

DECISION RESEARCH

June 26, 1989

Professor Stuart R. Walker
Centre for Medicines Research
Woodmansterne Road
Carshalton
Surrey SM5 4DS
England

Dear Stuart:

Enclosed is the revised version of my lecture. I hope you find it in satisfactory shape.

Best wishes,



Paul Slovic
Research Associate

Enclosure

PS/ch

P.S. I believe we sent you better quality figures with the first draft. Please use those. Note that two of them - Figures 2 and 12 of the first draft - have been deleted from this version.

Royal College of Physicians
London

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with the production, use, transport, and disposal of chemicals (Roper, 1985). When people in the U.S. are asked to report the first thing that comes to mind when they hear the word "chemicals," the dominant response is "dangerous" or some closely related term (toxic, hazardous, poisonous, harmful, deadly, pollution, risk). Beneficial aspects of chemical technologies are rarely mentioned (Slovic, Kraus, & Malmfors, in preparation).

In many places, manufacturers and users of industrial and agricultural chemicals are virtually at war with the public and the regulatory authorities. At the same time, manufacturers of another important chemical technology, pharmaceutical drugs, are also concerned about what appears to be a changing social and political environment. The preface to a recent book reporting the proceedings of an international conference on the perception and management of drug safety risks summarized these concerns as follows:

"In the past two decades public debate about the risks, benefits, and safety associated with drugs has intensified. Public disputes over risks are brought to court when individuals seek compensation for health problems attributed to a pharmaceutical product. The issue reaches legislatures and regulatory agencies when consumer advocates seek to influence the standards of drug usage. Front-page news tends to focus on accident or other risk events with drugs.

Drug risk and drug safety have become an important political issue. Drug regulatory agencies have been instituted, and their responsibility has increased. The approval to market a drug is dependent on a set of sophisticated studies executed according to strict protocols and scientifically defined criteria. Drug surveillance activities have gained recognition, and reporting systems to identify drug safety problems have been strengthened. The understanding and management of drug safety is, nonetheless, beset by doubts, disagreements, and disputes. Conflict occurs over the significance of risk, the adequacy of evidence, the methodologies used to evaluate and measure risk, the standards that guide regulation, and the optimal means of communicating risk information to the public."

(Horisberger & Dinkel, 1989; pg. v).

At this same conference, Dr. Walter von Wartburg elaborated these concerns:

"Drug risks . . . constitute a major anxiety today If we look only at the 1980s, we see a phenomenon which was and still is difficult to explain. A number of old, established drugs have suddenly disappeared. We find quite a number of newly introduced 'wonder' drugs being withdrawn after a promising start. The number of drug issues has

been rising rather dramatically.¹ And both manufacturers and drug-regulatory authorities have come under increasing public criticism" (von Wartburg, 1989, p. 39). In part, von Wartburg argued, this change can be attributed to the emergence of new publics in the management of drug risks--patients, the public at large, politicians, the media, consumer organizations, and special interest groups.

Working effectively with these new publics brings issues of perception and communication into prominence. Knowledge of perception has been shown to be vitally important in understanding how individuals and societies manage the risks of daily life (The Royal Society, 1983; Slovic, 1987). In medicine, perceptions of drug risks are likely to influence patients' treatment choices, their compliance with treatment regimens, their views on the acceptability of adverse reactions and the drugs that cause them, and their attitudes toward government regulation of drugs (Burley & Inman, 1988). Understanding perceptions is a prerequisite for designing better communication materials for patients and the public.

Risk Perception and the RAD-AR Program

Within the pharmaceutical industry, RAD-AR, standing for Risk-benefit Assessment of Drugs--Analysis and Response, is a new program designed to improve the risk management process. Research on the

¹ Evidence for this claim is provided by Spriet-Pourra and Auriche (1988) who examined 77 cases in which medicines were withdrawn from the market in France, Germany, the United Kingdom, and the United States between 1961 and 1988. They found that withdrawals increased from a rate of 2.2 products per year prior to 1983 to 8.6 products per year thereafter.

perception of risks has been designated as a priority topic within the RAD-AR program. To date, few studies have examined the perceptions of risk from pharmaceutical products. The RAD-AR program is attempting to remedy this deficiency by conducting a series of national surveys designed to meet the following objectives:

1. Describe precisely and quantitatively the public's perceptions of risk and benefit from the use of various kinds of prescription drugs.

2. Place perceptions of prescription drugs within a broader context of risk perceptions regarding many other activities (e.g., driving, smoking) and technologies (e.g., air travel, pesticides), including other medical technologies (X-rays, surgery).

3. Allow comparisons to be made across populations from different nations and, within national samples, across important personal and demographic characteristics (e.g., health status, age).

4. Provide baseline data that will allow the impact of new drug problems and controversies to be monitored and allow trends in relevant attitudes and perceptions to be followed over time.

5. Help pharmaceutical companies understand the influence of public perceptions on the sociopolitical environment in which they operate.

