The Effects of Disease-Relevant Information on Subjective Probability Estimates of Causal Factors for Symptoms

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LOYOLA UNIVERSITY CHICAGO

THE EFFECTS OF DISEASE-RELEVANT INFORMATION ON
SUBJECTIVE PROBABILITY ESTIMATES OF
CAUSAL FACTORS FOR SYMPTOMS

A THESIS SUBMITTED TO
THE FACULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF
MASTER OF ARTS

DEPARTMENT OF PSYCHOLOGY

BY

JAMES RICHARD SWINEHART

CHICAGO, ILLINOIS
MAY 1996
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# TABLE OF CONTENTS

LIST OF TABLES .................................................................................. v

LIST OF ILLUSTRATIONS ................................................................. vi

Chapter

I. LITERATURE REVIEW ........................................................................ 1
   Overview
   Subjective Probability Overestimation
   Estimation of Causes of Death
   Purpose

II. METHOD .......................................................................................... 8
   Participants
   Instrument and Procedure
   Method of Analysis

III. RESULTS ....................................................................................... 14
   Effects of Information on Probability Estimates
   Relationship Between Familiarity and Probability Estimates

IV. DISCUSSION .................................................................................... 20
   Effects of Information on Probability Estimates - The Subjective
   Overestimation Effect
   Limitations of the Overestimation Effect
   Relationship Between Familiarity and Probability Estimates
   Conclusion

Appendix

A. STUDY QUESTIONNAIRES .............................................................. 38
Appendix

B. SAMPLE QUESTIONNAIRE ........................................ 52
C. INFORMED CONSENT FORM ................................... 61
D. DEBRIEFING FORM .......................................... 62
REFERENCES .................................................. 64
VITA .......................................................... 66
LIST OF TABLES

Table                                      Page
1. Predicted Probability Estimates for Ankle Pain, by Disease, Based on the Information Provided to the Participants .......... 11
2. Predicted Probability Estimates for Chest Pain, by Disease, Based on the Information Provided to the Participants .......... 12
3. Predicted Probability Estimates for Weight Loss, by Disease, Based on the Information Provided to the Participants .......... 12
4. Estimated Probability that Disease Caused Ankle Pain ................. 14
5. Estimated Probability that Disease Caused Chest Pain ................. 15
6. Estimated Probability that Disease Caused Weight Loss ................. 15
7. Pearson Correlations of Disease with Familiarity for Ankle Pain ...... 18
8. Pearson Correlations of Disease with Familiarity for Chest Pain ...... 19
9. Pearson Correlations of Disease with Familiarity for Weight Loss ...... 19
LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mean Estimates with Standard Error Bars for Scenario 3</td>
<td>24</td>
</tr>
<tr>
<td>2.</td>
<td>Mean Estimates with Standard Error Bars for Scenario 4</td>
<td>26</td>
</tr>
<tr>
<td>3.</td>
<td>Mean Estimates with Standard Error Bars for Scenario 6</td>
<td>28</td>
</tr>
<tr>
<td>4.</td>
<td>Mean Estimates with Standard Error Bars for Scenario 7</td>
<td>29</td>
</tr>
<tr>
<td>5.</td>
<td>Mean Estimates with Standard Error Bars for Scenario 8</td>
<td>31</td>
</tr>
<tr>
<td>6.</td>
<td>Mean Estimates with Standard Error Bars for Scenario 9</td>
<td>33</td>
</tr>
</tbody>
</table>
Overview

Having an accurate perception of the likelihood of personal injury, disability or death from various causes can give people the opportunity to take preventive measures against those events which are most likely to cause problems. Unfortunately, several studies suggest that a sizeable proportion of people have difficulty accurately judging the likelihood of events that can impact one's health status. Previous research has provided two relevant findings: people overestimate the likelihood of events under certain circumstances, and people overestimate the likelihood of sensational but relatively rare causes of death.

Subjective probability overestimation is a phenomenon which can occur when people are given an event, such as the selection of one person to fill a job position, and are asked to estimate the probabilities of several choices regarding the event, such as the probabilities of one of four candidates being chosen for the job. The "fundamental convention" (Feller, 1957) of the theory of probability states that the probabilities assigned to a set of mutually exclusive and exhaustive events should add up to 1. This assumes a discrete sample space, which is defined as a sample space containing only a finite number of points or an infinite number of points which can be arranged in a simple sequence. In the studies conducted in the past, the sample spaces were discrete as the number of points varied from two to about 10. Teigen (1974a, 1974b, and 1983) and Sanbonmatsu, Posavac, and Stasney (1995) found that subjects tend to overestimate the total probability of a family of events whose probability logically equals 1.
Lichtenstein, Slovic, Fischhoff, Layman and Combs (1978) found that subjects tended to overestimate the frequency of rare causes of death and underestimate the frequency of common causes of death. They proposed that rare causes of death which were sensational such as tornado deaths, were easier for subjects to recall than were more common but less sensational causes, such as diabetes. In essence, this reflects the use of the availability heuristic (Tversky & Kahneman, 1973). The availability heuristic refers to the phenomenon wherein people overestimate the occurrence of events which can readily be brought to mind. An event such as a tornado may be brought more easily to mind than a person dying of diabetes.

**Subjective Probability Overestimation**

Subjective probability overestimation is a phenomenon which can occur in a variety of situations, such as those shown by Teigen (1974a, 1974b, 1983) and Sanbonmatsu et al. (1995). Subjects tended not to adhere to the fundamental convention of probability theory.

In Teigen's (1974a) first studies on the subject, people estimated the probabilities of different combinations of caught fish and selected voters. In the fish conditions, subjects were told that lakes contained either 80% x-fish and 20% y-fish or 60% x-fish and 40% y-fish. They were asked how likely it would be to obtain all the combinations of 5 caught fish, namely, (a) 5 x-fish, (b) 4 x-fish and 1 y-fish, (c) 3 x-fish and 2 y-fish, (d) 2 x-fish and 3 y-fish, (e) 1 x-fish and 4 y-fish, and (f) 5 y-fish. Subjects overestimated the sum total probability, whether by percentage or proportion, in both conditions. The average sum probability was 2.642 in the "80% x-fish" condition and 2.463 in the "60% x-fish" condition. The voter study was very similar, with subjects estimating the likelihood of obtaining different proportions of x-voters and y-voters from a group of 10 voters chosen at random. The voting population was designated to be either 80% x-voters or 60% x-voters. Instead of a sample of five, as in the fish condition, the samples of voters were of the size 10, and the subjects overestimated the sum total likelihood to an even greater
extent than in the fish condition. The totals for the "80% x-voter" condition and the "60% x-voter condition" were 4.472 and 4.028 respectively.

Teigen (1974b) replicated his findings and extended the known boundaries of the phenomenon by demonstrating that overestimation can occur when judging the likelihood of specific sequences of events rather than just outcomes. A mere outcome (i.e., a combination) could be something such as drawing 2 red and 2 blue marbles from a bag containing 75% red marbles and 25% blue marbles. A specific outcome (i.e., a permutation) would mean drawing, in order, red, red, blue, blue. The tendency to overestimate was attenuated when subjects judge specific sequences of events. The same was true when the number of marbles was increased from 4 to 8. Teigen also showed that overestimation occurs using distributions with which subjects should be fairly familiar, namely the distribution of male and female heights at their university. He argued that the sampling distributions of the marbles or other objects may simply be too unfamiliar to students, so he sought to test the overestimation phenomenon with a distribution of which students should be aware. Subjects still overestimated the probabilities of students falling in height ranges or being a specific height, with the sum total values clustering across several conditions in the 1.6 to 2.6 range.

Teigen also investigated non-chance events. All of his previous work centered on chance events, such as catching fish or selecting people at random. In an effort to define the boundary conditions of the overestimation phenomenon, Teigen (1983) found that when subjects were asked to assign probability judgements to a set of only two mutually exclusive and exhaustive events, over 70% of the sample gave estimates which totalled 1.00. The events were whether one suspect or the other in a store robbery was the actual robber, and the descriptions did not favor one or the other suspect.

In another experiment in the same study, Teigen (1983) varied the number of alternatives and the strength of the evidence suggesting that some choices would be more likely than others to be the correct choice. Subjects assigned probabilities to (a) four
suspects in a murder, (b) seven possible causes of death in a case of sudden death, and (c) each of ten career choices for a young person. Two versions of each scenario were presented, one of which gave no evidence to favor any of the choices, and the other with information designed to favor some of the choices. The results showed that as the number of choices increased, the degree of overestimation increased. There was a slight, non-significant trend toward lower-probability estimates for the versions which gave no evidence to favor any of the choices in the murder and sudden death scenarios, but the reverse was true for the career scenario.

Teigen (1983) also presented subjects with a murder mystery set in a school. He varied the number of suspects, their motives, and the favorableness of their descriptions such that certain people rather than others would be more likely to be the correct suspect across different scenarios. The results were mixed and difficult to interpret, with the likelihood of any one person being the killer depending on the particular characteristics and presence of varying numbers of other suspects, but the results at least suggested that relevant information had an effect on the likelihood estimates.

In the final experiment, Teigen (1983) sought to test whether or not people who had made a set of probability estimates would, upon being given additional alternatives within the same problem space, revise their estimates downward to accommodate the new alternatives. Subjects estimate the likelihood of four different types of weather which would best describe the conditions in a Norwegian city. Of the 50 subjects, only 16 revised their initial estimates upon receiving additional options (two additional types of weather descriptions), and only 8 of these revised their original judgements downward.

Sanbonmatsu et al. (1995) conducted a series of studies in which, instead of asking subjects to estimate the likelihood of each of four choices, each subject estimated the likelihood of only one choice. The mean baseline probability for each choice was .25. There was no reason to believe that some choices were more likely than others. The authors reasoned that overestimation occurs if the mean estimate for an event with a
baseline probability of .25 is significantly greater than .25. The overestimation phenomenon was tested by comparing the overall mean estimate for the four candidates to the baseline probability of .25. In their first study, overestimation occurred when subjects estimated the probability that one of four job candidates would be hired for a faculty position at a university. The one candidate that any given subject judged was termed the target candidate. Each candidate was described favorably, which meant that seven positive and one negative statement served as the description. The mean probability estimate for a candidate being hired was .60, which was significantly higher than .25. Subjects also overestimated the expected percentage of the faculty vote. The mean percentage estimate for the candidates was .55, which was also significantly higher than .25.

