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RISK ATTITUDES IN HEALTH: AN EXPLORATORY STUDY

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ABSTRACT

Recent studies on human decision-making under uncertainty have revealed the following typical behavioral principles: (1) the importance of the status quo as a reference point ("target") for assessing outcomes, (2) the prevalence of risk-aversion for gains, i.e. above-target payoffs, but risk-seeking for potential losses, and (3) a tendency to give more weight or "marginal utility" to a small loss than a gain of the same size.

We investigate whether and how these aspects carry over from the money to the health context, examining the responses to a questionnaire by 325 patients from three outpatient facilities in Palo Alto, California. The questionnaire consisted of twelve hypothetical choice situations each with the choice between two alternative modes of treatment for a supposed illness. In each case, one of the options promised a certain (favorable or unfavorable) health effect, the other one a probabilistic effect.

The majority choices confirm the relevance for the health context of all three above-mentioned priciples. Risk-aversion for gains, risk-seeking for losses and the differences in slope of the utility function were all significant and substantial in magnitude. When trying to trace back differences in risk attitudes to demographic or socioeconomic characteristics of the respondents, we find that education is the most important correlate: choices of people with more years of schooling exhibit less risk-aversion for gains and less risk-seeking for losses and thus correspond to a more linear relationship between health and utility.

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RISK ATTITUDES IN HEALTH: AN EXPLORATORY STUDY

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1. Introduction

In the past few years psychologists and economists have conducted numerous experiments on human decision-making under uncertainty (for overviews see Kahnemann & Tversky, 1979, Shoemaker, 1980). A primary goal of many of these studies was to test the empirical validity of the expected utility maximization hypothesis. Further, since the outcomes of the choices are typically stated as payoffs in money (or, at least, a marketable commodity), the results can be used to construct "utility-of-money" functions for the respondents.

These studies frequently report the existence of a reference point (often the status quo or some "target return") against which a decision-maker measures the payoffs. Decision behavior was found to differ substantially between the two regions of payoffs separated by this benchmark. Kahnemann & Tversky (1979), e.g., observed that a majority of subjects proved to be risk-averse (concave utility) for above-target outcomes, but risk-prone (convex utility) for below-target outcomes. Moreover marginal utility appeared to be considerably larger below the reference point than above (see Figure 1).

