

THE EFFECT OF HINDSIGHT BIAS ON FEAR OF FUTURE ILLNESS

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ABSTRACT: This article reports on the relationship between outcome knowledge regarding an environmental event and self-reported fear of future illness. A sample of 95 subjects in three conditions showed that outcome knowledge increases postevent likelihood estimations, thus indicating a hindsight bias. Subjects' perceived likelihood of increases in disease rate is shown to substantially predict subjects' level of fear of future illness for both cancer and noncancer disease. Demographic variables of gender, political ideology, and attitude toward environmental activism were shown to have mixed results in predicting fear of future illness. Positive attitude toward environmental activism modestly predicted fear of cancer but not fear of noncancer disease. Political ideology failed to significantly predict fear of future illness, although it showed a trend toward significance for predicting fear of cancer. Gender significantly predicted fear of noncancer disease but not fear of cancer, with females indicating more fear than males. The implications of the accuracy of outcome information following ambiguous and uncertain events on the genesis and exacerbation of fear of future illness is discussed.

Hindsight bias research has shown that when estimating the probability of events, persons advantaged with information about outcomes retrospectively estimate their likelihood as greater than do persons without this knowledge (for reviews,

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see Christensen-Szalanski & Willham, 1991; Hawkins & Hastie, 1990). Hindsight bias has been demonstrated to affect probability judgments regarding medical diagnoses (Arkes, Wortmann, Saville, & Harkness, 1981), political election outcomes (Powell, 1988), and legal judgments (Sue, Smith, & Caldwell, 1973), as examples. In an early investigation of hindsight bias, Fischhoff (1975) examined the influence of outcome information regarding historical events on postevent likelihood appraisals. Unfamiliar events were presented to subjects—for example, the 19th-century British-Gurka war—followed by four possible outcomes and data relevant to their determination. Subjects assigned to the hindsight conditions were told that one of the four possible consequences was the actual outcome. Subjects in the nonhindsight condition were given no outcome information. Subjects then indicated their predictions regarding the probability of each outcome on the list and, in the hindsight conditions, to respond as if they had not been told what happened. Results showed that subjects given an outcome were mostly unable to ignore this information when making probability judgments. These subjects indicated greater certainty that they would have predicted the outcome and that antecedent data was important in determining its realization than did subjects not given an outcome.

Although hindsight bias has been demonstrated in a variety of contexts, a systematic investigation of the potential effects of hindsight bias on fears of future illness remains largely unexplored. In the research reported in this article, we tested the influence of outcome information on the perceptions of disease likelihood and fears of future illness. We hypothesized that outcome information leads to increased perceptions of disease likelihood, which predict subjective fear of future illness. We investigated this avenue for several reasons. First, we believe that fears of future illness are predicated on social and personal perceptions prone to many cognitive and perceptual biases and can only be fully understood when such biases are taken into consideration. Second, fear of future illness is a growing complaint of psychological distress, particularly in cases of low-level

toxic exposures and other perceived increases in health risks. Finally, no comprehensive account of fear of future illness has empirically investigated the influence of hindsight bias on these perceptions.

STUDY OVERVIEW

All subjects read about a company that disposed of hazardous waste material near a community. Some subjects read that the groundwater in the community became contaminated and that cancer rates either subsequently increased (hindsight condition) or remained constant (nonhindsight condition). A third group was given no information about groundwater contamination or cancer rates (control condition). It was hypothesized that subjects who were told that cancer rates had increased would indicate increased perceived likelihood of cancer rates increasing (a hindsight bias), which, in turn, would predict heightened fears of future illness.

METHOD

SUBJECTS

A sample of 95 subjects from the UCLA psychology department subject pool participated in partial satisfaction of an introductory psychology course requirement. Subjects were randomly assigned to hindsight ($n = 32$), nonhindsight ($n = 32$), or control conditions ($n = 31$) and were run in groups of up to 8 persons.

MATERIALS AND PROCEDURE

Upon arrival in the experimental room, subjects were informed that they were participating in an experiment regarding perception of negative environmental events. Subjects were

instructed to read a scenario about an environmental event and to answer the questions that followed. Regardless of condition, all subjects read the following paragraph:

For ten years, from 1972 to 1982, the Sherdon landfill operated legally about 5 miles outside the small community of Hanville Station. Many companies used the Sherdon site to dispose of a variety of hazardous materials. The Williams Corporation produced toxins as a by-product of their production processes, stored those toxins in 55-gallon sealed containers, and buried them ten feet deep in the Sherdon landfill. The Williams Corporation was in compliance with all regulations throughout the entire course of their dumping materials at the Sherdon site, and was not in violation of any environmental guidelines established at that time.