6. Provide guidance for communication programs.

The first study in this series examined the attitudes and perceptions of a representative sample of the public in Sweden (Slovic, Kraus, Lappe, Letzel, & Malmfors, 1989). Parts of this survey were

subsequently replicated in the United Kingdom with a large sample of patients suffering from ankylosing spondylitis (O'Brien, Elwood, & Calin, 1989). A third survey of the general public in Canada is presently being completed and several additional studies in other nations are in the planning stages. After a brief general introduction to the study of risk perception, I shall describe the results of the study in Sweden and, in less detail, the results of the patient survey in Britain.

The Psychometric Paradigm

One broad strategy for studying perceived risk is to develop a taxonomy for hazards that can be used to understand and predict responses to their risks. A taxonomic scheme might explain, for example, people's extreme aversion to some hazards, their indifference to others, and the discrepancies between these reactions and experts' opinions. The most common approach to this goal has employed the psychometric paradigm (Slovic, 1987) which uses psychophysical scaling and multivariate analysis techniques to produce quantitative representations or "cognitive maps" of risk attitudes and perceptions. Within the psychometric paradigm, people make quantitative judgments about the current and desired riskiness of diverse hazards and the desired level of regulation of each. These judgments are then related to judgments about other properties, such as the hazard's status on characteristics that have been hypothesized to account for risk perceptions and attitudes (e.g., voluntariness, dread, knowledge,

controllability) and the benefits that each hazard provides to individuals and to society.

Results from these studies have shown that perceived risk is quantifiable and predictable. Psychometric techniques seem well suited for identifying similarities and differences among groups with regard to risk perceptions and attitudes (see Table 1). They have also shown that the concept "risk" means different things to different people. When experts judge risk, their responses correlate highly with technical estimates of annual fatalities. Lay people can assess annual fatalities if they are asked to (and produce estimates somewhat like the technical estimates). However, their judgments of "risk" are sensitive to other factors as well (e.g., catastrophic potential, threat to future generations) and, as a result, tend to differ from their own (and experts') estimates of annual fatalities.

Insert Table 1 about here

Another consistent result from psychometric studies is that people tend to view current risk levels as unacceptably high for most activities. The gap between perceived and desired risk levels suggests that people are not satisfied with the way that market and other regulatory mechanisms have balanced risks and benefits. These studies also show that people are willing to tolerate higher risks from activities seen as highly beneficial. People are also more willing to accept risks that are seen as voluntary, controllable, familiar, non-

catastrophic, and fair in the way that risks and benefits are distributed across individuals.

Various models have been advanced to represent the relationships between perceptions, behavior, and the various characteristics of hazards. As we shall see, the picture that emerges from this work is both orderly and complex.

Factor-Analytic Representations

Many of the risk characteristics are highly correlated with each other, across a wide range of hazards. For example, hazards rated as "voluntary" tend also to be rated as "controllable" and "well-known"; hazards that appear to threaten future generations tend also to be seen as having catastrophic potential, and so on. Investigation of these interrelationships by means of factor analysis has shown that the broader domain of characteristics can be condensed to a small set of higher-order characteristics or factors.

The factor space presented in Figure 1 is based on one of our early studies of college students in Oregon.² Factor 1, labeled "dread risk," is defined at its high (right hand) end by perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of risks and benefits. Nuclear weapons and nuclear power scored highest on the characteristics that make up this factor. Factor 2, labeled "unknown risk," is defined at its high end

² Lincoln Moses, a statistician at Stanford University, has pointed out that this factor space summarizes the relationships among more than 1400 mean scores built from more than 40,000 judgments.

by hazards judged to be unobservable, unknown, new, and delayed in their manifestation of harm. Chemical technologies scored particularly high on this factor. Medical procedures and pharmaceutical products also scored high on factor 2 but they were perceived to be low on the characteristics that define factor 1, thus appearing in the upper left quadrant of the space. In other words, they were seen as controllable, not fatal, not dreaded, equitable (the person who benefits also bears the risks), and individual rather than catastrophic. They also tended to be rated low in risk and high in benefit.

Insert Figure 1 about here

Research has shown that laypeople's risk perceptions and attitudes are closely related to the position of a hazard within the factor space. Most important is the factor "Dread Risk." The higher a hazard's score on this factor (i.e., the further to the right it appears in the space), the higher its perceived risk, the more people want to see its current risks reduced, and the more they want to see strict regulation employed to achieve the desired reduction in risk. In contrast, experts' perceptions of risk are not closely related to any of the various risk characteristics or factors derived from these characteristics. Instead, as noted earlier, experts appear to see riskiness as synonymous with expected annual mortality. As a result, some conflicts over "risk" may result from experts and laypeople having different definitions of the concept.

Accidents as Signals

Risk analyses typically model the impacts of unfortunate events (e.g., an accident, a discovery of pollution, an adverse drug reaction, etc.) in terms of direct harm to victims--deaths, injuries, and damages. The impacts of an unfortunate event, however, sometimes extend far beyond these direct harmful effects, and may include indirect costs to the responsible government agency or private company that far exceed direct costs. In some cases, all companies in an industry are affected, regardless of which company was responsible for the mishap. In extreme cases, the indirect costs of a mishap may even extend past industry boundaries, affecting companies, industries, and agencies whose business is minimally related to the initial event. Thus, an unfortunate event can be thought of as a stone dropped in a pond. The ripples spread outward, encompassing first the directly affected victims, then the responsible company or agency, and, in the extreme, reaching other companies, agencies, and industries.