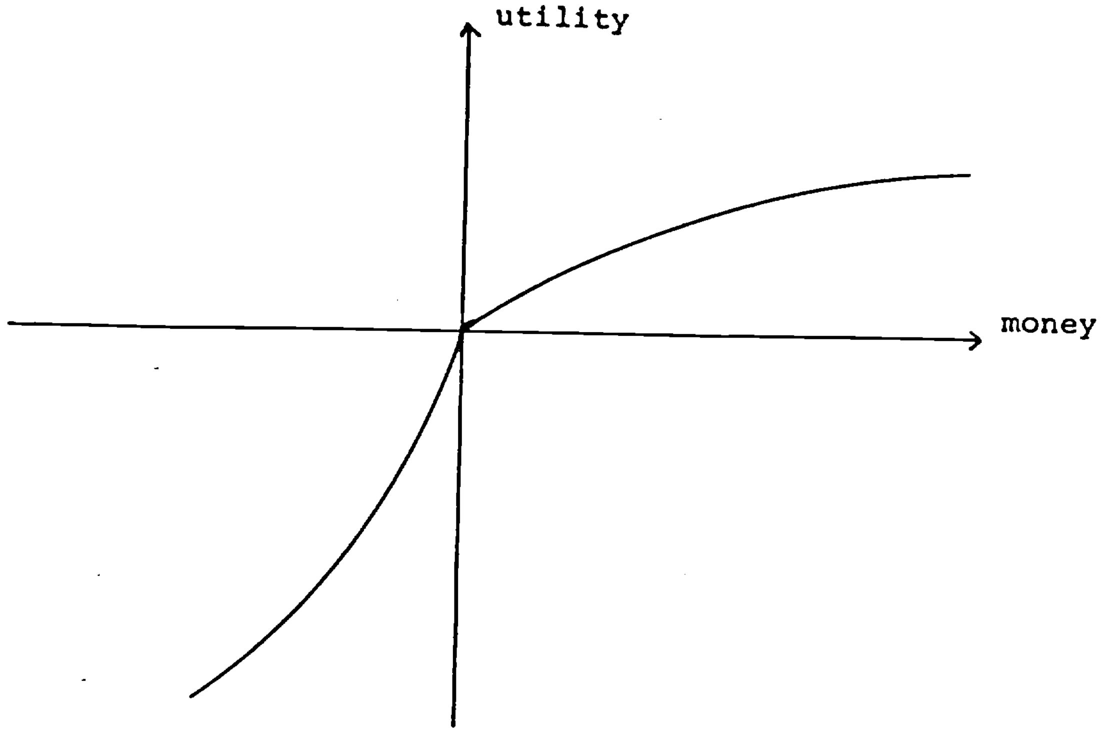

Figure 1: A typical empirical utility-of-money curve

A natural extension of this research is to determine whether the same principles govern choice behavior when the consequences ("payoffs") are not monetary but involve a different dimension, e.g., the decision-maker's health. This is an interesting question for two reasons. First, if the results of studies of money choices were replicated in health, this would suggest the possibility of a general law of decision-making under uncertainty and thereby broaden the psychological foundation of decision theory. Second, and more practically, evidence on typical utility-of-health relationships could provide physicians with information on how therapeutic effects and side-effects are valued by patients in general and could, therefore, help them to make better choices on behalf of their patients.[1/]

In an important pioneer work on this subject, Eraker & Sox (1981) asked respondents to make hypothetical choices between alternative drug therapies where the health changes associated with the therapies were formulated in terms of discomfort (hours of headache or nausea), physical disability (distance walked before developing chest pain), or life expectancy. The general procedure was to let respondents choose between one mode of treatment with a certain effect and one with the same expected value but considerable uncertainty. Preferences revealed by the answers to their questions confirm two of the main findings of the studies on money choices, namely a tendency toward risk-aversion with respect to favorable outcomes and risk-seeking with respect to unfavorable outcomes.

The purpose of this paper is to raise and attempt to answer several questions regarding risk attitudes with respect to health that were not addressed in the Eraker-Sox study:

1) Is the slope of the utility-of-health function different for losses than for gains? In Eraker-Sox each choice involved only positive therapeutic effects (gains) or only side effects (losses). We add choices that cross the reference point by introducing options that contain both a chance of improvement and a chance of deterioration in health.

2) How strong is the aversion to risk for gains and the preference for risk for losses? In Eraker-Sox each choice involved two alternative options that were identical with respect to the expected magnitudes of

the consequences of the therapy. There was no possibility, therefore, to learn anything about the strength of these risk attitudes. It would be interesting to know if the preference for certain over uncertain prospects (in gains) persists even when the latter has a larger mean. We therefore include choice situations where the expected values differ, as well as situations where they are equal.

3) Are differences in individual attitudes toward risk correlated with socioeconomic characteristics? Previous studies have revealed large differences across individuals but have not suggested reasons for these differences. As a modest first step toward explaining how risk attitudes develop, we gathered data on the socioeconomic characteristics of the respondents and related these characteristics to their risk attitudes.

The remainder of this paper is organized in the following way. Section 2 recapitulates the theories to be tested. Section 3 describes the design of the questionnaire and the collection of data. Section 4 discusses the main findings of the data analysis and Section 5 presents conclusions and proposals for further research.

2. Theories of Decision-Making under Uncertainty

Among the more recently proposed theories of risky choice behavior are Kahneman & Tversky's (1979) "prospect theory" and Fishburn's (1977) "mean-risk dominance criterion." Both are briefly restated here.

According to prospect theory, the evaluation of an uncertain prospect ("lottery") A by an individual can be broken into two components, a "value function" v and a "weighting function" f. Suppose that A consists of n possible payoffs x_i (i=1,...,n) with associated probabilities p_i. Then the overall value of the lottery A according to prospect theory is

$$(2.1)\quad V(A) = V(x_1,p_1;\ldots;x_n,p_n) = \sum_{i=1}^{n} f(p_i)\cdot v(x_i) \ .$$

As is clear from (2.1), the domain of the value function v consists of payoffs from the lottery, i.e. changes in wealth (or health, respectively) rather than achieved levels of it as proposed by expected utility theory. This stresses the importance of the initial wealth position or status quo as a reference point. As to the curvature of the value function, Kahneman & Tversky suggest that v is concave for gains ($x>0$) and convex for losses ($x<0$). The psychological basis for this phenomenon is the relative overvaluation of small gains and losses owing to their greater familiarity and the inability to fully imagine large departures from the status quo. In the neighborhood of $x=0$, v is claimed to be not differentiable, but steeper for small losses than for small gains.