In a second experiment, Sanbonmatsu et al. (1995) demonstrated that the overestimation phenomenon occurred when descriptions of the candidates were favorable or moderate. When candidates were described favorably, the mean probability of hiring any one was .61. When the description was only moderate, which meant that four positive and four negative statements served as the description, the mean figure fell to .41, but this was still significantly greater than .25. In this second study subjects were given five minutes to recall the statements used to describe the four candidates. Significantly more statements were recalled about the target candidate than the three others, but there was no interaction with the candidate favorability or main effect for favorability.

In a third experiment (Sanbonmatsu et al., 1995), all candidates were described unfavorably, which meant that seven of eight descriptive statements were negative. Underestimations occurred, even though subjects were told that one of the four people was in fact hired. The estimated mean probability of hiring any one candidate was only .17, and this figure was inflated by a small minority of subjects who gave very high estimates. The median probability estimate was a very low .03.
Estimation Of Causes Of Death

Lichtenstein et al. (1978) found that subjects tended to overestimate the frequency of rare causes of death and underestimate the frequency of more common causes of death. They proposed that rare and sensational causes of death, such as those due to tornadoes, motor vehicle accidents, and homicides, were easier for subjects to recall than were more common but less sensational causes, such as diabetes, asthma, tuberculosis, and stomach cancer. Subjects judged that homicides kill about as many people as strokes, although in reality strokes kill over ten times as many people. The authors maintain that this reflects the use of the availability heuristic (Tversky & Kahneman, 1973). Causes of death which are easily brought to mind tend to be overestimated.

To test this idea, the authors measured subjects' direct and indirect experience with the various causes of death. Direct experience included knowing a close relative or friend who has died from the disease. Indirect experience, which was hypothesized to represent availability, was measured by subjects' reports of how often they had heard about the causes of death via the media. Actual inches of newspaper space (in the Eugene Register-Guard), also believed to represent availability, were measured, and over a six-month period, many major causes of death were never mentioned, such as digestive tract cancer, diabetes, and tuberculosis. Tornadoes received a disproportionate amount of space, and homicide, which was 23% less frequent than suicide, received 15 times as much coverage as suicide (Lichtenstein et al., 1995). Subjects' judgements about the frequencies of the various causes of death were correlated with the measures of availability.

Purpose

Previous research has not investigated the effects of providing disease-relevant information on peoples' estimates of the likelihood of diseases causing symptoms. This study is designed to test the hypothesis that providing disease-relevant information regarding the likelihood of given diseases striking given people of varying ages and
medical histories will enhance the accuracy of subjects' estimates of the likelihood of diseases being the causal factors in the occurrence of symptoms.

This study seeks to extend the findings of earlier researchers by demonstrating that the phenomenon of subjective probability overestimation can be mitigated by providing people with relevant and accurate information about symptoms, diseases, and which types of people are more likely to fall victim to various diseases. It is expected that, overall, subjective overestimations will still occur. This effect should be tempered in the situations where information is provided which makes a disease seem like an unlikely cause for a symptom. The unanswered question is whether or not providing this information to people will allow them to make "better" judgements regarding the probability that a given person will experience a given disease. In the context of this study, "better" judgements are ones which are responsive to the relevant information provided regarding the likelihood that person X has disease Y.
Participants

Participants were 179 (64 male and 115 female) undergraduates enrolled in introductory psychology courses at Loyola University of Chicago during the fall semester of 1995. While the ages of the participants were not recorded, other recent research (Bryant, Yarnold, and Grimm, in press) on the same population of students showed that, in a sample of 218 (68 males and 150 females) students, the mean age was 18.8 years with a standard deviation of 2.4 years. Each participant received an informed consent form, a questionnaire, and a debriefing form. The questionnaires were generated such that an approximately equal number of subjects would participate in each condition of the study. Subjects received one experiment credit for participating.

Instrument and Procedure

The measurement instrument was a questionnaire titled "Study Questionnaire" (see Appendix A). Disease information was gathered from Magalini (1981). This is a fully factorial between-groups design. No repeated measures were taken as the focus of the study is not on how subjects change their estimates over time, but on the subjective overestimation phenomenon for three separate judgements. Subjects first indicated their familiarity with twelve different diseases and disorders by circling a number on a five-point scale anchored by the phrases "Not at all familiar" and "Extremely Familiar." The twelve diseases and disorders were: anorexia nervosa, atelectasis (collapsed lung), bulimia, Crohn's disease, gout, heart attack, heartburn, rheumatic fever, rheumatoid arthritis,
sprain, stomach ulcer, and torn muscle.

Subjects then read a brief scenario about an ostensibly real person. Subjects were told that they could refer back to any part of the questionnaire at any time. The scenario included the fact that the person came to experience a rather vague symptom, such as ankle pain, which could be indicative of several underlying diseases or disorders. The person scenarios included information both relevant and irrelevant to the determination of which disease caused the symptom. Three scenarios were written for each of the three symptoms of the study, which were ankle pain, chest pain, and weight loss, for a total of nine person-symptom combinations. As an example, one scenario read "Agnes M. is a 61-year-old retired school teacher. Her husband of 36 years, Fred, died two years ago of a heart attack. Agnes smoked one pack of cigarettes per day for 15 years, but quit completely 12 years ago. She makes an appointment to see her physician regarding a new problem: pain in her ankles." In brief, the other scenarios concern:

1. a 29-year-old carpenter who feels lethargic and complains of ankle pain
2. an 18-year-old soccer player complaining of ankle pain
3. a 17-year-old football player complaining of chest pain after being tackled
4. a 62-year-old smoker complaining of chest pain on the golf course
5. a 35-year-old woman on vacation in Greece complaining of chest pain
6. a 14-year-old whose family has just moved experiences weight loss
7. a 30-year-old who is under increased job stress complains of weight loss
8. a 45-year-old mother who experiences weight loss

Next, subjects read about four possible causes of the symptom in question. The information about the diseases included a definition of the disease, the sex and age of people most commonly affected by the disease, and information about the known or suspected cause or causes of the disease. The scenarios and diseases were chosen such that the person in the scenario seems relatively more likely to suffer from one, or perhaps two or three, of the diseases and not very likely to suffer from the others. It is expected
that different judgements will be manipulated both upward and downward within each scenario. For example, subjects read that the four possible causes of Agnes' ankle pain are rheumatic fever, gout, rheumatoid arthritis, and sprain. Subjects are given the information that gout occurs 20 times more often in men than in women, which makes it relatively unlikely that Agnes is suffering from gout. Subjects also read that rheumatoid arthritis is three times more common in women than in men and often begins between the ages of 20 and 60, which could lead one to estimate that this is a relatively more likely cause of ankle pain for Agnes. The information given about rheumatic fever and sprain do not favor genders or ages, and represent the middle ground of likelihood as being the cause of the symptom.

Next, subjects estimated the likelihood that one of the four diseases caused the symptom for the person in the scenario. Subjects judgements can range from 0.00, which indicates "It is certain that (the disease) did not cause the pain in the ankle" and 1.00, which indicates "It is certain that (the disease) did cause the pain in the ankle." After completing this estimate for ankle pain, subjects repeated the process for scenarios regarding chest pain and weight loss. Thus, each subject provided three probability estimates, one for each symptom.

Finally, subjects indicated whether or not they have personally experienced any of the twelve diseases and disorders which appear in the questionnaire and whether or not a close friend or relative has experienced each of the twelve. Subjects also indicated their gender. These measures allowed investigation of the possibility that personal experience with diseases and disorders is correlated with subjects' likelihood estimates. A sample questionnaire is included as Appendix B.

Method of Analysis

The results I expected to get were derived from both the general hypothesis that providing relevant information would lead to more accurate likelihood estimates and the specific scenarios and disease information contained in the study questionnaire (see
Appendix A). If there was no reason to believe that some diseases were more likely to cause symptoms in the persons in the scenarios, all probability estimates should average, at most, .25 for all estimates, since any one of the diseases would be equally likely to be present. This is the logical maximum for judging the likelihood of one outcome due to four possible causes. A t test was performed for each of the nine scenarios. The mean likelihood estimate for each scenario was tested against the logical baseline of .25.

Within each scenario, there were four possible causes for the symptom. Analyses of variance (ANOVA) were performed to determine if there were significant differences between the four estimates for each scenario. Some mean estimates were predicted to be overestimated, some underestimated, and some neither over- nor underestimated. The ANOVAs compared means within a scenario to determine if the three aforementioned groups can be distinguished from each other. The specific predictions within each of the nine scenarios were tested using Tukey Honestly Significant Difference (HSD) tests to control the error rate. The expected results are listed in Tables 1, 2 and 3. In addition, it was predicted that Scenarios 1 through 8 will be overpredicted. More specifically, the

<table>
<thead>
<tr>
<th></th>
<th>Scenario 1 (Bill Y.)</th>
<th>Scenario 2 (Agnes M.)</th>
<th>Scenario 3 (Mary D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic Fever</td>
<td>Overest.</td>
<td>Neither</td>
<td>Neither</td>
</tr>
<tr>
<td>Sprain</td>
<td>Neither</td>
<td>Neither</td>
<td>Overest.</td>
</tr>
</tbody>
</table>
Table 2.--Predicted Probability Estimates for Chest Pain, by Disease, Based on the Information Provided to the Participants

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Scenario 4 (Ryan P.)</th>
<th>Scenario 5 (Robert G.)</th>
<th>Scenario 6 (Amy M.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atelectasis</td>
<td>Overest.</td>
<td>Overest.</td>
<td>Neither</td>
</tr>
<tr>
<td>Heartburn</td>
<td>Neither</td>
<td>Neither</td>
<td>Overest.</td>
</tr>
<tr>
<td>Torn Muscle</td>
<td>Overest.</td>
<td>Overest.</td>
<td>Neither</td>
</tr>
</tbody>
</table>

Table 3.--Predicted Probability Estimates for Weight Loss, by Disease, Based on the Information Provided to the Participants

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Scenario 7 (Jennifer N.)</th>
<th>Scenario 8 (John D.)</th>
<th>Scenario 9 (Martha B.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crohn's Disease</td>
<td>Neither</td>
<td>Neither</td>
<td>Underest.</td>
</tr>
</tbody>
</table>

mean probability estimate for the four diseases in each of the eight scenarios was expected to be significantly higher than .25. This prediction stems from the almost universal finding in previous research that subjective probability estimates occur in scenarios similar to
these. Scenario 9, however, is predicted to be underestimated. Three of the four diseases which could cause weight loss in Scenario 9 were expected to be underestimated, while only one cause was expected to be overestimated. Sanbonmatsu et al. (1995) found that when all possible choices in a scenario are poor, the resulting probability estimates tended to be low. Scenario 9 includes three times as many poor choices as good ones, thus the estimates for the scenario were expected to be significantly less than .25.

