worry will lead to fewer preventive actions taken. Quite the contrary, greater worry had a positive linear association with the reported likelihood of taking actions to prevent medical errors. This finding is consistent with research on the relationship between worry and behaviors in cancer (i.e., McCaul & Mullens, 2003). Second, personal experience with a medical error was not related to worry about medical errors nor its perceived likelihood (see Table 2). It may be that personal experience elevates emotional reactions and memory accessibility only for medical errors similar to the one experienced and not for a broad range of errors as we presented. Alternatively, personal experience may lead to the view that the errors are not preventable and therefore some patients will give up and not worry about them (see Weinstein, 1989, for an excellent review of the influence of experience on self-protective behaviors).

Increasing perceptions of preventability should help engage patients by increasing their worry about medical errors and directly impacting their likelihood of taking preventive actions. Weinstein (1989) also offers a further reason for increasing perceptions that medical errors are preventable. Specifically, not only should greater perceptions of preventability increase worry and behavioral intentions in turn, but a social-influence perspective suggests that people are strongly motivated to gain praise and avoid censure from others. If medical errors are generally believed to be (at least in part) preventable by patients, then patients may work harder to avoid blame by taking preventive actions.

Testing intervention and communication strategies designed to increase worry is warranted on the basis of the strength of the present data. Whether these strategies are acceptable and feasible within our medical establishment is a separate issue. Increasing worry could have unintended side effects such as a decrease in trust in our medical systems that has a detrimental effect in the long run. These issues, however, are testable.

The present study brings well-established methods from the psychology of technological risk perception to bear on issues of patient safety. The applicability and generalizability of the methods was supported, and the findings illustrated the use of new tools for understanding the psychology that underlies perceptions of medical errors specifically and health and health-policy issues more generally. Patients can play an important role in their own care including the prevention of costly medical errors. With increased knowledge about the psychology that underlies patient behaviors combined with a greater understanding of medical domains in which patients have the potential to help themselves (but perhaps not the motivation, knowledge, or skills), practitioners and policy experts may be able to encourage more informed decision making by patients. Further research is needed to clarify the communication attempts that will engage patients best in a role of “vigilant partner” in care.

References


Appendix A

Precautionary Behavior Items

**Preventive Action Index (Average Calculated Across 14 Items; \( \alpha = .90 \))**

1. How likely are you to make sure that someone, such as your personal doctor, is in charge of your care during your hospital stay?
2. When you go into the hospital, how likely are you to make sure that all of your doctors know about any allergies or adverse reactions to medication you have had?
3. If you have a choice, how likely are you to look for a hospital that has a lot of experience doing the procedure or surgery you are going in for?
4. While in the hospital, how likely are you to ask the health care workers who come in direct contact with you if they have washed their hands?
5. When you are going to choose a hospital, how likely are you to talk to your doctor about which hospital has fewer problems with medical errors?
6. When you are going to have surgery, how likely are you to ask your surgeon how many of these surgeries he or she has done?
7. How likely are you to ask your surgeon to mark with a pen before surgery the part of your body where the surgery will happen?
8. When your doctor orders medication for you while you are in the hospital, how likely are you to confirm with the hospital staff that you are being given the right medication and dose?
9. How likely are you to ask a family member or friend to come with you to the hospital and be there as your advocate (someone who can help get things done and speak up for you if you can’t)?
10. How likely are you to choose a hospital based, at least in part, on whether they have a computer system that tracks each patient’s medication and medication history?
11. How likely are you to make sure all of your doctors know about all of the prescription medicines you are taking?
12. How likely are you to make sure all of your doctors know about all of the over-the-counter medicines and dietary supplements such as vitamins and herbs you are taking?
13. If you have a test at the hospital, how likely are you to ask about the results if you are not told?
14. How likely are you to choose a hospital based, at least in part, on a report that compares medical errors in different hospitals?

**Strategic Action Index (Average Calculated Across Three Items; \( \alpha = .79 \))**

N1. If you read in the newspaper that local hospitals had been rated in terms of the frequency and type of medical errors made at each hospital, how likely would you be to seek out this information before choosing a hospital?
N4. How likely would you be to discuss the occurrence of medical errors in hospitals with a doctor who referred you or a loved one to the hospital for medical treatment?
N5. How likely would you be to change hospitals if you found out that your hospital had more than an average number of medical errors?

**Government Regulation Item**

How necessary do you believe it is to have new government regulations to reduce the occurrence of medical errors?

Appendix B

Medical Error Items

1. A medical error that occurs during surgery
2. An error in the prescription medication that is given
3. An error in a laboratory test report
4. An error in diagnosis is made
5. Unnecessary surgery is performed
6. The wrong prescription medication is given
7. The patient is prescribed a treatment, but it is not the most effective one
8. Too high a dose of a prescription medication is given
9. A patient is given unnecessary lab tests
10. A routinely used test to detect disease in its early stage is not done
11. A patient gets too high a dose of medication when the intravenous (IV) equipment fails
12. A drug allergy is overlooked when a medication is prescribed
13. A patient is given unnecessary x-rays
14. Surgery is performed on the wrong limb
15. Lab test results are never reported to the doctor or the patient

(Appendix continues)
16. An instrument is left inside a patient during surgery
17. A medical condition is overlooked and not diagnosed
18. The patient is not given the medications that are prescribed
19. Surgery is performed on the wrong patient
20. An invasive cardiac procedure is done unnecessarily
21. The prescribed diet for the patient is overlooked and the patient is given food not on his allowed diet
22. Too low a dose of prescription medication is given
23. An MRI machine malfunctions while the patient is inside it
24. The wrong intravenous medication is given
25. Too high a dose of a chemotherapy drug is given
26. A mistake in patient identification leads to the wrong blood type being transfused
27. A mistake in a review of a biopsy leads to a diagnosis of cancer when there is no cancer
28. A patient is sent home too quickly after surgery
29. An unconscious patient in the intensive care unit gets too high a dose of medication when the intravenous (IV) equipment fails.

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