The probability weighting function f is normalized by setting $f(0) = 0$ and $f(1) = 1$. If, moreover, f were equal to the identity function, then prospect theory would formally collapse to expected utility (or value) maximization. Kahneman & Tversky, however, theorize that due to an imperfect ability to discriminate among low probabilities, very low values of p, as soon as they are recognized as different from zero, are overweighted ($f(p)>p$), whereas all probabilities in the middle range are underweighted ($f(p)<p$) relative to the case of certainty.

The mean-risk dominance model generalizes the reference point concept by allowing the benchmark, denoted by t, to differ from the status quo. A prospect A is judged by its mean payoff and its "riskiness" where the latter is defined by

$$(2.2) \qquad R(A) = R(x_1,p_1;\ldots;x_n,p_n) = \sum_{i\in T} p_i\cdot(t-x_i)^{\alpha}$$

with

$$(2.3) \qquad T = \{i \mid 1 \leqq i \leqq n \text{ and } x_i<t\}$$

and $\alpha>0$ a parameter. For this measure only below-target outcomes count. Prospect A dominates another prospect B is it has larger mean and smaller riskiness (with equality allowed in one of the two criteria). While this constitutes only a partial ordering, an obvious supplementation consists of maximizing a weighted difference between mean and riskiness with the weights 1 and b (b>0), respectively. As Fishburn (1977) showed, this procedure is equivalent to applying expected utility maximization to the utility function

$$(2.4) \qquad u(x) = \begin{cases} x & \text{if } x \geqq t \\ x - b\cdot(t-x)^{\alpha} & \text{if } x < t. \end{cases}$$

This function is clearly linear for above-target outcomes and steeper to the left of t than to the right. Its curvature for below-target outcomes depends upon the value of the parameter α: for $\alpha>1$ it is concave, for $\alpha=1$ linear, and for $\alpha<1$ convex.

3. Questionnaire Design and Data Collection

We designed a questionnaire comprising six different medical scenarios, each with at most four similar choice situations. In each case the consequences of two alternative treatments of a hypothetical condition were described, one of them involving a certain outcome and the other an uncertain one. Both the magnitudes of the effects and the probabilities associated with the uncertain option were stated explicitly in numerical terms. Subjects were asked to indicate how they would prefer to be treated in each situation.

In translating stylized choice situations into plausible health-related scenarios several difficulties were encountered. Unlike money, health is multi-dimensional, but in order to observe pure risk attitudes all outcomes belonging to one particular choice situation had to be stated in terms of one dimension. This created a plausibility problem, especially in cases that contain both gains and losses. We had to describe medical circumstances in which the same therapy has the potential to alleviate as well as to aggravate an existing health problem.

Furthermore, there is no generally accepted cardinal scale for measuring the severity of pain or disability, so we decided to keep severity constant and vary duration of the effects. Unlike Eraker & Sox we did not use a life expectancy framework because this allows differences in time preference to influence the choice and, therefore, makes questionable the interpretation of the answers within the risk attitude models described above. Also we did not distinguish scenarios into the categories of discomfort and disability, but described situations in which both types of effects are present (e.g. headaches and the inability to work, read, or concentrate). By mentioning pain as well as physical limitation we tried to make the medical problem sound important as well as understandable to the respondents.

In this paper we will report on only three of the six scenarios, which are reprinted in the Appendix. The other three scenarios are left out because they contained choice situations which were mathematically more complicated and probably less plausible making those results less dependable.

In June/July 1981 the questionnaires were given to adult patients in the waiting rooms of three outpatient facilities in the Palo Alto (California) area, namely the Veterans Administration Medical Center, the Stanford General Medical Clinic and the Mid-Peninsula Health Service. Of the 325 completed questionnaires returned, roughly equal numbers came from each of the three sources.

Table 1 contains summary statistics of various demographic and socio-economic characteristics of the sample population.
As can be been from Table 1, women and men are roughly equal in proportion. All adult age groups, education levels, and income classes were well represented. The three last-mentioned attributes were originally observed in categorical form (6-8 classes) and then translated into the continuous variables shown in Table 1. Note that 37% and 42%, respectively, had recently experienced the medical conditions in which the scenarios were framed. Although the sample was drawn from the waiting rooms of medical clinics, more than 66% of the respondents assessed their health status as good or excellent; they were not a particularly sick population.