It was further predicted that familiarity with a disease, including personal experience or the experience of a close friend or family member, would be positively correlated with estimates of the likelihood of the disease. Familiarity served as a measure of the availability of the disease. These correlations are informative because the availability heuristic was postulated to be the cause of overestimation in previous studies (Lichtenstein et al. 1978). Correlations were calculated using the Pearson product-moment $r$. In an effort to reduce the probability of making Type II errors, no adjustments will be made to control the Type I error rate, aside from the very conservative Tukey HSD tests used above. As Schmidt (1992) argues, statistical power is often sacrificed in situations where previous research in an area suggests that Type I errors cannot be made because the effect being investigated is real. The only remaining error possible is the Type II error, and taking steps in the data analysis to reduce the alpha level only reduces power and increases the chances of making a Type II error. It is my belief that previous research has shown the phenomenon of subjective overestimation to be real, and in an effort to avoid making Type II errors, the alpha level for all tests will be equal to .05.
CHAPTER III

RESULTS

Effects of Information on Probability Estimates

The effects of the relevant information provided subjects about diseases and the hypothetical persons in the questionnaire were tested using t tests. One t test was performed for each of the nine hypothetical scenarios included in the questionnaires. Scenarios 1 through 8 were hypothesized to be overpredicted, and Scenario 9 was hypothesized to be underpredicted. The tests compared the mean of all of the estimates for a scenario against the logical average maximum estimate of .25. Tables 4, 5, and 6 present the results of nine t tests, five of which indicated a significant difference.

Table 4--Estimated Probability that Disease Caused Ankle Pain

<table>
<thead>
<tr>
<th>Disease or Disorder</th>
<th>Scenario 1 (Bill Y.)</th>
<th>Scenario 2 (Agnes M.)</th>
<th>Scenario 3 (Mary D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic Fever</td>
<td>.315</td>
<td>.320</td>
<td>.248</td>
</tr>
<tr>
<td>Gout</td>
<td>.384</td>
<td>.440</td>
<td>.206</td>
</tr>
<tr>
<td>Rheumatoid Arthritis</td>
<td>.400</td>
<td>.607</td>
<td>.227</td>
</tr>
<tr>
<td>Sprain</td>
<td>.524</td>
<td>.347</td>
<td>.710</td>
</tr>
<tr>
<td>Overall</td>
<td>.409***</td>
<td>.427***</td>
<td>.335</td>
</tr>
</tbody>
</table>

Significantly different from expected baseline: *** p=.001
### Table 5: Estimated Probability that Disease Caused Chest Pain

<table>
<thead>
<tr>
<th>Disease or Disorder</th>
<th>Scenario 4 (Ryan P.)</th>
<th>Scenario 5 (Robert G.)</th>
<th>Scenario 6 (Amy M.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atelectasis</td>
<td>.633</td>
<td>.386</td>
<td>.311</td>
</tr>
<tr>
<td>Heart Attack</td>
<td>.083</td>
<td>.519</td>
<td>.291</td>
</tr>
<tr>
<td>Heartburn</td>
<td>.126</td>
<td>.310</td>
<td>.662</td>
</tr>
<tr>
<td>Torn Muscle</td>
<td>.466</td>
<td>.274</td>
<td>.391</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td><strong>.331</strong></td>
<td><strong>.372</strong></td>
<td><strong>.410</strong></td>
</tr>
</tbody>
</table>

Significantly different from expected baseline: **p = .01 ****p < .0005

### Table 6: Estimated Probability that Disease Caused Weight Loss

<table>
<thead>
<tr>
<th>Disease or Disorder</th>
<th>Scenario 7 (Jennifer N.)</th>
<th>Scenario 8 (John D.)</th>
<th>Scenario 9 (Martha B.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia Nervosa</td>
<td>.621</td>
<td>.117</td>
<td>.272</td>
</tr>
<tr>
<td>Bulimia</td>
<td>.315</td>
<td>.053</td>
<td>.254</td>
</tr>
<tr>
<td>Crohn's Disease</td>
<td>.177</td>
<td>.173</td>
<td>.206</td>
</tr>
<tr>
<td>Stomach Ulcer</td>
<td>.300</td>
<td>.841</td>
<td>.539</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td><strong>.354</strong></td>
<td><strong>.286</strong></td>
<td><strong>.318</strong></td>
</tr>
</tbody>
</table>

Significantly different from expected baseline: *p = .026.

For the symptom of ankle pain, estimates were significantly higher than .25 for Scenario 1 (Bill Y.) (M = .409) (t(57) = 3.650, p = .001) and Scenario 2 (Agnes M.) (M =
.427) \(t(57) = 3.674, p = .001\). The mean estimate for Scenario 3 (Mary D.) \((M = .335)\) \((t(62) = 1.977, p = .053)\) very nearly reached the required level of significance.

For the symptom of chest pain, estimates were significantly higher than .25 for Scenario 5 (Robert G.) \((M = .372)\) \((t(57) = 2.670, p = .01)\) and Scenario 6 (Amy M.) \((M = .410)\) \((t(61) = 3.763, p < .0005)\). The mean estimate for Scenario 4 (Ryan P.) \((M = .082)\) \((t(58) = 1.770, p = .082)\) did not quite reach the required level of significance.

Among the scenarios concerning weight loss, only in Scenario 7 (Jennifer N.) \((M = .354)\) \((t(58) = 2.291, p = .026)\), were the estimates significantly higher than .25. The estimates for Scenario 8 (John D.) \((M = .286)\) \((t(58) = 0.723, p = .472)\) were not significantly different from .25. Scenario 9 (Martha B.) \((M = .318)\) \((t(60) = 1.632, p = .108)\) was predicted to yield a mean estimate significantly lower than .25, but this did not occur.

Analyses of variance were performed on the nine scenarios in order to explore the issue of whether or not means hypothesized to be in three categories, which were "Overestimated", "Underestimated", and "Neither", could be distinguished from each other. Ideally, within each scenario, the means predicted to be overestimated should be significantly different from the two remaining categories ("Underestimated" and "Neither"). Also, the means predicted to be underestimated should be significantly different from the two remaining categories ("Overestimated" and "Neither"). Finally, the means predicted to be neither over- or underestimated should be significantly different from the two remaining categories ("Overestimated" and "Underestimated"). In the scenarios concerning ankle pain, only the ANOVA for Scenario 3 (Mary D.) \((F(3,59) = 10.806, p < .0005)\) reached the level of significance. Tukey HSD comparisons showed that the mean estimate for Sprain \((M = .710)\) was significantly larger than the means for Rheumatic Fever \((M = .248)\) \((HSD_{crit} = .268, p < .0005)\), Rheumatoid Arthritis \((M = .227)\) \((HSD_{crit} = .272, p < .0005)\), and Gout \((M = .206)\) \((HSD_{crit} = .272, p < .0005)\).
Two of the three ANOVAs for the scenarios concerning chest pain were significant. The ANOVA for Scenario 4 (Ryan P.) \((F(3,55) = 14.731, p < .0005)\) as well as the ANOVA for Scenario 6 (Amy M.) \((F(3,58) = 4.666, p = .005)\) indicated differences between the means in the scenarios. In Scenario 4, Tukey HSD tests showed that the mean estimate for Atelectasis \((M = .633)\) was significantly greater than the mean estimates for Heart Attack \((M = .083)\) \((HSD_{crit} = .257, p < .0005)\) and Heartburn \((M = .126)\) \((HSD_{crit} = .262, p < .0005)\). The mean estimate for Torn Muscle \((M = .466)\) was also significantly greater than the mean estimates for Heart Attack \((M = .083)\) \((HSD_{crit} = .257, p = .001)\) and Heartburn \((M = .126)\) \((HSD_{crit} = .262, p = .006)\). In Scenario 6 (Amy M.), the mean estimate for Heartburn \((M = .662)\) was significantly greater than the mean estimates for Atelectasis \((M = .311)\) \((HSD_{crit} = .290, p = .011)\) and Heart Attack \((M = .291)\) \((HSD_{crit} = .299, p = .009)\).

