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Risk Perception by Patients with Anxiety Disorders

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Studies by social psychologists have recently shown that normal people have systematically distorted perceptions of risk. We extend these studies to patients with anxiety disorders to see how they differ from normal subjects, and, more specifically, to test the hypothesis that anxiety disorders might result from excessively objective risk assessments. Fifty patients with anxiety disorders and 50 matched controls estimated the likelihood that 22 events would happen to the average person or to the self. On both measures, and on accuracy, the groups were essentially identical. In confirmation of previously reported patterns of risk distortion, both groups overestimated rare risks, underestimated common risks, and consistently underestimated the relative risks to self. These results suggest that cognitive estimates of specific risks are normal in patients with anxiety disorders.

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The past two decades have seen marked improvements in the science of risk estimation (Wilson and Crouch, 1987; Zeckhauser and Viscusi, 1990), but the general public has often mistrusted such technical estimates, sometimes for good reasons (Feinstein, 1988; Freudenberg, 1988). The discrepancies between technical risk estimates and public fears have spurred interest in studies by social psychologists about biases in normal people's perceptions of risk (Slovic, 1987). Two kinds of bias have been repeatedly confirmed. First, people systematically overestimate the risks of rare events and underestimate the risks of common events (Fischoff, 1981; Johnson and Tversky, 1983; Lichtenstein et al., 1978). Second, people consistently underestimate the risks to themselves as compared with others (Weinstein, 1980, 1987, 1989). We have been unable to find a report that investigates these findings in a clinical population, and so decided to study how anxiety patients compared with normal subjects on these patterns of risk estimation. In light of recent suggestions that depressed patients may not be unduly pessimistic, but merely brutally objective (Taylor and Brown, 1988), it seemed especially worthwhile to consider the possibility that anxiety patients might lack the normal tendency to unjustified optimism.

Studies of risk perception by social psychologists have remained remarkably isolated from studies by cognitive therapists that have abundantly demonstrated distorted ideas about risks in patients with anxiety disorders. Studies of cognitive distortions in anxiety can be categorized according to a) whether subjects were normal controls or patients, b) whether state anxiety was manipulated, and if so, whether by an artificial intervention or a natural stress, and c) whether the outcome measure was thoughts of danger, risk estimates (absolute or relative risk, risk to self or to others), or biases (of memory encoding, memory availability, attention, judgment, or associations) (Mineka and Sutton, 1992). We will briefly review some of these findings to highlight the similarities and differences with the social psychology studies reviewed above.

It has long been known that anxiety patients are preoccupied with thoughts about threats (Beck et al., 1974; Mathews and Shaw, 1977), and that they have unrealistic beliefs about danger (Deffenbacher et al., 1986). There is also substantial evidence that correcting these distortions can decrease anxiety (Beck, 1985; Butler et al., 1991; Clark, 1988; Power et al., 1990; Sokol et al., 1989). Also, anxiety patients preferentially attend to (MacLeod et al., 1986) and remember (Cloitre and Liebowitz, 1991) threatening cues. They interpret ambiguous words as threatening (Mathews et al., 1989). They are slower to name colors of threatening words in the Stroop task (MacLeod et al., 1986), and show increased interference to threat words in a subliminal dichotic listening task (Mathews and MacLeod, 1986). These biases are not entirely state dependent, since diazepam reduces anxiety in outpatients with generalized anxiety disorder but does not change their bias to attend to threatening material on a Stroop color test (Golombok et al., 1991).

Butler and Mathews compared 12 anxiety patients with 12 depressives and 12 normal subjects using a questionnaire in which subjects ranked the relative

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likelihood of three predefined explanations for descriptions of 10 ambiguous situations (Butler and Mathews, 1983). For instance, one item was "you wake with a start in the middle of the night, thinking you heard a noise, but all is quiet," and one of the three alternatives was "it could be a burglar." They found that anxiety patients and depressives were both more likely than controls to interpret ambiguous material as threatening. In a subsequent study, the same investigators compared students who were and were not facing an upcoming examination using a questionnaire that elicited likelihood ratings on a 9-point scale for 48 subjective items, such as "the next exam you sit will be an unusually hard one" (Butler and Mathews, 1987). They found positive events were consistently rated more likely than negative events, that negative expectancy increased more for students facing the examination, and that subjects with high trait anxiety had increased ratings for the likelihood of negative events to the self.