Some events make only small ripples; others make big ones. The challenge is to discover characteristics associated with an event and the way that it is managed that can predict the breadth and seriousness of these impacts (see Figure 2). Early theories equated the magnitude of impact to the number of people killed or injured, or to the amount of property damaged. Unfortunately, things aren't this simple. The accident at the Three Mile Island (TMI) nuclear reactor in 1979 provides a dramatic demonstration that factors besides injury, death,

and property damage impose serious costs. Despite the fact that not a single person died at TMI, and few if any latent cancer fatalities are expected, no other accident in our history has produced such costly societal impacts. The accident at TMI devastated the utility that owned and operated the plant. It also imposed enormous costs (estimated at 500 billion dollars by one source) on the nuclear industry and on society, through stricter regulation, reduced operation of reactors worldwide, greater public opposition to nuclear power, reliance on more expensive energy sources, and increased costs of reactor construction and operation. It may even have led to a more hostile view of other large scale, modern technologies, such as chemical manufacturing and genetic engineering. The point is that traditional economic and risk analyses tend to neglect these higher-order impacts, hence they greatly underestimate the costs associated with certain kinds of mishaps.³

Insert Figure 2 about here

Although the TMI accident is extreme, it is by no means unique. Other recent events resulting in enormous higher-order impacts include: the chemical manufacturing accident at Bhopal, India; the pollution of Love Canal, New York, and Times Beach, Missouri; the disastrous launch

³ In their analysis of 77 cases in which a drug product was withdrawn from the market, Spriet-Pourra and Auriche (1988) compiled a list of the types of adverse impacts of such withdrawals on manufacturers and provided rough estimates of the substantial costs to the manufacturers that have been associated with such withdrawals.

of the space shuttle Challenger; and the meltdown of the nuclear reactor at Chernobyl. Within the domain of pharmaceutical products, the tragic effects of Thalidomide would certainly qualify as events with serious consequences for the industry as well as for the victims. Following these extreme events are a myriad of lesser mishaps varying in the breadth and size of their impacts.

A new theory aimed at describing how psychological, social, cultural, and political factors interact to "amplify risk" and produce ripple effects has been presented by Kasperon, Renn, Slovic et al. (1988). An important element of this theory is the assumption that the perceived seriousness of an accident or other unfortunate event, the media coverage it gets, and the long-range costs and other higher-order impacts on the responsible company, industry, or agency are determined, in part, by what that event signals or portends. Signal value reflects the perception that the event provides new information about the likelihood of similar or more destructive future mishaps.

The informativeness or signal value of an event, and thus its potential social impact, appears to be systematically related to the characteristics of the hazard and the location of the event within the factor space described earlier (see Figure 3). An accident that takes many lives may produce relatively little social disturbance (beyond that caused the victims' families and friends) if it occurs as part of a familiar and well-understood system (e.g., a train wreck). However, a small accident in an unfamiliar system (or one perceived as poorly

understood), such as a nuclear reactor, a recombinant DNA laboratory, or even a prescription drug, may have immense social consequences if it is perceived as a harbinger of further and possibly catastrophic mishaps.

Insert Figure 3 about here

The concept of accidents as signals was eloquently expressed in an editorial addressing the tragic accident at Bhopal, India: "What truly grips us in these accounts [of disaster] is not so much the numbers as the spectacle of suddenly vanishing competence, of men utterly routed by technology, of fail-safe systems failing with a logic as inexorable as it was once--indeed, right up until that very moment--unforseeable. And the spectacle haunts us because it seems to carry allegorical import, like the whispery omen of a hovering future" (The New Yorker; February 18, 1985).

One implication of the signal concept is that effort and expense beyond that indicated by a cost/benefit analysis might be warranted to reduce the possibility of "high-signal accidents." Unfortunate events involving hazards in the upper quadrants of Figure 1 appear particularly likely to have the potential to produce large ripples. As a result, decisions regarding these hazards need to take account of these possible higher-order impacts.

Media reports are likely to be a major determiner of ripple effects and signal value is likely to determine the nature and thoroughness of media coverage for risk stories. Brown (1989) points

out that medicine is of great interest to the media and he provides insight into the type of signals that journalists look for when covering a story about an adverse drug reaction:

"Stories involving ADRs and their victims are generally classified as being stories about quackery, which basically means false medical claims and exploitation of the sick for profit. Given this general approach, it is hardly surprising that the starting point for the journalist investigating an ADR story is that innocent people have been harmed when they thought they were being helped; that the provider of the treatment must have been either less than honest in his claims or negligent in the way that he conducted his experiments; and that doctors and authorities were duped or bribed. His task is to prove that any or all of these assumptions are true." (Brown, 1989; p. 150).

The Swedish Survey

Design of the Survey

The national survey of risk perception of prescription drugs conducted in Sweden by Slovic et al. (1989) was designed to apply concepts and methods taken from the literature described above. The survey had two separate components. Part I employed a traditional survey format in which respondents were asked to indicate their attitudes, perceptions, and opinions in response to specific questions on the following topics:

- Perceptions of risk today as compared to risks in the past
- Perceived frequency of drug side effects
- The adequacy of performance by government regulators, drug manufacturers, doctors, and pharmacists in ensuring drug safety and efficacy
- The respondent's personal experiences with drug side effects
- Perceived causes of drug side effects
- Opinions in response to a vignette describing a drug controversy.