All three ANOVAs for the weight loss scenarios reached the significance level. The ANOVA for Scenario 7 (Jennifer N.) \((F(3,55) = 5.317, p = .003)\) revealed differences between the means. The Tukey comparisons show that the mean estimate for Anorexia Nervosa \((M = .621)\) was significantly greater than the mean estimates for Bulimia \((M = .315)\) \((HSD_{crit} = .300, p = .046)\), Crohn's Disease \((M = .177)\) \((HSD_{crit} = .305, p = .002)\), and Stomach Ulcer \((M = .300)\) \((HSD_{crit} = .317, p = .047)\). The ANOVA for Scenario 8 (John D.) \((F(3,55) = 40.908, p < .0005)\) also revealed differences between the means. The Tukey tests indicate that the mean estimate for Stomach Ulcer \((M = .841)\) was significantly greater than the mean estimates for Anorexia Nervosa \((M = .117)\) \((HSD_{crit} = .217, p < .0005)\), Bulimia \((M = .053)\) \((HSD_{crit} = .210, p < .0005)\), Crohn's Disease \((M = .173)\) \((HSD_{crit} = .213, p < .0005)\). The final ANOVA showed a difference between means for Scenario 9 (Martha B.) \((F(3,57) = 3.583, p = .019)\). The only difference revealed by the Tukey tests was that the mean estimate for Stomach Ulcer \((M = .539)\) was significantly greater than the mean estimate for Crohn's Disease \((M = .206)\) \((HSD_{crit} = .300, p = .024)\).
Relationship Between Familiarity and Probability Estimates

The relationship between familiarity and probability estimates was calculated using the Pearson product-moment $r$. Probability estimates were hypothesized to be positively correlated with subjects' familiarity ratings, with whether or not subjects had personally suffered from the disease in question, and with whether or not subjects had a close friend or family member who ever suffered from the disease. Two of the 36 correlations reached the level of significance. The correlation between self-rated familiarity and likelihood estimates for rheumatoid arthritis was significant ($r = .364, p \leq .007$) as was the correlation between self-rated familiarity and likelihood estimates for stomach ulcer ($r = .289, p \leq .032$).

Table 7--Pearson Correlations of Disease with Familiarity for Ankle Pain

<table>
<thead>
<tr>
<th>Disease or Disorder</th>
<th>Self-Rated Familiarity</th>
<th>Had Disease Personally?</th>
<th>Friend Had Disease?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic Fever</td>
<td>.164</td>
<td>.046</td>
<td>-.088</td>
</tr>
<tr>
<td>Gout</td>
<td>.146</td>
<td>***</td>
<td>.032</td>
</tr>
<tr>
<td>Rheumatoid Arthritis</td>
<td>.364*</td>
<td>-.199</td>
<td>.098</td>
</tr>
<tr>
<td>Sprain</td>
<td>-.199</td>
<td>.093</td>
<td>-.221</td>
</tr>
</tbody>
</table>

* $p \leq .007$.
*** An absence of variability in the measure of familiarity makes the correlation calculation impossible.
Table 8--Pearson Correlations of Disease with Familiarity for Chest Pain

<table>
<thead>
<tr>
<th>Measure of Familiarity</th>
<th>Self-Rated Familiarity</th>
<th>Had Disease Personally?</th>
<th>Friend Had Disease?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease or Disorder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atelectasis</td>
<td>-.196</td>
<td>.115</td>
<td>.149</td>
</tr>
<tr>
<td>Heart Attack</td>
<td>.011</td>
<td>***</td>
<td>-.209</td>
</tr>
<tr>
<td>Heartburn</td>
<td>-.099</td>
<td>.046</td>
<td>.092</td>
</tr>
<tr>
<td>Torn Muscle</td>
<td>-.028</td>
<td>-.009</td>
<td>-.138</td>
</tr>
</tbody>
</table>

*** An absence of variability in the measure of familiarity makes the correlation calculation impossible.

Table 9--Pearson Correlations of Disease with Familiarity for Weight Loss

<table>
<thead>
<tr>
<th>Measure of Familiarity</th>
<th>Self-Rated Familiarity</th>
<th>Had Disease Personally?</th>
<th>Friend Had Disease?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease or Disorder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anorexia Nervosa</td>
<td>-.031</td>
<td>-.001</td>
<td>-.009</td>
</tr>
<tr>
<td>Bulimia</td>
<td>-.162</td>
<td>.038</td>
<td>.018</td>
</tr>
<tr>
<td>Crohn's Disease</td>
<td>-.159</td>
<td>***</td>
<td>-.009</td>
</tr>
<tr>
<td>Stomach Ulcer</td>
<td>.289**</td>
<td>.029</td>
<td>-.205</td>
</tr>
</tbody>
</table>

**p ≤ .032.

*** An absence of variability in the measure of familiarity makes the correlation calculation impossible.
CHAPTER IV
DISCUSSION

In general, the phenomenon of subjective probability overestimation was demonstrated in this study. The overall probability judgements were overestimated in five of the eight scenarios where overestimation was predicted. The three scenarios which had means which were not significantly greater than .25 nonetheless had means which were in the predicted direction and almost reached the significance level, with p values ranging from .053 to .108. The expectation that there would be significant differences within each scenario between those means predicted to be overestimated, underestimated, and neither over- or underestimated also received support. The hypothesized positive relationship between familiarity with a disease or disorder its likelihood estimate was not demonstrated in this study.

Effects of Information on Probability Estimates - The Subjective Overestimation Effect

The subjective overestimation effect was indicated by five out of eight scenarios being overestimated to a significant degree. Scenarios 1 and 2 had mean estimates of .409 and .472 respectively. All disease estimates were greater than .25 in these scenarios. If one wishes place these figures in the perspective of past research, one may observe that the figures represent 1.64 and 1.89 times the expected baseline of .25. While some of Teigen's (1974a) work found figures as high as 4.472 times the expected baseline, other results (Teigen, 1974b and Sanbonmatsu et al., 1995) found figures in the range of 1.6 to 2.6 times the expected baseline. Scenario 3 had a mean estimate of .335 (p = .053), which nearly reached the required level of significance. It appears that the reason that this mean
estimate was slightly lower than expected is that the mean estimates for three of the causes (rheumatic fever, gout, and rheumatoid arthritis) were close to the baseline ($M_s = .248, .206, \text{ and } .227$ respectively). The one very good explanation for ankle pain in a female soccer player, sprain, was overestimated indeed ($M = .710$), but this one mean was not sufficient to pull the overall mean above the level of significance.

A significant overall overestimation effect was not found for Scenario 4 either, but here too the mean ($M = .331$) was close to the significance level ($p = .082$). In this case, one very unlikely explanation for a chest pain in a young male, heart attack, yielded a mean estimate of .083, which reduced the overall mean for the scenario. Scenarios 5 and 6 were overestimated to a healthy degree ($M_s = .372 \text{ and } .410, ps = .01 \text{ and } <.0005$, respectively), with all disease means being above .25.

The mean estimate for Scenario 7 ($M = .354, p = .026$) was significantly greater than the .25 baseline. Scenario 8 was the last scenario predicted to have an overall mean significantly greater than .25, but this did not happen. The mean of .286 ($p = .108$) was in the predicted direction, however. Two disorders which were very unlikely to strike a 30-year-old male, anorexia nervosa and bulimia, yielded mean estimates ($M_s = .117 \text{ and } .053$, respectively) which decreased the overall mean. The mean estimate for stomach ulcer ($M = .841$) was the highest estimate in the entire study. This is perhaps not surprising, given the other choices and the information given in the scenario that John D. was experiencing recent job stress.

It was predicted that the mean estimate for Scenario 9 would be significantly less than .25, but surprisingly, the mean was .318. In the scenario, Martha B. was 45 years old and engaged to be married. Anorexia nervosa and bulimia ($M_s = .272 \text{ and } .254$) were supposed to be underestimated, as the disorders strike younger females primarily. Crohn's Disease ($M = .206$) was also predicted to be underestimated. Stomach ulcer ($M = .539$) was predicted to be overestimated. Subjects did not respond as predicted to anorexia
nervosa or bulimia, and the underestimation effect found by Sanbonmatsu et al. (1995) was not replicated here.

**Differences Between Groups Within Each Scenario**

ANOVAs and Tukey HSD tests were used to determine if subgroups would emerge within each scenario. The subgroups were expected to be the overestimated means, the underestimated means, and the means neither over- or underestimated.

In Scenario 1, rheumatic fever and gout were predicted to be overestimated for Bill Y., a carpenter who felt lethargic. It was hypothesized that gout would be overpredicted because it strikes males 20 times as often as it strikes females. Rheumatic fever, caused by a preceding strep infection, was also predicted to be overestimated in someone who builds homes in the cold climate of Chicago. The mean estimates for these two afflictions ($M_s = .387$ and $,.315$, respectively) were somewhat large, but they were smaller than the estimates for rheumatoid arthritis and sprain ($M_s = .400$ and $_.524$, respectively). Rheumatoid arthritis primarily strikes women older than Bill Y., and was hypothesized to be underestimated. Logic would seem to dictate this, but experimental participants apparently did not share this view. Sprain was not expected to be different from the overall mean, but subjects may have thought the injury quite likely to strike a carpenter. The overall mean estimate for the experiment was $.360$, so the overall overestimation effect could account for perhaps some of these results. The ANOVA did not indicate any significant differences between the means in this scenario. If anything, differences would have been in the direction opposite to the one predicted.

An ANOVA indicated no significant differences between the means in Scenario 2, also. Rheumatoid arthritis, which strikes mainly older females, was seen as the most likely ($M = .607$) cause of ankle pain for Agnes M. Gout rarely strikes women, yet the mean estimate was a rather high $.440$. Gout was hypothesized to be underestimated, and its apparent overestimation suggests that the overestimation effect was more powerful than the expected moderating effect of the information. Rheumatic fever and sprain ($M_s = .320$
and .347, respectively) were not expected to be over- or underestimated. These figures were relatively close to the overall experimental mean of .360, which suggests that they were overestimated to the typical degree for this experiment.