Subjects in the hindsight and nonhindsight conditions read two additional paragraphs that varied with regard to cancer rate information. The first additional paragraph provided information regarding groundwater contamination identically for both groups. In the second additional paragraph, hindsight subjects read that cancer rates increased while nonhindsight subjects read that cancer rates remained stable:

In 1982, the Sherdon site was closed and all dumping at the landfill was halted. In 1992, the Environmental Protection Agency (EPA) called for an investigation on the impact of all hazardous waste landfills which had operated within the past twenty years on the water supplies of neighboring communities. As a result, the EPA determined that the water supply was contaminated.

A few years later, EPA called for another analysis, including the health effects that hazardous waste landfills may have on the residents of neighboring communities. Investigators looked at Hanville Station community health records for ten years immediately prior to the opening of the Sherdon site (1962-1972), the ten years the site operated (1972-1982) and the ten year period following the closure of the site (1982-1992). They found that there *was more (no increase in)* cancer among Hanville Station residents since the opening of the Sherdon site. This was true for Hanville Station, and for all of the other communities nearby.

DEPENDENT MEASURES

After reading the scenario, subjects responded to a series of 9-point Likert-type scales. These included questions assessing the subjects' perceptions regarding (a) the likelihood that cancer rates would increase, (b) the likelihood other diseases would increase, (c) fear of contracting cancer in the future, and (d) fear of contracting other diseases in the future. Because previous research has indicated the influence of certain demographic variables in predicting perceived environmental threat (Baldassare & Katz, 1992), we included questions regarding gender, political ideology, and attitudes toward environmental activism. The study by Baldassare and Katz (1992) showed that environmental concern was highest among females, liberals, and Democrats; thus we wanted to control for the influence of political ideology and gender on fear of future illness by including these measures in our study. Political ideology and attitude toward environmental activism were each measured using a 9-point Likert-type scale (1 = *very liberal*, 9 = *very conservative*; and 1 = *very positive*, 9 = *very negative*, respectively). Gender was measured as a dichotomous variable (male = 1, female = 2).

Upon completion of the dependent measures, subjects were thoroughly debriefed on the purpose of the experiment. Subjects were then thanked for their cooperation and dismissed.

RESULTS

Preliminary analysis (ANOVA) of group differences revealed a main effect of perceived likelihood of contracting cancer, $F(2, 92) = 6.56, p < .002$, thus supporting the presence of a hindsight bias. The use of t tests showed that hindsight subjects, presented with information that cancer rates had increased, predicted that future cancer rates were more likely to increase ($M = 7.03$) than did either nonhindsight subjects who were told that cancer rates remained stable ($M = 5.50$), $t(62) = 3.41, p < .001$,

or control subjects who were given no outcome information ($M = 5.94$), $t(61) = 3.13$, $p < .003$.

Further analyses indicated that outcome information influenced fears of future illness. Analyses of variance for fear of contracting cancer in the future and fear of contracting some other disease in the future provided mixed results. Fear of contracting cancer was not significantly different among the three conditions (mean scores were 6.91, 7.15, and 7.13 for the hindsight, nonhindsight, and control conditions, respectively), $F(2, 92) = 0.18$, $p < .83$. However, fear of contracting some other disease in the future was significantly different among the groups, $F(2, 92) = 4.81$, $p < .01$, with subjects in the hindsight condition ($M = 8.16$, $SD = 0.92$) exhibiting greater fear of future illness than those in either the nonhindsight group ($M = 7.22$, $SD = 1.77$), $t(62) = 2.65$, $p < .01$, or control condition ($M = 7.23$, $SD = 1.33$), $t(61) = 3.23$, $p < .002$.