In addition, Part I included a non-traditional task in which respondents were asked to read the words 'prescription drugs' which were printed six times on a card. Each time they read these words, they were instructed to write down the first association that came to their minds. This technique, called 'the method of continued associations,' has been shown by Szalay and Deese (1978) to be a sensitive indicator of the imagery and meaning associated with people's mental representations for a wide variety of concepts. Of particular interest in the present context is the frequency and nature of negative associations and the ratio of positive to negative responses to prescription drugs.

Part I concluded with a series of demographic questions pertaining to the patient's age, sex, health status, cigarette smoking, occupation, income, marital status, medicine usage, health consciousness, attitude toward risk taking, attitude toward fate, and attitude toward using medicines.

Part II of the survey used the psychometric paradigm described earlier, in which people were asked to make quantitative judgments about the riskiness of various hazards. In the present survey, each of the 29 items shown in Table 2 was rated by each respondent on 7 characteristics of risk found to be important in prior studies of perceived risk. The 29 items included 15 pharmaceutical products (e.g., vaccines, antibiotics, etc.), 5 medical devices or procedures (e.g., X-rays, heart surgery), and 9 non-medical items (e.g., automobiles, nuclear power plants). The non-medical items were included to provide a broad context against which to compare the medical and pharmaceutical items. The pharmaceutical items were carefully selected according to several criteria, including importance, familiarity to the general public, and diversity.

Insert Table 2 about here

Respondents rated the perceived risk and perceived benefit for each item, the extent to which the risks are known to those exposed to them, the likelihood that people exposed to the risk would experience any degree of personal harm, the extent to which the risk associated with each item was new or old, the seriousness of harmful effects in the event of an accident or mishap, and the degree to which a mishap would serve as a warning sign indicating that the risk from this item might be greater than was thought before the problem occurred. The full set of rating scales for these seven characteristics is shown in Table 3. All 29 hazard items were rated on

one scale before the next scale was considered. Before starting this task, respondents were asked to examine a glossary which defined each term (e.g., insulin - a drug used to treat diabetes). Respondents were allowed to refer to this glossary as necessary during this task.

Insert Table 3 about here

Administration of the Survey

A representative sample of the Swedish adult population between the ages of 16 and 74 was interviewed in person in their own homes by personnel from SIFO, a leading survey and market research firm in Sweden. The interviews took place from February 24 through March 19, 1988. From 1234 persons contacted, 961 completed interviews were obtained, for a completion rate of 78%.

Results

Characteristics of the Sample. The sample was about equally split between females (50.4%) and males (49.6%). About 28% of the respondents resided in Stockholm or Gothenberg; 17% resided in small villages (less than 3000 inhabitants) or rural areas; the remaining 55% came from towns and cities of intermediate size. Most of the respondents were between the ages of 16 and 39 (47.3%), 34.8% were between the ages of 40 and 59, and 17.9% were between 60 and 74 years of age. In these respects, the sample closely matched the characteristics of the Swedish adult population.

The majority of respondents rated their health as either excellent (34.6%) or very good (28.4%); 30.2% rated their health as fair and 6.6% as poor. When asked if they had a chronic illness or condition, 12.7% answered yes.

Some 20.9% of the sample said that they saw their doctor regularly; 40.2% replied that they had taken prescription drugs during the past 4 months, and 27.0% had bought a nonprescription medicine within the previous four months; 62.5% said they had benefited significantly during the last five years from taking a prescription drug.

Respondents were also asked to indicate the degree to which various statements about risk taking, health consciousness, fatalism, and medicine taking described them personally. The results, shown in Figure 4, indicate that most of these individuals characterized themselves as not liking to take risks, being health conscious, not feeling comfortable about taking medicines, and resisting the use of medicine until they are absolutely forced to do so (92.2% said they were very well or somewhat well characterized by this last statement).

Insert Figure 4 about here

Images of Prescription Drugs. More than 3000 associations were produced in response to the stimulus concept 'prescription drugs.' The major types of associations are listed in Table 4 in order of their frequency. Names of drugs headed the list, followed closely by names of illnesses and types of drugs. Strong positive images (helpful,

recovery, healing, effective, reliable) accounted for 259 responses. Strong negative imagery was somewhat more frequent and took two general forms: one form had to do with side effects, dangerousness, warning, allergic and other reactions, and death (total frequency of this form, 253); the other had to do with abuse, addiction, dependency, overdose, and overconsumption (total frequency, 152). Natural and herbal medicines were mentioned 92 times. Cost was mentioned rather infrequently.

Insert Table 4 about here

Surveys in the United States have shown that associations to the word 'chemicals' are dominated by negative imagery (death, toxic, dangerous). The Swedish data show that responses to one class of chemicals, prescription drugs, are much more neutral and positive. Also of interest is the fact that there is very little association of prescription drugs with illicit drugs. Overall, the data in Table 4 seem to provide a useful baseline against which to compare responses over time in Sweden and responses from other nations.