The mean estimate for sprain (\(M = .710\)) in Scenario 3 was significantly different from the other three mean estimates (see Figure 1). It was the only mean predicted to be overestimated in the scenario, and it is arguably a better explanation for sudden ankle pain in a soccer player on a cold afternoon than are the other three possible causes. It was further hypothesized that the mean estimates for gout and rheumatoid arthritis would form the underestimated group, distinct from the sprain mean and the rheumatic fever mean. The rheumatic fever mean estimate was not found to be significantly different from the underestimated group, although the mean was in the predicted region, between the overestimated mean and the underestimated group. Figure 1 shows the means for the four potential causes of ankle pain as points and shows one standard error of the mean on either side of the mean as lines. It becomes apparent that the estimates for sprain are distinct from the other three estimates, which appear to be difficult to distinguish from each other. The fifth point, with standard error lines, is the grand mean estimate for the entire study (\(M = .360\)). It seems to inhabit a region of the figure quite apart from the overestimated mean and slightly above the other means. This hints at the idea that the three means below the overall mean were underestimated relative to the overall mean. Study participants appeared to believe that the three underestimated causes were not very good explanations for Mary's problem and, given the scenario, they are probably making reasonable estimates. It is likely that the base rate for sprains on cold days for soccer players is substantially higher than the base rates of the other choices.

The analysis of Scenario 4 shows that the mean estimates for atelectasis and torn muscle (\(Ms = .633\) and .466, respectively) were significantly different from the mean estimates for heart attack and heartburn (\(Ms = .083\) and .126, respectively). Atelectasis,
cause of Ankle Pain

Legend:
(1) Rheumatic Fever
(2) Rheumatoid Arthritis
(3) Sprain
(4) Gout
(5) Overall experimental mean

Fig. 1. Mean Estimates with Standard Error Bars for Scenario 3
or collapsed lung, and torn muscle were predicted to be overestimated for Ryan P. In the scenario, he was just tackled in a varsity high school football game and complained to his coach that he had chest pain, so these two explanations seem fairly plausible. Heart attack was expected to be underestimated, and its mean was far below the overall experimental mean (see Figure 2). Heartburn was predicted to be neither over- or underestimated, but it appears to be underestimated. Perhaps when placed next to other much better possible causes of chest pain for Ryan P., heartburn did not seem very likely to the participants. Again examining Figure 2, atelectasis seems to be distinct from the overall mean, but the distribution of torn muscle estimates has some overlap with the overall mean distribution. I can only tentatively claim that the torn muscle as a cause of chest pain was overestimated.

There were no significant differences between the means in Scenario 5. It was predicted that the mean estimates for heart attack, atelectasis, and torn muscle would be overestimated for Robert G., a 62-year-old golfer who smokes two packages of cigarettes per week and complains of chest pains on the golf course. The mean estimate for heart attack ($M = .519$) was the highest, and this seems logical given the situation. Atelectasis ($M = .386$) was expected to be overestimated, but is instead quite close to the overall mean of .360. Torn muscle ($M = .274$) would seem to be a good explanation for an older person who may be overusing a muscle group playing golf, but it was not overestimated as predicted. Perhaps subjects felt that heart attack was a good and expected explanation, given the idea that chest pains and heart attacks "go together" frequently in older males. This may have cast doubt on the idea that torn muscle would be a good explanation in this case. Heartburn was expected to be neither over- or underestimated, and its mean of .310 is not readily distinguishable from the overall mean. The fact that these four groups of means are not significantly different from each other may be in part due to the fact that none of the explanations were predicted to be underestimated. The four groups were not designed to be very dissimilar from each other, and, indeed, they were not.
Fig. 2. Mean Estimates with Standard Error Bars for Scenario 4

Legend:
(1) Atelectasis
(2) Heart Attack
(3) Heartburn
(4) Torn Muscle
(5) Overall experimental mean
The ANOVA and Tukey HSD tests indicate that the mean estimate for heartburn ($M = .662$) was significantly greater than the estimates for atelectasis and heart attack ($Ms = .311$ and .291, respectively) in Scenario 6 (see Figure 3). It was predicted that heartburn would be the only potential cause overestimated for Amy M., a 35-year-old woman on vacation. The mean estimate for heartburn was not significantly different from the mean estimate for torn muscle ($M = .391$), but it came fairly close to being significantly greater ($HSD_{crit} = .299, p = .089$). Torn muscle and atelectasis were expected to be neither over- or underestimated because nothing in the information provided to participants would suggest these causes as being particularly likely or unlikely. The mean estimates were fairly close to the overall mean. The estimates for heart attack were predicted to be underestimated because heart attack victims are mainly males over 40 years old. The mean for heart attack was the lowest of the four and below the overall mean, but the Tukey HSD tests did not indicate that it was significantly lower than atelectasis and heartburn. It may be the case that participants were influenced by the disease information which indicates heart attacks strike men most often, but that the incidence is rising in women.

In Scenario 7, it was predicted that the mean estimates for anorexia nervosa, bulimia, and stomach ulcer would be overestimated as causes of weight loss for Jennifer N. (see Figure 4). Instead, the ANOVA and Tukey HSD tests showed that the mean estimate for anorexia nervosa ($M = .621$) was significantly greater than the mean estimates for bulimia and stomach ulcer ($Ms = .315$ and .300, respectively). The information provided about bulimia and anorexia state that young females are usually the victims affected and that the causes are unknown, but that conflicts are suspected to be related to anorexia nervosa and dieting and its resultant stress are suspected to be related to bulimia. The scenario states that Jennifer N. recently moved with her family to a new area and that her grades in school have dropped. Participants may have interpreted the lack of reference to dieting as a clue that bulimia was not as likely a cause as anorexia nervosa, or they may
Fig. 3. Mean Estimates with Standard Error Bars for Scenario 6

Legend:
(1) Atelectasis
(2) Heart Attack
(3) Heartburn
(4) Torn Muscle
(5) Overall experimental mean
Fig. 4. Mean Estimates with Standard Error Bars for Scenario 7

Legend:
(1) Anorexia Nervosa
(2) Bulimia
(3) Crohn's Disease
(4) Stomach Ulcer
(5) Overall experimental mean
have brought information into the study which makes bulimia seem only a somewhat likely cause. The information provided about stomach ulcer states that young adults are usually the ones afflicted, and that the cause is unknown, but that emotional tension, irregular living habits, or a bacterial component may be causal factors. While tension seems to be a plausible correlate of being a teenager and moving to a new area, participants estimated the likelihood of Jennifer N. having a stomach ulcer as only .300, somewhat below the overall experimental mean. Participants may have believed that anorexia nervosa, or perhaps bulimia, were better explanations and tempered their estimates for stomach ulcer. The mean for anorexia nervosa was also significantly greater than the mean for Crohn's disease (M= .177), which was as expected. The information provided about Crohn's disease stated that it strikes young adults and its cause is unknown. It was hypothesized that this would yield an estimate neither over- or underestimated, but the low estimate suggests that participants viewed this potential cause as relatively unlikely. It may be the case that this looks like a rather obvious case of anorexia nervosa, which could deflated participants' estimates for Crohn's disease even though nothing in the information provided about the disease itself would logically reduce probability estimates.

In Scenario 8, it was hypothesized that participants would overestimate the probability that stomach ulcer caused weight loss for John D., a computer programmer who has been experiencing job stress (see Figure 5). Indeed, the mean estimate for stomach ulcer (M = .841) was significantly greater than the estimates for all other causes and was the highest estimate in the entire study. Tension and irregular living habits were suggested as possible causes, which may well result from personnel cutbacks and increased workload and stress. Anorexia nervosa and bulimia (Ms = .117 and .053, respectively) were expected to be underestimated as they primarily strike young women and girls, and their means were well below the overall mean of .360. Crohn's disease was also somewhat underestimated (M = .173), although the rather vague information about the disease was not designed to induce over- or underestimations. Since the mean
Cause of Weight Loss

Legend:
(1) Anorexia Nervosa
(2) Bulimia
(3) Crohn's Disease
(4) Stomach Ulcer
(5) Overall experimental mean

Fig. 5. Mean Estimates with Standard Error Bars for Scenario 8
estimate for stomach ulcer was so very high, and the reasons for that logically defensible, Crohn's disease may have seemed a weak choice by comparison.

In Scenario 9, it was predicted that the mean for stomach ulcer ($M = .539$) would be overestimated (see Figure 6). The mean estimate was indeed significantly higher than the mean for Crohn's disease ($M = .206$). The mean estimate for stomach ulcer was higher than the means for anorexia nervosa and bulimia ($Ms = .272$ and .254, respectively), and these differences were nearly significant ($HSD_{crits} = .286$ and .294, $ps = .077$ and .063, respectively). The means for anorexia nervosa, bulimia, and Crohn's disease were predicted to be underestimated, and the means are smaller than the overall mean. In the scenario, Martha B. is 45 years old, a single mother, and soon to be married. Anorexia nervosa and bulimia usually strike younger women, and Crohn's disease strikes young males and females, so the low estimates are justifiable. A high level of tension and stress could perhaps explain an ulcer and the resulting weight loss better than the other choices.

**Limitations of the Overestimation Effect**

While the probability estimates were in general overestimated in this study, as indicated by the total mean of .360, many of the mean estimates were less than the total mean and some were less than the logical mean limit of .25. Sanbonmatsu et al. (1995) found that when subjects were presented with four poor candidates for a position at a university, and were told that one of the candidates got the job, they underestimated the sum total probability, which logically equals 1. In Scenario 8, for example, it seems reasonable to conclude that subjects did not believe that it was very likely at all that a 30-year-old male would contract anorexia nervosa or bulimia, especially when a seemingly more likely disorder (stomach ulcer) was present as a possibility. I suspect that participants used the information provided, probability in concert with the knowledge about diseases before the study began, to make reasonable estimates for John D., which included some very low estimates. I believe the other best example of participants using
Fig. 6. Mean Estimates with Standard Error Bars for Scenario 9

Legend:
(1) Anorexia Nervosa
(2) Bulimia
(3) Crohn's Disease
(4) Stomach Ulcer
(5) Overall experimental mean
information wisely in producing low estimates occurs in Scenario 4. The mean estimate for heart attack causing chest pain in a 17-year-old boy was .083. The information provided, along with preconceived notions about who is likely to suffer a heart attack, apparently lead to a logical and low probability estimate in this case.