Table 1: Summary Statistics of the Sample (N=325)

Variable	Description	Mean	Standard Deviation
CAGE	Age, continuous in years	47.08	16.49
CEDUC	Schooling, continuous in years	14.38	2.72
ADJFINC	Income adjusted for family size in 1000 Dollars	12.49	7.86
DFEMAL	=1 if female	.474	
DMAR	=1 if married	.572	
DCHILD	=1 if child under 18 in household	.318	
DSMOKE	=1 if currently smokes	.226	
DEXGHLTH	=1 if excellent or good health	.662	
DHEAD	=1 if recently experienced headaches	.374	
DBACK	=1 if recently experienced back pain	.424	
DLEAVE	=1 if eligible for paid sick-leave	.326	
DVA [a/]	=1 if at Veterans Administration	.311	
DMHS [a/]	=1 if at Mid-Peninsula Health Service	.329	

a/ The omitted class is the Stanford General Medical Clinic.

4. Results

4.1 Testing Hypotheses on Risky Choice Behavior

Table 2 summarizes the results of the choices for each of the twelve choice situations. The numbers in the third column represent the percentages of all respondents who chose the certain option. In the fifth column only those respondents were counted who gave consistent answers within any given scenario. An answer was classified as inconsistent whenever a dominated alternative was picked (option B in I,1 or A in II,1) or the respondent switched preferences between certainty and uncertainty in the wrong direction. An example for the latter case is choosing B in I,2 and switching to A in I,3 although alternative B is now more attractive than before whereas A stayed the same. As can be seen from the table, the percentage of respondents who made at least one mistake lies around 10 percent in scenario I, 14 percent in scenario II, and 2 percent in scenario III. So on the whole the questions seem to have been well understood. Our subsequent analysis was confined to the set of consistent answers.

Table 2: Percentage Choosing Certainty

Scenario	Situation	all answers		only consistent answers	
		% A	N	% A	N
I	1	94.1	307	100	278
	2	60.5	299	65.3	274
	3	42.9	301	43.8	274
	4	34.9	307	35.2	273
II	1	11.0	317	0	272
	2	38.6	308	33.2	265
	3	62.7	306	60.7	267
	4	65.9	305	64.0	267
III	1	76.3	304	76.9	299
	2	70.6	299	70.6	293
	3	52.5	299	53.6	293
	4	39.1	299	39.0	292

Those choice situations in which the certain and the uncertain effects had equal expected size (I,2; II,2; III,1) can be used to test hypotheses derived from the theories presented in Section 2. Table 3 summarizes the predictions made by these theories and compares them with the majority choice observed in our sample.

The null hypothesis in each case is that the sample was drawn from a population where everybody was indifferent between the respective options and had to toss a coin to reach a decision. This would amount to taking N draws from a binominal distribution with the parameter $\pi=.5$. The observed frequencies, however, lead to a rejection of the null hypothesis in all three cases at the 99% confidence level.

In scenario I, situation 2, a significant majority prefers a certain relief from headaches to an uncertain one with equal mean duration, thereby exhibiting risk-aversion with respect to gains. Prospect theory would predict such a behavior both because of the concavity of the value function for gains and because of the underweighting of the probability 1/2 associated with the uncertain relief. In contrast, the mean-risk dominance criterion is not consistent with this choice since it implies risk-neutrality on the gain side.

Prospect theory is also supported by the results of scenario II, situation 2, where the majority prefers an uncertain to a certain side-effect in terms of headaches, i.e. risk-seeking with respect to losses in health. The convexity of the value function for losses and, again, the underweighting of the probability 1/2 contribute to this prediction. The mean-risk dominance model is immune to refutation in this case since by leaving the parameter α unspecified it is consistent with all three kinds of risk attitude on the loss side. Our results suggest that in the health context α has a value less than one.

Both results replicate findings by Eraker & Sox from similar scenarios in their study.

Tabel 3: Tests of Risk Attitude Theories

Scenario, situation	Description of alternatives [a]	Choice predicted by: Prospect Theory	Mean-Risk Dominance	Majority Choice	Percentage
I,2	A: certain gain B: uncertain gain	A	indiffer- ence	A	65.3
II,2	A: certain loss B: uncertain loss	B	$\alpha>1$:A $\alpha=1$:indiff. $\alpha<1$:B	B	66.8
III,1	A: no change B: gain or loss	A	A	A	76.9

[a] expected magnitudes of the effects are identical in each case.