Present and Past Risk. Respondents were asked to indicate whether they believed that there is more risk, less risk, or about the same risk today than there was 20 years ago for each of several major sources of risk. The results, shown in Figure 5, indicate that the risks from chemicals were perceived to be greater today by 80% of the respondents. Other percentages for the 'more risk' response were heart

disease (75%), cancer (74%), climate changes (69%), energy sources (67%), food (62%), quality of drinking water (60%), methods of travel (54%), infectious diseases excluding AIDS (35%), and prescription drugs (34%). Looking at the other side of the coin, the proportion of responses in the 'less risk today' category was highest for prescription drugs (35.8%) and infectious diseases (30.4%) and lowest for climate changes (2.7%).

Insert Figure 5 about here

We thus see a strong differentiation in the perceived trend in risk between prescription drugs and other chemicals as well as between drugs and other technologies. Although about one-third of the Swedish sample believes that drug risks have increased, this is far smaller than the percentage perceiving increased risk from the other hazards, with the exception of infectious disease, which may be seen as closely linked to drug efficacy.

Drug Efficacy and Side Effects

Several questions asked about drug efficacy and the frequency, severity, and causes of side effects. When asked to rate the job that various health-care agents were doing to make sure that prescription drugs are safe and effective, pharmacists received the highest marks (70% excellent or good), followed at quite a distance by doctors (56%), government regulatory agencies (50%) and drug manufacturers (40%). There were fewer than 20% excellent ratings in any category, which

suggests that, in the public mind, there is room for improvement in this matter.

When asked how often patients taking prescription drugs experience serious side effects, 23.5% replied always, very often, or often. When asked whether they personally had suffered a side effect from taking a prescription drug during the past five years 19.9% replied that they had; of these people, 26.5% considered the side effect serious. Multiplying these two proportions indicates that only 5.3% of the total sample claimed to have suffered a serious side effect, a proportion far smaller than that attributed to other patients who take prescription drugs. Self-reported occurrences of side effects are known to be unreliable, hence these responses should not be viewed as indicative of actual experience with side effects.

Respondents were also asked to indicate their opinions about the main cause of a drug side effect. Their spontaneous responses named patient sensitivity, improper drug prescription or wrong diagnosis, and non-compliance as the major causes. Following this question was a structured question that asked people to indicate how frequently each of eight specified factors is the cause of a side effect. The results, shown in Figure 6, indicate that patient sensitivity was again singled out as one of the most frequent causal factors (44.5% rated it always, very often, or often a cause). Improper monitoring of the patient by the doctor was also rated as a frequent cause (45% always, very often, or often). Slightly less frequent attributions of causality were assigned to failure to adequately inform the patient (41%), lack of

patient compliance (38%), and inadequate health and safety testing by the manufacturer (38%). Again, pharmacist's mistakes were seen as the least likely causes of a drug-induced side effect (2%).

Insert Figure 6 about here

A Drug Crisis Scenario. The following hypothetical scenario was posed to each respondent, indicating a possible link between a drug and some fatalities among its users.

'Imagine that a new prescription drug becomes available in this country for treating a serious disease. Other drugs are also available for treating this disease. A study reveals that some people may have died from taking this drug. What do you think the government should do in this case?'

- Leave the drug on the market.
- Take the drug off the market.
- Leave the drug on the market but warn the doctors
and patients.
- Not sure.

In response to this question, 75% wanted the government to take the drug off the market, 1.8% wanted the drug left on the market, and another 21.8% wanted it left on the market with a warning.

Those who wanted the drug removed from the market or who were not sure (76.7% of the total sample) were asked to reconsider their answers, taking into account each of six possible extenuating

circumstances. The results, shown in Figure 7, indicated that there is no circumstance that, by itself, would convince more than 16% of these people to leave the drug on the market as it was before. However, in combination with information warning doctors and patients about the possible problem, these circumstances led to considerable change in opinions. Knowledge that the risk affected only certain types of patients convinced 5.4% of these respondents to leave the drug on the market and another 52.6% to leave it on the market with a warning. Changes such as this also occurred when respondents were told that the drug is more effective than other, similar drugs, or that the drug has fewer side effects for most patients than other, similar drugs. Being told that the drug has been used safely and effectively for many years in another country produced somewhat less change of opinions. The two circumstances that produced the least opinion change were the fact that the government and manufacturer are actively gathering more information about the problem, and the fact that the respondent had taken the drug for many months and was very satisfied with it.

Insert Figure 7 about here

The Psychometric Questionnaire. Ratings of each hazard item were averaged across all 961 respondents for each scale. The mean ratings for perceived risk, ordered from high to low, are shown in Figure 8. Three non-drug chemicals--cigarette smoking, pesticides, and alcohol--stood out as highest in perceived risk, followed by two drug items--antidepressants and sleeping pills--which, surprisingly, were judged

more risky than nuclear power. Vitamin pills, acupuncture, and herbal medicines were judged lowest in risk.