Interestingly, the mean estimates for Crohn's disease were low in Scenarios 7, 8, and 9 (Ms = .177, .173, and .206, respectively). No other disease yielded estimates this low across three scenarios. The information provided about Crohn's disease states that young adults are most often affected and that the cause is unknown. This information is not particularly helpful in either eliminating or confirming Crohn's disease as a cause of weight loss for the three hypothetical people. In each scenario, there are one or two seemingly probable causes, and, in the case of Scenario 8, one or two very unlikely causes. It may be the case that when other good choices are available, a choice which seems neither good or bad, such as Crohn's disease, will be underestimated to a degree.

Relationship Between Familiarity and Probability Estimates

Two of the 36 correlations between measures of familiarity and probability estimates reached the required level of significance. It should be noted that without a Bonferroni adjustment to control for the inflated error rate, the expected number of correlations which should happen by chance when 36 correlations are calculated using a .05 significance level is 1.8, so it is not reasonable to conclude that, based on this study, there is a relationship between familiarity and probability estimates. The earlier finding that familiarity and likelihood estimates can be positively correlated (Lichtenstein et al., 1978) was not replicated in this study. Some possible reasons for this concern differences between the two studies. First, Lichtenstein et al. used many measures of familiarity. They used self reports and an archival measure of familiarity: newspaper coverages of various diseases and disorders. If self reports are biased, which may be the case, or contain a degree of error, which is almost certainly the case, this additional newspaper measure can tap an aspect of the construct of familiarity in an independent fashion. The
present study included no archival measures, which may help to explain the lack of findings. The Lichtenstein et al. research was conducted in or around Eugene, Oregon. The Eugene-Springfield metropolitan area had a population of about 215,000 in the mid 1970's (Gilmore, Highsmith, and Notson, 1975). Since the authors tabulated data from only one newspaper, the Eugene Register-Guard, it is possible that the authors felt that it covered the area thoroughly. The 1995 Chicago metropolitan area is considerably larger than the Eugene-Springfield metropolitan area, and there are many newspapers published in and around Chicago. This researcher had neither the time or resources to attempt an adequate archival measure of familiarity in an area as populated as Chicago. If self reports are biased, which may be the case, or contain a degree of error, which is almost certainly the case, this additional newspaper measure can tap an aspect of the construct of familiarity in an independent fashion. The present study included no archival measures, which may help to explain the lack of findings.

Second, the present study covers 12 diseases, and the earlier study covers 41 diseases. I suspect that the correlations in the present study were reduced by the lack of variability in the familiarity ratings. It would seem that I selected diseases either quite familiar or very unfamiliar to participants. In an effort to explore the issue of how participants familiar with the diseases compared to participants unfamiliar with the diseases, I split each of the 12 rating distributions at the mean. The ratings were on a one to five scale, and the mean ratings were never integers. So, for example, if the mean familiarity rating was 3.75, the "low familiarity" group would be comprised of the ratings 1, 2, and 3, and the "high familiarity" group would be the ratings 4 and 5. The lack of variability in these ratings becomes evident because, for 7 of the 12 diseases, subjects were either so very familiar or unfamiliar that it was not possible to calculate a Pearson product-moment correlation for either the "low familiarity" or "high familiarity" group. Stated differently, in these cases, the "low familiarity" group gave ratings of 1 only, or the "high familiarity" group gave only the rating 5. The range of diseases in the Lichtenstein et al.
study covered more of the middle ground between the two extremes, and I suspect they
did not suffer from a restriction of range. It is possible to make a correction for a
restricted range (Hunter and Schmidt, 1990) in order to estimate what the correlations
might have been had the range of scores not been restricted. However, the correction
requires using the population value for the variable, which was not available for this study,
so the correction was not performed.

The third and perhaps most important difference between the two studies is the
fact that likelihood estimates were manipulated as part of the design in the present study
but were not in the Lichtenstein et al. (1978) study. In this earlier study, subjects
estimated the likelihood of dying assuming a person was afflicted with the disease or
disorder listed. In the present study, any effect of familiarity with a disease becomes
confounded with the effects of the information about the person in the scenario and the
disease or disorder itself. Identifying the relative strengths of these components could be a
topic for further study in this area.

Conclusion

The results of this study support the contention that the phenomenon of subjective
probability overestimation is pervasive but can be influenced by the provision of relevant
and accurate information. In an age of skyrocketing medical costs, one advantage every
citizen can use is the ability to more accurately judge his or her likelihood of falling victim
to various diseases. Ignoring symptoms or avoiding medical screenings can lead to
personal disaster, while seeking medical care whenever the slightest symptom appears is
costly to the individual and an inefficient use of the health care system. These two
extremes can be avoided when people can make better estimates regarding symptoms and
diseases in their own lives.

Having an accurate perception of the likelihood of personal injury, disability or
death from various causes can give people the opportunity to take preventive measures
against those events which are most likely to cause problems. Squandering an opportunity,
especially early in life, to reduce one's chances to avoid the more likely disorders and
diseases is an unfortunate but probably common occurrence. One cannot expect to live
forever by taking preventive measures against diseases, but a longer, higher-quality life
seems an attainable goal for those who are dedicated and informed. The type of
information provided to participants in this study is probably not sufficient to make
everyone an expert diagnostician. Many other factors, such as disease base rates, age,
gender, medical history, and family history must be considered in making accurate
estimates about one's health status. This study shows that providing information can have
positive effects on likelihood estimates of disease.

Suggestions for further work in this area include changing the design of the study
to allow a comparison of groups who receive disease-relevant information to control
groups which do not. It would be valuable to be able to quantify the effect size of
providing disease-relevant information. It could also be valuable to make the symptom-
scenario-disease combinations more systematic. For example, some scenarios could
include diseases which are all predicted to be overestimated, while others could include
those predicted to be all underestimated. Incorporation of other types of information,
such as base rates, would be of additional value. It may be worthwhile to explore the
finding that familiarity with a disease is positively correlated with an estimate of its
likelihood (Lichtenstein et al., 1978). This effect was not found in this study, but may be
present in alternative designs, for example, where no disease-relevant information is
provided. It would, of course, be wise to include non-college populations in subsequent
research.
APPENDIX A

STUDY QUESTIONNAIRES

STUDY QUESTIONNAIRE
PART I.

Please indicate how familiar you are with the following diseases and disorders by circling a number for each disease or disorder:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
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<td></td>
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<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>A.</td>
<td>Anorexia Nervosa</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B.</td>
<td>Atelectasis</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.</td>
<td>Bulimia</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D.</td>
<td>Crohn's Disease</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E.</td>
<td>Gout</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>F.</td>
<td>Heart Attack</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>G.</td>
<td>Heartburn</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>H.</td>
<td>Rheumatic Fever</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I.</td>
<td>Rheumatoid Arthritis</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>J.</td>
<td>Sprain (e.g., of ankle)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>K.</td>
<td>Stomach Ulcer</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>L.</td>
<td>Torn Muscle</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Part II.

(Scenario 1.)

Please read the following story.

Bill Y. is a 29-year-old married carpenter who has one child. He works as an independent contractor building homes in the Chicago suburbs. As the building season came to a close in the fall of 1994, he felt run down and lethargic. He makes an appointment to see his physician regarding a new problem: pain in his ankles.

(Scenario 2.)

Please read the following story.

Agnes M. is a 61-year-old retired school teacher. Her husband of 36 years, Fred, died two years ago of a heart attack. Agnes smoked one pack of cigarettes per day for 15 years, but quit completely 12 years ago. She makes an appointment to see her physician regarding a new problem: pain in her ankles.

(Scenario 3.)

Please read the following story.

Mary D. is an 18-year-old college student who plays for her school's soccer team. After soccer practice on a particularly cold afternoon, she complains to her coach of pain in her ankles.
Now, please read the following information about some potential causes of pain in one's ankles.

1. RHEUMATIC FEVER

**Definition:** An inflammatory complication of strep infections that affects many parts of the body, especially the joints and heart.

**Sex or Age Most Affected:** Both children and adults

**Causes:** Rheumatic fever is caused by a preceding strep infection, usually in the throat, that occurs one to six weeks prior to the onset of symptoms. It is probably an autoimmune disorder in which antibodies produced to attack the strep bacteria also attack the tissues of the joints or heart.

2. GOUT

**Definition:** Recurrent attacks of joint inflammation caused by deposits of uric acid crystals in the joints.

**Sex or Age Most Affected:** Adults of both sexes, but 20 times more frequent in men than women.

**Causes:** A high level of uric acid in the blood.

3. RHEUMATOID ARTHRITIS

**Definition:** An illness characterized by joint disease that involves muscles, membrane linings of the joints, and cartilage.
Sex or Age Most Affected: Three times more common in women than in men. It begins between ages 20 and 60, with a peak incidence between ages 35 and 45.

Causes: Unknown, but probably an autoimmune disease.

4. SPRAIN

Definition: A sprain is a stretched and torn ligament and can occur in any joint. Sprained joints can function - but only with pain.

Age or Sex Most Affected: Both sexes, all ages.

Causes: Overuse or stress of a ligament or membrane around a joint. The ankle is injured most often because of its anatomical weakness, its exposed position and the stress it sustains in athletic and recreational activities.

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the ankle, please estimate the likelihood of the pain in the ankle being caused by Gout by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Gout caused the pain in the ankle," and 0.00 means "It is certain that this Gout did not cause the pain in the ankle."

Gout ___________________________
Next, after considering the information about the person in the story and the information about the possible cause of the pain in the ankle, please estimate the likelihood of the pain in the ankle being caused by Rheumatic Fever by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Rheumatic Fever caused the pain in the ankle," and 0.00 means "It is certain that this Rheumatic Fever did not cause the pain in the ankle."

Rheumatic Fever

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the ankle, please estimate the likelihood of the pain in the ankle being caused by Rheumatoid Arthritis by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Rheumatoid Arthritis caused the pain in the ankle," and 0.00 means "It is certain that this Rheumatoid Arthritis did not cause the pain in the ankle."