Finally in Scenario III, situation 1, the uncertain option B can be regarded as an even bet on a gain and a loss of equal magnitude. Both Prospect Theory and the Mean-Risk Dominance model propose that the marginal disutility of losses is larger in absolute value than the marginal utility of gains and, therefore, predict the rejection of the gamble in favor of the status quo. A clear majority of the sample confirms this prediction. Put together, the utility-of-health function appears to have the same shape as the utility-of-money function that was constructed using the results of earlier studies and depicted in Figure 1.

4.2 The Intensity of Risk Attitutes

While the discussion of the results so far is concerned with qualitative aspects of the utility-of-health function we now draw some conclusions on the quantitative degree of the concavity on the gain side and the convexity on the loss side. For example, is the risk aversion with respect to gains strong enough to make a certain gain preferable even to an uncertain one that is twice as large in expected magnitude?

To answer this question and similar ones for the other two scenarios we varied the magnitude of the uncertain effect (or its probability, respectively) across the choice situations in each scenario, holding the certain option constant. By looking at the percentage distributions of answers in successive situations (see Table 2) we tried to infer what difference in expected value would exactly compensate for the greater variance involved in the uncertain option, thus bringing about a 50:50 division of respondents between the two alternative choices.

In Scenario I, 65.3% of all subjects preferred the certain gain to an uncertain gain of equal expected magnitude (situation 2), but with the uncertain magnitude 25% larger, the proportion preferring certainty went down to 43.8% (situation 3). Assuming a constant rate of switchover from the certain to the uncertain gain as the latter appreciated in size, an even split of answers would be obtained at a "risk premium" of about 18% of the magnitude of the certain gain.

Whether this figure is perceived as "high" or "low" and accordingly the utility function as "strongly curved" or "fairly linear" largely depends, of course, on what one anticipated this figure to be. Two remarks seem worth adding, though. First, the extent of risk-aversion in the domain of gains does not appear to be trivial since an 18% difference in expected size is definitely more than a marginal distinction. Respondents obviously did not place overwhelming importance on the mean effect but were willing to trade off mean against a smaller variance. On the other hand, their choices exhibit a pronounced departure from maximin behavior which would have implied picking the certain option regardless of the mean of option B.

Similarly, in Scenario II the share of respondents who chose the uncertain loss rather than the certain one dropped from 66.8 to 39.3% as the former was increased in size by one-fourth. Again assuming a constant rate of switchover from the uncertain to the certain option, a 15% increase in expected magnitude of the uncertain loss would just make the median respondent indifferent between the two alternatives. This interpretation is similar to the one given above concerning the gain side. The degree of risk-seeking with respect to losses is neither merely marginal nor is it large enough to induce people always to choose the option with the smallest possible loss (maximax criterion).

In addition to these observations on the degrees of curvature in the two parts of the utility function for health changes, we attempted to measure the differences in slope just left and just right of the reference point. In the four situation of Scenario III the certain option is always "no change" whereas the uncertain one offers a chance of a gain and a chance of a loss equal in magnitude, with the odds varying from 50:50 to 60:40, 70:30 and, finally, 80:20 in favor of the gain. In the first three cases a majority of subjects declined to take the gamble; only the 80:20 odds were acceptable to a majority.

Again looking at the percentages choosing certainty in the last two situations (53.6% and 39%, respectively) and assuming a switchover linear to the ratio of the odds offered, we infer that the odds required to create just an even split of the sample would be 72.5:27.5 or about 2.64:1. The figure 2.64 can then be interpreted as the ratio of slopes of the utility function below and above the reference point.

It is worth mentioning that this slope differential is considerably smaller than the median value of 4.8 which Fishburn & Kochenberger (1979) found when they tried to fit utility functions to people's choices in the money context. Moreover, our estimate is probably biased upward since in our medical scenarios the uncertain alternative implied undergoing an operations whereas the certain one did not. To the extent that respondents attributed some fixed (psychic) costs to having an operation in the first place, e.g. because they did not quite believe our assertion that the operation was completely safe, even a utility function symmetric around the reference point would lead the majority to reject the operation at least in the case of even chances of alleviating or aggravating the illness. Whether this effect alone is strong enough to explain the preference for the no-change option to its full extent (and, therefore, to wipe out any slope differential) remains an open question.