Insert Figure 8 about here

The high level of concern about sleeping pills and antidepressant drugs may be due to extensive media publicity in Sweden regarding the risks of addiction and overdose from these and similar drugs. A subgroup analysis was conducted in which perceived risks and benefits for those persons (N = 145) associating prescription drugs with 'overdose,' 'addiction,' or 'abuse' were compared with judgments of persons not having any negative associations (N = 776). These two groups did not differ in their ratings of nuclear power, pesticides, and other nonmedical hazards. Nor did they differ much in their ratings of vaccines, antibiotics, or cancer drugs. The group with these particular negative associations did, however, judge sleeping pills and antidepressants to have much greater risk and much lower benefits compared to persons without such associations. This evidence is congruent with the hypothesis that high levels of perceived risk associated with sleeping pills and antidepressants stem from concerns about overdose, addiction, and abuse.

Additional analysis of specific subgroups of respondents showed that women perceived far higher risk from nuclear power than did men (mean rating, 4.86 for women and 3.53 for men; $p < .001$). This is a common finding in studies of perceived risk. However, no other

differences between men and women exceeded .4. Those who claimed to have experienced any sort of side effect from a prescription drug showed slightly higher mean perceptions of risk than those without side effect experience (the largest mean difference was .57 for antibiotics; $p < .001$). Perceptions of risk seemed unaffected by having experienced significant benefits from taking drugs.

Mean ratings of perceived benefit are shown in Figure 9. Unlike mean perceptions of risk, which exhibited a smooth, continuous decline from high to low values, benefits seemed to fall into three categories. High benefits were associated with cancer drugs, heart surgery, insulin, AIDS drugs, appendectomy, antibiotics, vaccines, X-rays, airplanes, automobiles, and drugs to treat arthritis and hypertension. Moderate benefits were attributed to 11 items ranging from antidepressants to laxatives. Very low benefits were perceived for cigarettes, alcohol, food additives, pesticides, artificial sweeteners, and sleeping pills. The perceived benefit of various drug items was only slightly higher for those claiming to have experienced significant benefits in the past 5 years than for those not claiming such beneficial experiences.

Insert Figure 9 about here

The risk and benefit means are superimposed in Figure 10. Perceived risks and benefits were somewhat negatively related across items (the correlation was $-.23$). Appendectomy, insulin, vaccines, and antibiotics stood out as being quite high in perceived benefit and low

in perceived risk. Other drug items, with the notable exception of antidepressants and sleeping pills, showed a similar, though less extreme, pattern. Four non-drug chemical hazards--cigarettes, alcohol, pesticides, and food additives, were judged extremely high in risk and low in benefit.

Insert Figure 10 about here

Although the scales are not strictly commensurable, it is instructive to create a net benefit score by subtracting the risk judgment from the benefit judgment for each item. Subgroup analysis on this measure showed that the perceived net benefits for anti-depressants, birth control pills, sleeping pills and antihypertensives were higher for those persons claiming to be comfortable taking medicines than for those who are not comfortable doing so. However, these two groups of people did not differ in their net benefit ratings for such high benefit drugs as vaccines, antibiotics, and insulin. Older respondents (ages 60-74) showed slightly higher net benefit ratings than younger respondents for antihypertensives, cancer drugs, antidepressants, and artificial sweeteners.

The scales measuring likelihood of harm and seriousness of harm correlated highly with perceived risk and are not shown here. The scale values for knowledge of risk took an intermediate position for all items--there was rather little variation from the least well known risks (biotechnology drugs, food additives) to the best known

(airplanes, automobiles, and cigarettes). There was much greater variation on the new vs. old scale ranging from AIDS and biotechnology drugs (newest risks) to cigarettes and alcohol (oldest). The warning sign scale also showed rather small variation around the midpoint. Nuclear power and pesticides were highest on this scale, and automobiles and airplanes were lowest.

Correlation coefficients were calculated between the means of each pair of scales, across the 29 items. These correlations were subjected to a principal components factor analysis which uncovered two dominant, uncorrelated factors accounting for 71% of the variance in the scales. Factor I, which we shall label 'risk,' consisted of three scales: perceived risk, the likelihood of harm, and the seriousness of harm, given a mishap. Factor II, which we shall call 'warning,' consisted of the scales pertaining to newness, knowledge, and warning sign. Factor scores were computed for each hazard item by weighting the mean ratings on each scale proportionally to the importance of that scale for the factor and summing over all scales. The weighted sum gives each item a score that is an amalgamation of its ratings on the scales that define each factor. The factor scores for each item are plotted in Figure 11. As one moves from left to right in the factor space, the items are judged to have higher likelihood of causing harm, greater severity of harm in the event of a mishap, and, overall, greater perceived risk. As one goes from the bottom to the top of the space, the items are judged to have risks that are newer and less precisely known, and a

mishap is judged as providing a stronger warning about the possibility that the risk is greater than was previously believed.

Insert Figure 11 about here

Most pharmaceutical products clustered together at an intermediate level on Factor II. However, there was considerable differentiation on the risk factor, with sleeping pills and antidepressant drugs seen as extremely high in risk. Nuclear power and pesticides were judged to be new, unknown, and high-risk technologies and are located in the upper-right quadrant of the space, much as previous studies have shown. Drugs against AIDS and drugs made by means of biotechnology were seen as new and unknown risks, and relatively higher in perceived risk than most other pharmaceutical products.