It increasingly appears that this bias results not from the accessibility of the information in memory, as proposed by Bower's network theory (Bower, 1981), but because anxiety is associated with a higher processing priority for threatening information, as measured by patterns of attention to words on a video screen (MacLeod and Mathews, 1991a). Increases in state anxiety increase automatic (subliminal) attention to negative stimuli in subjects with high trait anxiety, but decrease such attention in controls (MacLeod and Rutherford, 1992), a positive feedback process that offers a possible fundamental explanation for anxiety disorders (MacLeod, 1991). The same study found that when the stimulus is conscious, however, both high and low trait anxiety subjects increase processing of threatening information that is not related to the current stressor (an impending examination) (MacLeod and Rutherford, 1992). Extensive reviews of work in this area (MacLeod and Mathews, 1991b; Mineka and Sutton, 1992) support the broad conclusions that patients with anxiety disorders attend preferentially at an unconscious level to threat stimuli, and are more likely than normal subjects to interpret ambiguous stimuli as threatening. These studies do not, however, allow a conclusion about how anxiety patients compare with normal subjects in direct estimation of the frequency of specific dangerous events.

One study has investigated the effect of emotional manipulations on estimates of specific risks. Johnson and Tversky had undergraduates read brief paragraphs, some of which vividly described a death in a way "designed to induce anxiety and worry" (Johnson and Tversky, 1983, p. 23). Subjects who read the disturbing paragraph made higher estimates of the frequency of various causes of fatalities as compared with estimates made by controls who read nondisturbing paragraphs. The increases were global, with no tendency for ratings to increase disproportionately for the causes of mortality described in the paragraph. This outcome weighs against an explanation based on "availability" and toward the possibility that judgments are globally distorted by changes in mood. This study comes close to addressing our research question, but it probes the effects of brief artificially induced changes in mood of normal subjects, not the effects of trait anxiety in patients. Our study uses similar methods to determine whether and how patients with anxiety disorders differ from normal subjects in their frequency estimates for a variety of specific dangers.

Method

We developed a questionnaire to obtain estimates of the absolute and relative frequency of 22 events. The events, listed in Table 1, were chosen to range widely in kind and frequency, with emphasis on objective events previously studied by social psychologists, so that results could be compared with previous studies and so that accuracy of estimates could be calculated. Two positive events were included with the 20 negative events. For each event, subjects rated "How likely is it that the event will happen to the average person in the U.S.A. in the next year?" on the 16-point scale shown in Table 2. For the 15 events on which objective frequencies of occurrence were available, we calculated the deviation of each subject's estimate from the actual risk for people in the United States as reported in the

TABLE 1
Risk Assessment Questionnaire Items[a]

1. Break a bone (BONE)
2. Injured in car crash (MVAI)
3. Find $10 or more on the street (FIND)
4. Murdered (MURD)
5. Struck by a metorite (METR)
6. Killed in an automobile accident (MVAF)
7. Drown (DRWN)
8. Hospitalized due to contaminated food (FOOD)
9. Die from heart problem or stroke (HART)
10. Die in a fire (FIRE)
11. Burglary at your house or apartment (BURG)
12. Found to have cancer (CA)
13. Need to be hospitalized (HOSP)
14. Sick in bed more than a week (SICK)
15. Struck by lightning (LIGT)
16. Win over $100 in a contest (WIN)
17. Die from a gunshot (SHOT)
18. Killed in a plane crash (AIR)
19. Catch pneumonia (PNEU)
20. Get rabies from an animal bite (RABI)
21. Robbed on the street (ROB)
22. Injured in tornado or hurricane (TORN).

[a] Abbreviations in parentheses are the same as those used in Figure 1.