Rheumatoid Arthritis

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the ankle, please estimate the likelihood of the pain in the ankle being caused by A Sprain by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that A Sprain caused the pain in the ankle," and 0.00 means "It is certain that this A Sprain did not cause the pain in the ankle."

A Sprain
PART III.

(Version 4.)

Please read the following story.

Ryan P. is a 17-year-old high school student and tailback on his high school's varsity football team. After being tackled at the end of his team's first game, he complains to his coach of pain in his chest.

(Version 5.)

Please read the following story.

Robert G. is a 62-year-old advertising executive who has a wife and three children. He smokes two packages of cigarettes per week and plays golf on the weekends. One Saturday on the golf course, he complains to the other members of his foursome that he is experiencing chest pains.

(Version 6.)

Please read the following story.

Amy M. is a 35-year-old sales representative for a large pharmaceutical manufacturer. She is on her first vacation in three years -- a weeklong stay in Greece. After three days of sightseeing, she experiences pain in her chest.
Now, please read the following information about some potential causes of pain in one's chest.

1. ATELECTASIS

**Definition:** Collapse of part or all of one lung, preventing normal oxygen absorption.

**Sex or Age Most Affected:** Both sexes; all ages

**Causes:** Obstruction of small or large lung air passages by thick mucus plugs, tumors, inhaled objects, or due to chest injury or fractured ribs.

2. HEART ATTACK

**Definition:** Death of heart-muscle cells from reduced or obstructed blood flow through the coronary arteries.

**Sex or Age Most Affected:** Adults over 40. This is more common in men, but the incidence is rising for women.

**Causes:** Partial or complete blockage of coronary arteries. Symptoms are often triggered by an emotional crisis, a heavy meal, or heavy exercise.

3. HEARTBURN

**Definition:** Discomfort of the upper digestive tract.

**Sex or Age Most Affected:** All ages, but most common in adults over 60.
Causes: Hiatal hernia (part of stomach protrudes into the chest), ulcers of the esophagus, or irritation of the esophagus caused by stomach acid.

4. TORN MUSCLE

Definition: Torn muscle fibers.

Sex or Age Most Affected: Both sexes; all ages.

Causes: Injury caused by overuse or stress of a muscle group.

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the chest, please estimate the likelihood of the pain in the chest being caused by Atelectasis by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Atelectasis caused the pain in the chest," and 0.00 means "It is certain that Atelectasis did not cause the pain in the chest."

- Atelectasis

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the chest, please estimate the likelihood of the pain in the chest being caused by Heart Attack by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Heart Attack caused the pain in the chest," and 0.00 means "It is certain that Heart Attack did not cause the pain in the chest."

- Heart Attack
Next, after considering the information about the person in the story and the information about the possible cause of the pain in the chest, please estimate the likelihood of the pain in the chest being caused by **Heartburn** by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that **Heartburn** caused the pain in the chest," and 0.00 means "It is certain that **Heartburn** did not cause the pain in the chest."

- **Heartburn**

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the chest, please estimate the likelihood of the pain in the chest being caused by **A Torn Muscle** by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that **A Torn Muscle** caused the pain in the chest," and 0.00 means "It is certain that **A Torn Muscle** did not cause the pain in the chest."

- **Torn Muscle**
PART IV.

(Scenario 7.)

Please read the following story.

Jennifer N. is the 14-year-old daughter of Thomas and Nancy N. The family has just moved from San Diego, California to Jacksonville, Florida because of a job transfer. Jennifer's grades have dropped since moving to Jacksonville, and her parents have noticed that she has lost weight.

(Scenario 8.)

Please read the following story.

John D. is a 30-year-old computer programmer who lives on the north side of Chicago. His job has recently become very stressful for him due to personnel cutbacks in his department and the resulting increased workload. Unexpectedly, he has been losing weight.

(Scenario 9.)

Please read the following story.

Martha B. is a 45-year-old single mother of two teenage boys. She was divorced six years ago but is engaged to be remarried. Unexpectedly, she has been losing weight.
Now, please read the following information about some potential causes of weight loss.

1. ANOREXIA NERVOSA

**Definition:** A psychological eating disorder in which a person refuses to eat adequately - in spite of hunger - and loses enough weight to become emaciated.

**Sex or Age Most Affected:** Female adolescents and young adults.

**Causes:** Unknown, although many patients have family and internal conflicts, including sexual conflicts.

2. BULIMIA

**Definition:** A psychological eating disorder characterized by abnormal perception of body image, constant craving for food and binge eating, followed by self-induced vomiting or laxative use.

**Sex or Age Most Affected:** Adolescents or young adults, usually female.

**Causes:** Unknown. The disorder often begins during or after stringent dieting and may be caused by stress related to insufficient food intake.

3. CROHN'S DISEASE

**Definition:** An inflammatory disease of the ileum, the lower part of the small intestine.
**Sex or Age Most Affected:** Young adults.

**Causes:** Unknown.

### 4. STOMACH ULCER

**Definition:** A raw spot that develops in the stomach lining.

**Sex or Age Most Affected:** Both sexes of young adults (20 to 45 years).

**Causes:** Unknown. Persons with ulcers often have irregular living habits. Many doctors believe emotional tension causes ulcers. A bacterial component may contribute to ulcer formation.

Next, after considering the information about the person in the story and the information about the possible cause of the weight loss, please estimate the likelihood of the weight loss being caused by **Anorexia Nervosa** by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that **Anorexia Nervosa** caused the weight loss," and 0.00 means "It is certain that **Anorexia Nervosa** did not cause the weight loss."

- **Anorexia Nervosa** __________________________
Next, after considering the information about the person in the story and the information about the possible cause of the weight loss, please estimate the likelihood of the weight loss being caused by **Bulimia** by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that **Bulimia** caused the weight loss," and 0.00 means "It is certain that **Bulimia** did not cause the weight loss."

- **Bulimia**

Next, after considering the information about the person in the story and the information about the possible cause of the weight loss, please estimate the likelihood of the weight loss being caused by **Crohn's Disease** by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that **Crohn's Disease** caused the weight loss," and 0.00 means "It is certain that **Crohn's Disease** did not cause the weight loss."

- **Crohn's Disease**

Next, after considering the information about the person in the story and the information about the possible cause of the weight loss, please estimate the likelihood of the weight loss being caused by **Stomach Ulcer** by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that **Stomach Ulcer** caused the weight loss," and 0.00 means "It is certain that **Stomach Ulcer** did not cause the weight loss."

- **Stomach Ulcer**
PART V.

NOTE: This survey is confidential, and no one's name will be attached to his or her responses. You do not have to answer any items which you believe are too personal. However, the information we request in Part V. will make our analyses more informative.

Please circle your gender: MALE FEMALE

Please indicate whether you personally or a close friend or family member has ever experienced the following diseases and disorders.

<table>
<thead>
<tr>
<th>YouPersonally</th>
<th>Close Friend/Family Member</th>
</tr>
</thead>
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<tr>
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</tr>
<tr>
<td>Atelectasis</td>
<td>Yes No</td>
</tr>
<tr>
<td>Bulimia</td>
<td>Yes No</td>
</tr>
<tr>
<td>Crohn's Disease</td>
<td>Yes No</td>
</tr>
<tr>
<td>Gout</td>
<td>Yes No</td>
</tr>
<tr>
<td>Heart Attack</td>
<td>Yes No</td>
</tr>
<tr>
<td>Heartburn</td>
<td>Yes No</td>
</tr>
<tr>
<td>Rheumatic Fever</td>
<td>Yes No</td>
</tr>
<tr>
<td>Rheumatoid Arthritis</td>
<td>Yes No</td>
</tr>
<tr>
<td>Sprain (e.g., of ankle)</td>
<td>Yes No</td>
</tr>
<tr>
<td>Stomach Ulcer</td>
<td>Yes No</td>
</tr>
<tr>
<td>Torn Muscle</td>
<td>Yes No</td>
</tr>
</tbody>
</table>
Please indicate how familiar you are with the following diseases and disorders by circling a number for each disease or disorder:

<table>
<thead>
<tr>
<th></th>
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<th>3</th>
<th>4</th>
<th>5</th>
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<td>B. Atelectasis</td>
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<tr>
<td>C. Bulimia</td>
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<td>5</td>
</tr>
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<td>D. Crohn's Disease</td>
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<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E. Gout</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F. Heart Attack</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>G. Heartburn</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>H. Rheumatic Fever</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I. Rheumatoid Arthritis</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>J. Sprain (e.g., of ankle)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>K. Stomach Ulcer</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>L. Torn Muscle</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Part II.

Please read the following story.

Mary D. is an 18-year-old college student who plays for her school's soccer team. After soccer practice on a particularly cold afternoon, she complains to her coach of pain in her ankles.

Now, please read the following information about some potential causes of pain in one's ankles.

1. RHEUMATIC FEVER

   Definition: An inflammatory complication of strep infections that affects many parts of the body, especially the joints and heart.

   Sex or Age Most Affected: Both children and adults

   Causes: Rheumatic fever is caused by a preceding strep infection, usually in the throat, that occurs one to six weeks prior to the onset of symptoms. It is probably an autoimmune disorder in which antibodies produced to attack the strep bacteria also attack the tissues of the joints or heart.

2. GOUT

   Definition: Recurrent attacks of joint inflammation caused by deposits of uric acid crystals in the joints.

   Sex or Age Most Affected: Adults of both sexes, but 20 times more frequent in men than women.
Causes: A high level of uric acid in the blood.

3. RHEUMATOID ARTHRITIS

Definition: An illness characterized by joint disease that involves muscles, membrane linings of the joints, and cartilage.

Sex or Age Most Affected: Three times more common in women than in men. It begins between ages 20 and 60, with a peak incidence between ages 35 and 45.

Causes: Unknown, but probably an autoimmune disease.

4. SPRAIN

Definition: A sprain is a stretched and torn ligament and can occur in any joint. Sprained joints can function - but only with pain.

Age or Sex Most Affected: Both sexes, all ages.