4.3 Risk Attitude and Socioeconomic Characteristics

We finally examined what personal characteristics of the respondents are associated with certain risk attitudes. This line of research was not systematically pursued by Eraker & Sox in their similar study. While they report that in their sample there were no differences in risk attitudes by age, sex, or level of education, they did not use multivariate techniques to control for influences of other variables when they looked at the effects of each variable in turn.

We tried to fill this gap by estimating the association between risk attitudes and the set of background variables introduced above (Table 1) in a multiple regression framework. To this end we transformed the responses to the various situations in each of the three scenarios into continuous left-hand variables.

Our procedure is demonstrated with the help of Scenario I. For each respondent an artificial variable DRAGAIN ("degree of risk-aversion in gains") was defined as the risk premium in percentage terms that would just make the respondent indifferent between the certain and the uncertain gain. The value was taken to be the midpoint of the risk premiums implicit in those two situations where the respondent switched from the certain to the uncertain choice, i.e. 12.5 for those who preferred the certain gain in situation 2 and the uncertain one in situation 3, and 37.5 for those who chose certainty in situation 3 and uncertainty in situation 4. For those respondents who always picked either in certain or the uncertain option, the value of DRAGAIN was set arbitrarily by extrapolating percentages so as to create equal distances between any two successive points on the index scale, i.e., 62.5 for the former and -12.5 for the latter group.[2/]

Analogously, a variable DRSLOSS ("degree of risk-seeking in losses") was defined using the responses to Scenario II. Finally we created a variable SLOPERAT measuring the ratio of slopes of the utility function left and right of the reference point as inferred from the odds ratio at which the individual would just accept the operation offered in Scenario III. Again interpolation and extrapolation were performed with some degree of arbitrariness.

Each of the dependent variables was regressed on the full set of socioeconomic variables, with the results reported in Table 4. Very few of the regression coefficients were significantly larger than their standard errors, partly because of multicollinearity among the RHS variables. The R^2 of .14 and .16 for the first two equations is not too bad for cross-section observations on individuals. The R^2 of .05 for the third equation indicates that only a negligible portion of the variation in responses to Scenario III is accounted for by differences in the socioeconomic variables included in our study.

As is true of many studies in the human capital field, formal education appears to be the most important variable. The regression coefficient for years of schooling has high statistical significance ($p < .01$) in two of the three equations, and it is more than 1.5 times its standard error in the third. People with more years of schooling are less risk-averse in gains, less risk-prone towards losses, and have a smaller kink in their utility function at the reference point. In all three respects their behavior fits least well into the pattern proposed by Prospect Theory, but tends towards a linear relationship between health and utility. One possible explanation for this finding is that better educated people are more used to performing numerical calculations and are, therefore, more inclined to use expected payoff as an important decision parameter.

In addition to education, two other variables, income and marriage status, exhibit a sign pattern of coefficients that discriminates consistently between people behaving according to Prospect Theory and those who do not. The risk attitudes proposed by this theory are most

Table 4: OLS Regression Results on Risk Attitudes

dependent variable / RHS variable	DRAGAIN a/ regression coefficient	DRAGAIN a/ standard error	DRSLOSS b/ regression coefficient	DRSLOSS b/ standard error	SLOPERAT c/ regression coefficient	SLOPERAT c/ standard error
CAGE	.108	(.139)	.223	(.147)	-.004	(.010)
CEDUC	-3.309**	(.943)	-1.380	(.923)	-.169**	(.065)
ADJFINC	.253	(.292)	.275	(.287)	.002	(.021)
DFEMAL	-6.824	(5.188)	2.903	(5.106)	-.206	(.359)
DMAR	-3.555	(4.186)	-1.631	(4.232)	-.068	(.296)
DCHILD	5.214	(4.876)	-1.375	(4.870)	.108	(.338)
DSMOKE	-6.487	(4.776)	7.217	(4.920)	-.550	(.337)
DEXGHLTH	-3.716	(4.980)	-1.942	(5.056)	.150	(.347)
DHEAD/DBACK	1.969	(4.237)	-6.063	(4.271)	.518	(.284)
DLEAVE	4.135	(4.359)	1.880	(4.317)	-.076	(.308)
DVA	1.783	(5.885)	14.844*	(5.911)	-.149	(.413)
DMHS	-4.487	(5.155)	-4.572	(5.183)	.661	(.370)
R^2	.143		.161		.055	

a/ Degree of risk-aversion defined continuously by the percentage by which the uncertain gain would have to exceed the certain gain in expected size to make the subject indifferent.

b/ Degree of risk-seeking defined analogously for losses.

c/ Ratio of the slope of the value function for losses and gains, respectively, defined continously by the odds at which the subject would (just) take the operation in Scenario III.