TABLE 2
Anchor Points for Risk Estimation Scale

0 = Less than one person in 250,000,000 (population of the U.S.)
1 = One person in 100,000,000 (about half the population of U.S.)
2 = One person in 10,000,000 (population of Michigan)
3 = One person in 1,000,000 (population of Detroit)
4 = One person in 100,000 (population of Ann Arbor)
5 = One person in 50,000 (capacity of a large sports stadium)
6 = One person in 10,000
7 = One person in 5,000 (capacity of a large auditorium)
8 = One person in 1,000
9 = One person in 500
10 = One person in 100 (1%)
11 = One person in 20 (5%)
12 = One person in 10 (10%)
13 = One person in 5 (20%)
14 = One person in 2 (50%)
15 = Most people (over 50%)

World Almanac (World Almanac Publication Staff, 1989) and confirmed by other sources. For each item, subjects also rated "How likely is it that this event will happen to you in the next year as compared to the average person" on a scale from 1 = very much less likely to happen to me to 7 = very much more likely to happen to me. After completing both risk estimates for the 22 items, subjects completed seven demographic items, and self-report scales of anxiety, depression, and self-estimated accuracy on the test. Completion of the questionnaire took about 15 minutes.

Data were gathered on 117 patients and 148 controls. Patients were recruited from applicants for treatment at a university anxiety disorders clinic. They received a standardized evaluation that uses a semistructured interview to arrive at DSM-III-R diagnoses. They completed the questionnaire in the clinic waiting room or at home. Controls were recruited and studied in public places, most from an annual outdoor art fair that attracts a diverse crowd. Subjects were approached by the experimenter and asked if they "would like to participate in a study to determine how good people are at judging risks." To provide motivation, subjects were told there were cash prizes for the most accurate score and for a randomly selected score more accurate than the mean. Subjects received the two-page questionnaire and a pencil on a clipboard. The experimenter generally waited in the vicinity until the subject was finished. Data were not coded for subjects who appeared intoxicated, confused, or uncooperative.

Data from seven subjects (five patients and two controls) were excluded because their risk estimates were wildly inaccurate (mean risk estimate more than 4 scale points from the actual risk). The distribution of accuracy scores for the remaining subjects was smooth, with no subject deviant in a pattern that suggested cheating or special knowledge about risks. Preliminary data analysis showed that the groups differed substantially in sex ratio and age and that these covariates might significantly influence risk estimates and had complex interactions. For these reasons, patient/control pairs were extracted from a list of all subjects, sorted by age and sex, to give subgroups of 50 controls matched to 50 patients by sex, age, and, in so far as possible, marital status and education. All reported analyses were carried out on these matched subgroups. With type I error set at $p < .05$, this number of subjects gives, for each specific item, a power of .99 to detect an effect size of 1.0, and a power of .7 to detect an effect size of .5. This degree of power makes it unlikely that this design would fail to detect any substantial differences between the groups on one item, and very unlikely that it would miss any global differences between the groups.

Results

As shown in Table 3, the groups were well matched for age and sex. The groups were not significantly different in handedness or educational level, although there was a tendency for patients to be left-handed, and to have somewhat less education (30 patients *vs.* 35 controls had college degrees). Patients and controls were somewhat different in work status: full-time employment (23 *vs.* 27), homemakers (2 *vs.* 9), unemployed (0 *vs.* 4). Similar numbers of patients and controls were never married (21 *vs.* 18) or married (22 *vs.* 19), but patients were less likely to be remarried (0 *vs.* 4) or cohabiting (0 *vs.* 5), and more likely to be separated or divorced (7 *vs.* 4).

The validity of the test as a measure of accuracy of risk estimation is supported by part-whole correlations (between each subject's deviation from the correct rating on an item and the mean of all 15 of that subject's deviations from the correct rating) that were positive for all 15 items, with a mean correlation of .43, and a range of .12 to .57. These correlations were all significant at $p < .0001$, except for item about rabies ($p < .08$). Cronbach's alpha for the accuracy of risk estimation was .60. For raw risk estimates, Cronbach's alpha was .912; for ratings of relative risk to self, it was .89.

Patients and controls significantly differed on self-ratings of anxiety and depression (see Table 1) and these ratings were strongly correlated, ($r = .62$, $F = 60.9$, $p < .0001$). The patients had diagnoses of panic disorder ($N = 21$), obsessive-compulsive disorder ($N = 24$), social phobia ($N = 3$), and anxiety not otherwise specified ($N = 2$). There were no trends for differences between scores for patients who completed the questionnaire in the waiting room and those who completed it at home, nor were there differences between those studied before or after the start of treatment.