Risk Perception in Patients

The Swedish survey was administered to members of the general public, few of whom were chronically ill. Would a survey of patients who were heavily dependent on medicines produce similar results? Fortunately there is some relevant data on this question, collected recently by O'Brien, Elswood, & Calin (1989). These investigators administered a shortened and slightly revised version of the Swedish questionnaire to 1034 persons in the United Kingdom, all of whom were suffering from Ankylosing Spondylitis (AS), a chronic rheumatic disease. The average age of the respondents was 47 years; 72% of them were males. About 71% of these individuals were currently taking medications for AS.

As might be expected, a higher percentage of the AS patients reported experiencing a serious ADR (47%) than did the Swedish respondents (5%). Those AS patients who had experienced a serious ADR judged the incidence of ADRs from NSAIDs as more frequent than did persons without such ADR experience. Those who had experienced serious ADRs were more likely than others to attribute the cause of the reaction to the patient's having inadequate information about the drug, to inadequate testing by the manufacturer, and to inadequate monitoring by the doctor; Those who had experienced serious ADRs were less likely than others to blame the patient for a side effect.

Comparisons between the AS patients and the Swedish respondents are informative, though it must be recognized that these groups differed in nationality, average age (the Swedish respondents were younger), and ratio of men to women, as well as in their health status. The broad pattern of results were similar in the two groups, but there were certain sizable differences as well.

Both groups of respondents gave the highest ratings to pharmacists for making drugs safe and effective and the lowest ratings to government regulators and manufacturers. However, the AS patients gave about 10-15% fewer ratings in the combined categories "excellent and good" than did the Swedish respondents.

There were sizable differences between groups in attributing the causes of a drug side effect. The AS patients were much less likely to attribute the cause to patient non-compliance (19% said this was very

often or often the cause) compared to the Swedish sample (38%).

Similarly, the manufacturer was blamed only 23% of the time by the patients compared to 38% of the time in Sweden; wrong doses prescribed by the doctor were blamed only 8% of the time by the patients, compared with 28% by the Swedish sample. Lack of information for the patient was blamed 54% of the time by the patients compared with 40% in Sweden.

In response to the drug-crisis scenario, 61% of the patients wanted the suspect drug taken off the market, compared to 75% in Sweden. In the follow-up questions, the patients responded much like the Swedish sample. Depending on the circumstances, between 21% and 47% of the patients were willing to have the drug left on the market if warning information was provided; between 25% and 52% of the Swedish sample responded this way (see Figure 7).

In response to the question asking for comparisons between risks today and risks 20 years ago, the patients more frequently said that the various risks were the same as 20 years ago and the Swedish sample more frequently said that they were greater than they were 20 years ago. One striking exception was with infectious diseases, for which the 16% of the patients said that the risks were about the same (32% in Sweden); 61% of the patients said that risks from infectious diseases were less, compared to 30% in Sweden.

Risk Management through Provision of Warnings

My talk thus far has focused on perception, rather than management, of therapeutic risk. In this concluding section I shall briefly

discuss one facet of risk management -- that involving provision of risk information to patients.

There have been numerous surveys conducted in North American, Europe, and Japan, indicating that patients strongly desire warning information pertaining to prescription drugs (see, e.g., Keown, Slovic & Lichtenstein, 1984; Malmfors et al., 1988; Fujino, 1989). When the drug crisis scenario was evaluated by members of the public in Sweden (see Figure 7) and by patients in the United Kingdom, the results suggested that provision of warning information to patients may produce a much more tolerant attitude toward a beneficial but high risk drug. In addition, the survey by O'Brien et al. in the United Kingdom found that inadequate information was seen by patients as the major cause of ADRs.

Carpenter (1988) has argued that the provision of extensive, frank warnings and precautions is desirable because it affords the patient the opportunity for "informed choice." It also may help the patient use the drug safely and effectively. The concept of informed choice is a powerful idea with the potential to revolutionize the role of risk and warning information in the marketing and use of prescription drugs. The concept is currently being implemented by the Alza Corporation in their marketing of the IUD, Progestasert (Carpenter, 1988) and by Hoffman-La Roche, Inc., in their marketing of the anti-acne drug, Accutane. The results from these "field tests" of informed choice will be very useful. However, additional information is needed to delineate the boundaries for the successful application of this approach. For

which types of pharmaceutical or medical products will it be favorably received? Under what circumstances (or in what cultural or national environments) would such an approach be ill-advised? Will extensive warnings lead to concerns that would deter some patients from taking essential medicines? Would such concerns lead to non-compliance with the prescription regimen? New studies, focused specifically on issues pertaining to informed choice, are needed to inform policy makers about the merits of this approach.

We are currently studying attitudes toward precaution and warning information in a survey of the general public in Canada. In addition to replicating the Swedish survey, we have generated several new questions about information issues. One question was based on a study of perceptions of the risks from household chemicals (cleansers, bleaches, etc.) conducted in the United States by Kraus and Slovic (1988). That study found that 59% of the respondents agreed and another 22% strongly agreed with the statement "I feel safer when I use a (household) product that has caution/warning information on the label that I do when I use a similar product that does not have caution/warning information on the label." Extent of agreement or disagreement with this statement is being asked in the Canadian survey with the words "prescription drug" substituted for the word "product."