* $p < .05$ ** $p < .01$

pronounced in groups of people who have few years of schooling, high income, and are either single or divorced. Unfortunately, we have no intuitively plausible reason why the two last mentioned variables should have this influence. The income effect may be a statistical artifact stemming from the strong correlation between income and schooling (r=.40).

A few RHS are associated consistently with a preference either for or against certainty (i.e. their coefficients have a sign pattern of +,-,+ or -,+,- in the three equations, respectively). As might be expected, respondents with children in the household displayed more risk-aversion and less risk-seeking. This result makes intuitive sense because these people probably avoid risks in other aspects of life, too. A greater preference for certainty can also be observed in persons who have had recent experience with the conditions in which the scenarios were framed. It is worth noting, however, that this effect, like most others, is not significant at the 95% confidence level in any of the three regressions. Significant differences between the two groups of respondents with and without those experiences would have thrown doubt on the legitimacy of drawing inferences from these hypothetical choices for people's real world behavior.

The opposite sign pattern indicating greater willingness to choose the uncertain options is found for smokers and for women. The first of these two findings is hardly surprising since the very act of smoking signifies that one is prepared to accept a lottery on one's own health. In contrast, it is difficult to determine why women should be less risk-averse than men.

None of the remaining variables shows any consistent pattern of influence on the three aspects of risk attitude examined in this study. It is noteworthy that neither self-reported health status (i.e. the person's initial position in health) nor eligibility for paid sick-leave seem to have any significant impact on people's willingness to accept health gambles.

The only other significant coefficient is the one associated with the source dummy DVA in the equation for risk-seeking on the loss side. This is somewhat disturbing given the fact that so many other seemingly important attributes of the respondents, which discriminate between the Veterans Administration patients and the rest of the sample (only men, higher age, less schooling, lower income, poorer health, less children), are controlled for. However, since this is the only one of the six source coefficients that is significant, we do not think this implies that a systematic influence is exerted by the environment where the data are collected. If this were the case, then it would be questionable to generalize the results and draw conclusions on the risk attitudes of the population at large from this study.

5. Conclusions and Suggestions for Further Research

In this paper we investigated whether the typical patterns of decision-making under uncertainty that were observed empirically in many previous studies carry over from choices among monetary prospects to the health dimension. Using a questionnaire which presented hypothetical choice situations with payoffs in terms of outcomes of medical therapy, we found that the function relating utility to health changes (which is implicit in the majority choices) resembles the utility-of-money function derived from the results of the studies cited above: people display risk-aversion with respect to gains and risk-seeking towards losses, and they reject "fair" gambles on gains and losses, i.e. marginal utility of favorable health effects seems to be smaller than marginal disutility of unfavorable changes. These results confirm for the health dimension the prediction made by various theories on risky choice behavior that the initial position plays an important role as a reference point for evaluating outcomes.

The aversion to risk for gains and preference for risk when confronted with possible losses are not only statistically significant but also substantial in magnitude. We estimate that in order for the study population to be indifferent between a certain and an uncertain gain, the latter would have to be 18% higher in expected value. For a certain loss to be considered to be regarded as equal to an uncertain one, the former would have to be 15% higher in expected value.

The regressions that attempted to explain differences in attitudes toward risk across individuals revealed that education was the most important correlate. Ceteris paribus, the higher the level of education the less the subjects' choices conform to prospect theory and the more closely they approximate a linear relationship between health and utility.

While this study has added some new dimensions to the analysis of risk attitudes, the results are tentative and must be treated with caution. The sample size is relatively small and the number of questions that could be asked, limited. It would be desirable to attempt to replicate these results, not only in the health domain but in others as well. There seems to be general support here for prospect theory, but it would clearly be desirable to learn more about the strength of this departure from linearity and to identify those characteristics that are related to individual differences in attitudes toward risk.