To test the relationship between perceptions of disease likelihood and fear of future illness while controlling for the influence of gender, political orientation, and attitudes toward environmental activism, we conducted regression analyses on two measures of disease likelihood and fear of future disease. The first analysis investigated whether perceptions regarding the likelihood of increased cancer rates could predict fear of contracting cancer in the future beyond the influence of these demographic variables. Regression analysis showed a significant effect for the full model, $F^2 = .24$; $F(4, 90) = 7.22$, $p < .0001$, and for perceived likelihood of cancer as an independent predictor (see Table 1). Although a positive attitude toward environmental activism showed a small effect ($p < .03$), and a liberal political ideology indicated a trend toward significance ($p < .08$), gender showed no significant effect. However, fear of cancer was significantly predicted by the perceived likelihood of a cancer rate increase ($p < .0001$).

The second analysis tested whether perceptions regarding the likelihood that the rate of some disease other than cancer would increase could predict fear of contracting a disease other than cancer in the future. Again, regression analysis showed a significant effect for the full model, $F^2 = .25$; $F(4, 90) = 7.64$, $p <$

TABLE 1
Results of Multiple Regression on Fear of Cancer

<i>Variable</i>	B	p <
Perceived likelihood of cancer rate increase	.39	.0001
Gender	-.02	.95
Political ideology	-.17	.08
Attitude toward environmental activism	-.26	.03

.0001, and for perceived likelihood of an increase in the non-cancer disease as an independent predictor (see Table 2) beyond the influence of the demographic variables. Only gender showed a modestly significant contribution to predicting fear of future illness beyond perceived likelihood of disease rate increase ($p < .05$), with females indicating more fear of future illness than males. Thus as subjects saw increases in disease rates as more likely (a perception brought about via the hindsight bias), fear of future illness rose accordingly.

These analyses indicate that the perceived likelihood of an increase in a particular disease rate influences fears of contracting that disease in the future. This was true for cancer specifically and for noncancer diseases generally. This effect is significant even while controlling for the influence of variables previously shown to be influential in determining environmental threat.

DISCUSSION

Results from the present study show that the influence of hindsight bias on perceptions of fear of future illness should be considered in understanding the genesis of environmental fears. Previous research has outlined the influence of perceptual and cognitive biases in the formation of our perceptions (Fischhoff, 1975; Fischhoff & Beyth, 1975; Kahneman, Slovic, & Tversky, 1982; Nisbett & Ross, 1980; Tversky & Kahneman, 1974), and recent research has discussed the relative contributions of objective and subjective information in the development

TABLE 2
Results of Multiple Regression on Fear of Noncancer Disease

<i>Variable</i>	B	p <
Perceived likelihood of disease rate increase	.37	.0001
Gender	.58	.05
Political ideology	.08	.29
Attitude toward environmental activism	-.001	.98

of our perceptions (see Jussim, 1991). It is wise to use this knowledge when confronted with situations of perceptual issues currently not well understood, such as fear of future illness.

We have seen that outcome information can influence our perceptions of event likelihood, which can subsequently enhance fears of future illness. But we have not investigated the role that accuracy plays in this effect. Our scenario was hypothetical, but similar real-world situations exist where information regarding disease rates can be tested for accuracy. It is possible that the accuracy of information surrounding events leading to fears of future illness is required for public acceptance and thus moderates the effect that such information has on our perceptions and subsequent fears. Unfortunately, history indicates that this Pollyannaish conception is unwarranted. Beliefs surrounding alar, Love Canal, and, presently, silicone breast implants are, or were, fed not only by accurate scientific data but also by rumor, ideological rhetoric, and speculation. This is not an indictment of those who choose to err on the side of safety in issues regarding poorly understood scientific matters. But it is a warning that inaccurate reporting or misrepresentation could have deleterious ramifications. For example, in situations with unsubstantiated claims, such as the notion that exposure to alar substantially increases the probability of contracting cancer in humans, acceptance of such erroneous information can heighten perceptions of disease likelihood and subsequently engender unwarranted fears of future illness.

The task ahead for researchers investigating fear of future illness is daunting. Analysis of causation is challenged by the complex nature of our perceptions and their myriad influences.

Subjective sources that the individual brings to the perception, such as prior personal beliefs, stereotypes, and ideological perspectives, are relevant as well as social influences, media presentations, and objective information regarding preceding events. It is worthwhile to examine the relative influence of each of these sources on perceptions of fear of future illness in order to understand causation of fear of future illness complaints. Although this study identified one such perceptual influence, more work clearly needs to be done.

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