Causes: Overuse or stress of a ligament or membrane around a joint. The ankle is injured most often because of its anatomical weakness, its exposed position and the stress it sustains in athletic and recreational activities.
Next, after considering the information about the person in the story and the information about the possible cause of the pain in the ankle, please estimate the likelihood of the pain in the ankle being caused by Gout by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Gout caused the pain in the ankle," and 0.00 means "It is certain that this Gout did not cause the pain in the ankle."

Gout ___________________
PART III

Please read the following story.

Ryan P. is a 17-year-old high school student and tailback on his high school's varsity football team. After being tackled at the end of his team's first game, he complains to his coach of pain in his chest.

Now, please read the following information about some potential causes of pain in one's chest.

1. ATELECTASIS
   
   **Definition:** Collapse of part or all of one lung, preventing normal oxygen absorption.

   **Sex or Age Most Affected:** Both sexes; all ages

   **Causes:** Obstruction of small or large lung air passages by thick mucus plugs, tumors, inhaled objects, or due to chest injury or fractured ribs.

2. HEART ATTACK

   **Definition:** Death of heart-muscle cells from reduced or obstructed blood flow through the coronary arteries.

   **Sex or Age Most Affected:** Adults over 40. This is more common in men, but the incidence is rising for women.
Causes: Partial or complete blockage of coronary arteries. Symptoms are often triggered by an emotional crisis, a heavy meal, or heavy exercise.

3. HEARTBURN

Definition: Discomfort of the upper digestive tract.

Sex or Age Most Affected: All ages, but most common in adults over 60.

Causes: Hiatal hernia (part of stomach protrudes into the chest), ulcers of the esophagus, or irritation of the esophagus caused by stomach acid.

4. TORN MUSCLE

Definition: Torn muscle fibers.

Sex or Age Most Affected: Both sexes; all ages.

Causes: Injury caused by overuse or stress of a muscle group.

Next, after considering the information about the person in the story and the information about the possible cause of the pain in the chest, please estimate the likelihood of the pain in the chest being caused by Atelectasis by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Atelectasis caused the pain in the chest," and 0.00 means "It is certain that Atelectasis did not cause the pain in the chest."

- Atelectasis

_________________
PART IV.

Please read the following story.

Martha B. is a 45-year-old single mother of two teenage boys. She was divorced six years ago but is engaged to be remarried. Unexpectedly, she has been losing weight.

Now, please read the following information about some potential causes of weight loss.

1. ANOREXIA NERVOSA

   Definition: A psychological eating disorder in which a person refuses to eat adequately - in spite of hunger - and loses enough weight to become emaciated.

   Sex or Age Most Affected: Female adolescents and young adults.

   Causes: Unknown, although many patients have family and internal conflicts, including sexual conflicts.

2. BULIMIA

   Definition: A psychological eating disorder characterized by abnormal perception of body image, constant craving for food and binge eating, followed by self-induced vomiting or laxative use.

   Sex or Age Most Affected: Adolescents or young adults, usually female.
Causes: Unknown. The disorder often begins during or after stringent dieting and may be caused by stress related to insufficient food intake.

3. CROHN'S DISEASE

Definition: An inflammatory disease of the ileum, the lower part of the small intestine.

Sex or Age Most Affected: Young adults.

Causes: Unknown.

4. STOMACH ULCER

Definition: A raw spot that develops in the stomach lining.

Sex or Age Most Affected: Both sexes of young adults (20 to 45 years).

Causes: Unknown. Persons with ulcers often have irregular living habits. Many doctors believe emotional tension causes ulcers. A bacterial component may contribute to ulcer formation.

Next, after considering the information about the person in the story and the information about the possible cause of the weight loss, please estimate the likelihood of the weight loss being caused by Anorexia Nervosa by assigning a number between 0.00 and 1.00 below where 1.00 means "It is certain that Anorexia Nervosa caused the weight loss," and 0.00 means "It is certain that Anorexia Nervosa did not cause the weight loss."

- Anorexia Nervosa ____________________
PART V.

NOTE: This survey is confidential, and no one's name will be attached to his or her responses. You do not have to answer any items which you believe are too personal. However, the information we request in Part V. will make our analyses more informative.

Please circle your gender:  **MALE**  **FEMALE**

Please indicate whether you **personally** or a **close friend or family member** has ever experienced the following diseases and disorders.

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<tr>
<th></th>
<th>You Personally</th>
<th>Close Friend/ Family Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Anorexia Nervosa</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>B. Atelectasis</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>C. Bulimia</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>D. Crohn's Disease</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
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<td>Yes  No</td>
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</tr>
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<td>F. Heart Attack</td>
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<td>Yes  No</td>
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<td>G. Heartburn</td>
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<td>I. Rheumatoid Arthritis</td>
<td>Yes  No</td>
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</tr>
<tr>
<td>J. Sprain (e.g., of ankle)</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>K. Stomach Ulcer</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>L. Torn Muscle</td>
<td>Yes  No</td>
<td>Yes  No</td>
</tr>
</tbody>
</table>
APPENDIX C

INFORMED CONSENT FORM

Dear Friend:

Thank you for volunteering to participate in this research project.

Please know that all the information I collect today is confidential. This means that it will be seen only by myself and other qualified researchers and will be used for research purposes only. Further, the information is anonymous. Your name will not appear on any of the data. Instead, I am coding the information by number, not name. Finally, should you decide at any point to discontinue your participation in the project, for whatever reason, please feel free to do so. Though I do not expect this will happen, I want you to know that you are free to leave the study at any point without incurring any kind of penalty.

This study is concerned with how people interpret illness symptoms and the diseases or disorders which may cause them. You will be asked to indicate your familiarity with several diseases. You will also be asked to read a small number of scenarios and information about diseases and make some likelihood estimates.

Please feel free to ask any questions. Once again, thank you for participating in this project.

Sincerely,
Jim Swinehart

I have read the above and understand it.

Signature ___________________________ Date ___________________________
The present study concerns the areas of decision making and cognitive psychology. Previous research has shown that people will often overestimate the likelihood of a class of events when the events are all possible causes of some outcome. For example, people may be told that a lake contains only two species of fish. Further, they are told that 60% of the fish are Species A and 40% are species B. Then, given the assumption that they catch 5 fish, they are asked to estimate the likelihood of all possible combinations of the days' catch, i.e., 5 A fish and 0 B fish, 4 A fish and 1 B fish, 3 A fish and 2 B fish, 2A fish and 3 Bfish, 1 A fish and 4 B fish, and 0 A fish and 5 B fish. The fundamental convention of probability theory tells us that the total likelihood of all possible combinations of the 5 caught fish is 100%. Put differently, it is 100% certain that 5 fish were caught, and this 100% must be divided among the 6 possible combinations of fish caught.

<table>
<thead>
<tr>
<th>Fish Combination</th>
<th>Correct Percent Estimate</th>
<th>Incorrect Estimate (averages for subjects)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A 0B</td>
<td>7.8%</td>
<td>46.6%</td>
</tr>
<tr>
<td>4A 1B</td>
<td>25.9%</td>
<td>53.2%</td>
</tr>
<tr>
<td>3A 2B</td>
<td>34.6%</td>
<td>61.6%</td>
</tr>
<tr>
<td>2A 3B</td>
<td>23.0%</td>
<td>43.9%</td>
</tr>
<tr>
<td>1A 4B</td>
<td>7.7%</td>
<td>23.9%</td>
</tr>
<tr>
<td>0A 5B</td>
<td>1.0%</td>
<td>17.1%</td>
</tr>
<tr>
<td>Sum</td>
<td>100.0%</td>
<td>246.3%</td>
</tr>
</tbody>
</table>

The above table presents data from the Teigen (1974) study listed below. The correct percent estimates are derived from a binomial distribution. It is likely that few people are familiar enough with binomial distributions to be able to use them in this type of situation, but it does appear that subjects in this study greatly overestimated the total likelihood of the fish catch.

More recent research (Sanbonmatsu et al., 1995) has shown that asking people to judge just one of the possibilities, such as 4A fish and 1B fish, increases this overestimation effect. Other work (Lichtenstein et al., 1978) has indicated that people overestimate the likelihood of dying from sensationalized causes of death, such as death due to tornadoes, and underestimate the chances associated with more mundane causes, such as diabetes. One possible reason for this phenomenon is the use of the availability heuristic (Tversky and Kahnemann, 1973). In essence, causes of death which are easily brought to mind, or available, are judged to be more likely than those which are not easily brought to mind.

The present study is an attempt to demonstrate the overestimation phenomenon using symptoms and diseases. This will be a worthwhile endeavor because it may be the case that people will overestimate the likelihood of diseases they are familiar with more so than unfamiliar ones. A reliance on blaming familiar diseases may be an instance of relying
on the availability heuristic. This could potentially lead to delays in seeking appropriate medical treatment.

If you have any further questions about the study, feel free call me, Jim Swinehart, at (708) 246-5190. If you would like more information about this area of research, the references listed below would be a good place to start.


REFERENCES


VITA

James Richard Swinehart, Jr. was born on May 23, 1967 in LaGrange, Illinois. James attended the University of Illinois at Urbana-Champaign where he worked for the Department of Psychology as a research assistant. He received his Bachelor of Science degree in Psychology from the University of Illinois at Urbana-Champaign in May, 1989. He graduated with University Honors.

Mr. Swinehart enrolled in the Graduate School at Loyola University of Chicago in 1993. He is a student in the Applied Social Psychology program. He resides in Western Springs, Illinois.
The thesis submitted by James Richard Swinehart has been read and approved by the following committee:

Emil J. Posavac, Ph.D., Director
Professor, Psychology
Loyola University Chicago

Frederick Bryant, Ph.D., Reader
Professor, Psychology
Loyola University Chicago

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval by the committee with reference to content and form.

The thesis is, therefore, accepted in partial fulfillment of the requirements for the degree of Master of Arts.

April 9, 1996
Date

Emil J. Posavac
Director's Signature