As shown in Table 4, patients and controls had nearly

TABLE 3
Subject Characteristics

	Patients	Controls	*F* ratio	*p*-value	Chi-square
No. of subjects	50	50	—	—	
Sex (M/F)	15/35	15/35	—	—	
Mean age (range 20–60)	34.4 (10.2)	35.0 (10.3)	.07	.80	
Mean no. of children	.9 (1.3)	1.1 (1.5)	.76	.39	
Mean anxiety level	5.7 (1.1)	3.9 (1.2)	65.14	.000	
Mean depression level	4.6 (1.5)	3.2 (1.5)	26.65	.000	
Left handed or ambidextrous	14%	10%		.36	2.05
Education				.19	6.10
Work				.07	11.84
Marital status				.03	12.05

identical mean estimates of the frequencies with which the events happened to the average person in the United States. The similarity of patients and controls was confirmed in a repeated-measures analysis of variance of all risk estimates (see Table 5). Analyses of variance performed individually for each item showed no significant difference between the groups on any item except "catch pneumonia," where patients estimates were a bit higher (7.2 *vs.* 6.1, $F[1,98] = 4.5$, $p < .04$). Overall, patients rated risks lower than controls on 15 out of the 22 items. Risk estimates by patients with panic disorder were not significantly different, either overall or on any individual item, from those of patients with obsessive-compulsive disorder.

A repeated-measures analysis of variance of estimates for the frequency of the 20 risks found no differences between the sexes ($F[1,98] = .3$, $p = .57$). Risk estimates decreased with age ($r = -.26$, $F = 4.4$, $p = .04$). This was accounted for by a steady decline in estimates with age for controls ($r = -.46$, $F = 12.8$, $p < .001$), while patients' estimates did not change ($r = -.03$, $F = .05$, $p = .82$). Higher levels of education were associated with reduced risk estimates for patients ($r = -.34$, $F = 6.37$, $p = .02$) and, to a lesser extent, for controls ($r = -.13$, $F = .81$, $p = .37$). There were no significant relationships between risk estimates and number of children, work status, marital status, handedness, average estimates of relative risk to self, or self-perceived accuracy. Average risk estimates were notably unrelated to self-ratings of anxiety ($r = .000$, $F = .000$, $p = .99$) or depression ($r = .004$, $F = .001$, $p = .970$) in the whole group, and in the subgroups of controls and patients analyzed separately.

To investigate the accuracy of risk estimates, we calculated the deviation of each subject's estimate on each item from the actual frequency of the 15 risks for which objective rates were available. To get an overall (in)accuracy score for each subject, we took the mean of the absolute values of these deviations. As shown in Table 4, the groups were very similar on both measures, and on self-estimates of accuracy. None of the covariates were related significantly to accuracy. Especially notable is the lack of relationship to depression ($r = .02$) and anxiety ($r = .006$). There was a trend for self-rated accuracy to be associated with actual accuracy ($r = .16$, $F = 7.6$, $p = .11$). Figure 1 illustrates the similarity of the groups' risk estimates, and highlights the tendency for both groups to overestimate rare risks and underestimate common risks.

Mean estimates of the relative risk that one of the 20 negative events would happen to the self were also nearly identical in the two groups (Table 4). The groups did not differ significantly on any item. Both groups systematically underestimated relative risks to self: the mean estimate for both groups, for every item, was below 4, which is "About as likely to happen to me as compared to the average person." Half of the means were below 3, which is "A little less likely to happen to me than the average person." Higher age was associated with decreased estimates of relative risk to self in both subgroups as well as the total group ($r = -.21$, $F = 4.38$, $p = .04$). Mean estimates of relative risk to self were not significantly related to demographic variables, risk estimates, accuracy, or self-ratings of depression

TABLE 4
Comparison between Patients and Controls on Risk and Accuracy

	Patients	Controls	*F* ratio	*p*-value
Mean risk estimate (20 items)	6.3 (1.5)	6.4 (1.5)	.19	<.66
Mean deviation from actual risk	−.17 (1.6)	.01 (1.5)	.32	<.57
Mean absolute deviation from actual risk	2.1 (.7)	2.1 (.7)	.02	<.89
Mean self-estimated accuracy	3.9 (1.2)	3.7 (1.0)	.65	<.42
Mean relative risk to self	3.1 (.9)	3.2 (.7)	.26	<.61