Also, the results presented here exclude the practically relevant case of catastrophic but low-probability events. Accordingly, we cannot test those aspects of risk attitude theories that are concerned with behavior towards small probabilities, especially the "overweighting" effect proposed by Kahneman & Tversky. Unlike monetary choices, it is very difficult to describe plausible medical scenarios where large ("catastrophic") effects and, as alternative options, small certain effects can be measured along the same dimension because what makes an illness catastrophic is seldom its duration but much rather its severity, for which no generally agreed scale exists.

FOOTNOTES

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1. It may not be feasible or practical for physicians to ascertain separate risk attitudes for each patient.

2. The regression results were not sensitive to changes in the formula used for the extrapolation.

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Appendix: The Questionnaire Scenarios

I. Imagine that you are subject to headaches that last 6 hours every day if not treated and are so severe that you are unable to work, read or concentrate while they last. Suppose there are two drugs available for headaches:

drug A always gives you 2 hours of relief from headaches (i.e., the duration is reduced from 6 to 4 hours);

drug B may or may not give you relief from headaches.

Neither drug has any unfavorable side effects. Once you begin using one drug, it is not possible to switch to the other in the future. Check your choice in each of the following four situations:

Situation 1)

___ drug A: you will get 2 hours of relief from headaches.

___ drug B: there is a 50% chance that you will get 2 hours of relief from headaches, and a 50% chance of no relief.

Situation 2)

___ drug A: you will get 2 hours of relief from headaches.

___ drug B: there is a 50% chance that you will get 4 hours of relief from headaches, and a 50% chance of no relief.

Situation 3)

___ drug A: you will get 2 hours of relief from headaches.

___ drug B: there is a 50% chance that you will get 5 hours of relief from headaches, and a 50% chance of no relief.

Situation 4)

___ drug A: you will get 2 hours of relief from headaches.

___ drug B: there is a 50% chance that you will get 6 hours of relief from headaches, and a 50% chance of no relief.

II. Imagine that you have a serious disease which must be treated with drugs. Suppose that there are two drugs available which are both equally effective against this disease, but differ in their possible side effects:

drug A causes headaches that last for 2 hours each day;

drug B may or may not cause daily headaches.

Once you choose one drug, it is not possible to switch to the other one in the future. Remember that both are equally effective in treating the serious disease.

Check your choice for <u>each</u> of the following four situations:

<u>Situation 1)</u> ___ drug A: you will have 2 hours of headache per day.

___ drug B: there is a 50% chance that you will have 2 hours of headache per day, and a 50% chance of no headache.

<u>Situation 2)</u> ___ drug A: you will have 2 hours of headache per day.

___ drug B: there is a 50% chance that you will have 4 hours of headache per day, and a 50% chance of no headache.

<u>Situation 3)</u> ___ drug A: you will have 2 hours of headache per day.

___ drug B: there is a 50% chance that you will have 5 hours of headache per day, and a 50% chance of no headache.

<u>Situation 4)</u> ___ drug A: you will have 2 hours of headache per day.

___ drug B: there is a 50% chance that you will have 6 hours of headache per day, and a 50% chance of no headache.

III. Suppose that you have had back pain for two years. Despite the best medical treatment available, you have pain that lasts for 6 hours every day and makes you lie down.

A new surgical operation for back pain is now available. The operation is safe and requires only local anaesthetic and one day of recovery time. When the operation is successful, the duration of daily pain is reduced by 2 hours. When the operation fails, the duration of pain is 2 hours longer than before the operation. The effects of the operation are permanent.

The success rate for this operation is not yet known. How would you feel about having the operation if the success rate were as shown below? Check your answer for <u>each</u> of the following four situations:

<u>Situation 1)</u> ___ no operation: 6 hours of pain per day;

___ operation: 50% success (4 hours of pain);
50% failure (8 hours of pain).

<u>Situation 2)</u> ___ no operation: 6 hours of pain per day;

___ operation: 60% success (4 hours of pain);
40% failure (8 hours of pain).

<u>Situation 3)</u> ___ no operation: 6 hours of pain per day;

___ operation: 70% success (4 hours of pain);
30% failure (8 hours of pain).

<u>Situation 4)</u> ___ no operation: 6 hours of pain per day;

___ operation: 80% success (4 hours of pain);
20% failure (8 hours of pain).