TABLE 5
Repeated-Measures Analysis of Variance for Risk Estimates of Subjects within Groups[a]

Source	*df*	SS	MS	*F*	*p*
Two groups (A)	1	8.7	8.7	.2	<.66
Subjects within groups	98	4466.8	45.6		
Repeated measures (B)	19	9550.1	502.6	127	<.0001
A × B	19	96.1	5.1	1.2	<.19
Bx subjects within groups	1862	7367.1	4.0		

[a] Scheffé ($p < .05$), critical difference = .60, mean difference patients versus controls = .13, $p = .66$.

or anxiety, and were only weakly related to mean estimates of risks to the U.S. population ($r = .10$ $F = .97$, $p = .33$).

Discussion

Overall, these data reveal remarkably few differences between the patterns of risk estimation by anxiety disorder patients and those of controls. Patients do not overestimate the frequency of the studied dangerous events as compared with controls, nor do they overestimate the likelihood of these events happening to themselves. Patients and controls make equally accurate risk estimates. Both groups in this study did systematically distort risk estimates in the patterns well described for normal subjects; they overestimated rare risks, underestimated common risks, and underestimated risks to the self.

This study has limitations, but seems unlikely to have missed major differences between patients and controls. Inadequate matching between the groups on demographic variables other than age, sex, and education seems unlikely to be a significant limitation because of the small effects of these variables on risk estimates. The two groups completed the questionnaire in different settings, but it is most unlikely that such a difference could act in such a way as to make two dissimilar groups appear similar. The instrument has not been validated, but is at least equal to others used for similar studies. Its validity is supported by the face validity of the items, and the robust part-whole correlations for accuracy on individual items. Could it have such nonspecificity that it missed a major effect? This is unlikely given that it nicely replicates the two main biases demonstrated by many previous studies.

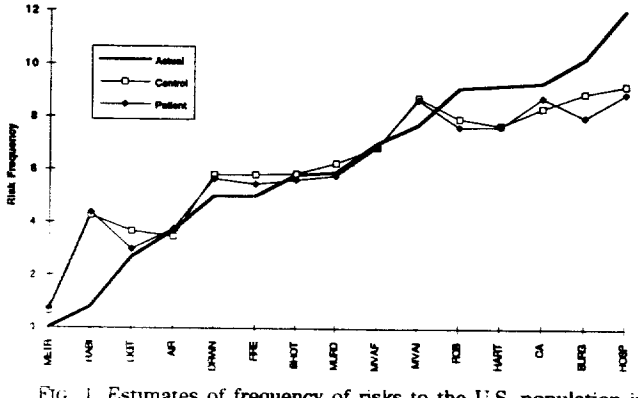

FIG. 1. Estimates of frequency of risks to the U.S. population in the next year, for 15 items on which actual data were available. See Tables 1 and 2 for abbreviations and anchor points for scale.

These results may seem to challenge the basic principle of cognitive therapy that anxiety often results from distorted risk assessments, but in fact, they are not at all incompatible. We measured intellectual estimates of the frequencies of specific objective events, using the methods and kinds of risks that have been used in studies by social psychologists. These intellectual estimates of the frequency of specific events are far different from emotional and cognitive reactions to actual cues of possible immediate danger to the self. They are also very different from the effects of anxiety on attention or recall of threatening stimuli, or ratings of the relative likelihood of alternative interpretations of ambiguous stimuli. If we had used different items or a different format, we would no doubt have found such distorted cognitions in the anxiety disorder patients, but this was not our goal. Instead, we wanted to follow the same methods used previously to investigate risk estimation by normal people to see whether anxiety disorder patients differ. They do not. This is consistent with the behavior therapists' longstanding knowledge that hours of explanation about the harmlessness of a phobic object is less useful than a single hour of exposure to the object (Marks, 1987) and the observation that fear has various "desynchronous" components (Rachman and Hodgson, 1974). If confirmed, these results suggest that the cognitive defects in anxiety patients are not in the accuracy of abstract knowledge or in basic patterns of estimating the frequency of dangerous events, but are instead in the cognitive processes that assess the personal significance of, and emotional reactions to, actual stimuli encountered in day-to-day life.

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