A second question in the Canadian survey is designed to assess attitudes toward one information strategy that is currently being used with Progestasert and Accutane. The question asks for degree of

agreement or disagreement with the statement "When drugs have a potential for serious unwanted effects/side effects, patients should be required to read warning information and to sign a form indicating that they understand the risk before being allowed to take the drug."

Additional questions in Canada are examining whether people believe that warnings and precautions give them greater ability to recognize and avoid problems when taking a drug and whether they feel that such information might make them uneasy and deter them from using a drug.

Conclusion

Recent surveys in Sweden and the United Kingdom provide insights into fundamental attitudes and perceptions regarding the risks and benefits of prescription drugs. Replication and extension of these studies in other countries with a variety of patient subgroups as well as with the general public should help pharmaceutical companies better understand patients' concerns, meet their needs for information, and facilitate wiser and safer use of prescription drugs.

In the words of Medawar (1989, p. 140), ". . . the key to making the progress that is needed [in drug risk management] is to identify with the people who take the risks. They will then identify with you." I believe that studies of the perception of risk will contribute significantly toward achieving this objective.

Acknowledgements

Many people have contributed to the ideas and results discussed in this paper. I am especially indebted to Nancy Kraus, Henner Lappe, Heintz Letzel, and Torbjörn Malmfors, who helped design the Swedish survey; to Walter von Wartburg, Günter Lewandowski, David Taylor, Dana Miller, and Peter Carpenter, who have supported and championed work on this topic; and to Bernie O'Brien, Judith Elswood, and Andrei Calin, who have generously allowed me to describe their recent research results.

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Table 1. Ordering of Perceived Risk for 30 Activities and Technologies. The ordering is based on the geometric mean risk ratings within each group. Rank 1 represents the most risky activity or technology.

	League of Women Voters	College students	Active club members	Experts
Nuclear power	1	1	8	20
Motor vehicles	2	5	3	1
Handguns	3	2	1	4
Smoking	4	3	4	2
Motorcycles	5	6	2	6
Alcoholic beverages	6	7	5	3
General (private) aviation	7	15	11	12
Police work	8	8	7	17
Pesticides	9	4	15	8
Surgery	10	11	9	5
Fire fighting	11	10	6	18
Large construction	12	14	13	13
Hunting	13	18	10	23
Spray cans	14	13	23	26
Mountain climbing	15	22	12	29
Bicycles	16	24	14	15
Commercial aviation	17	16	18	16
Electric power (non-nuclear)	18	19	19	9
Swimming	19	30	17	10
Contraceptives	20	9	22	11
Skiing	21	25	16	30
X rays	22	17	24	7
High school & college football	23	26	21	27
Railroads	24	23	20	19
Food preservatives	25	12	28	14
Food coloring	26	20	30	21
Power mowers	27	28	25	28
Prescription antibiotics	28	21	26	24
Home appliances	29	27	27	22
Vaccinations	30	29	29	25

Source: Slovic (1987)

Table 2.

Hazard items studied in Part II

1. Pharmaceutical items

Vaccines	Antidepressants
Laxatives	Anticancer Drugs
Antibiotic Drugs	Aspirin
Birth Control Pills	Herbal Medicines
Insulin	Vitamin Pills
Sleeping Pills	Antiarthritics
Antihypertensives	Biotechnology Drugs
	Drugs Against AIDS

2. Medical procedures, tests, and devices

Medical X-rays	Heart Surgery
IUDs	Acupuncture
	Appendectomy

3. Nonmedical hazards

Automobiles	Household Cleansers
Travel by Airplane	Artificial Sweeteners
Nuclear Power Plants	Food Additives
Pesticides	Alcoholic Beverages
	Cigarette Smoking

Source: Slovic et al. (1989)

Table 3.

Scales on which the 29 items were rated

RISK TO THOSE EXPOSED

To what extent would you say that people (for instance you or someone you know) who are exposed to this item are at risk of experiencing personal harm from it? (1 = they are not at risk; 7 = they are very much at risk)

BENEFITS

In general, how beneficial do you consider this item to be for society as a whole? (1 = not at all beneficial; 7 = very beneficial)

LIKELIHOOD OF HARM

How likely would you say it is that people who are exposed to this item actually will experience any type of personal harm, mild or serious? (1 = very unlikely to experience harm; 7 = very likely to experience harm)

SERIOUSNESS OF HARM

If an accident or unfortunate event involving this item occurred, to what extent are the harmful effects to a person likely to be mild, or serious? (1 = very mild harm; 7 = very serious harm)

KNOWLEDGE OF THOSE EXPOSED

To what extent would you say that the risks associated with this item are known precisely to people who are exposed to those risks? (1 = risk level known; 7 = risk level not known)

OLD OR NEW RISK

To what extent is this item a new risk, or an old one that has been around for a long time? (1 = very old; 7 = very new)

(Table continues)

Table 3 (continued)

WARNING SIGN

If you read in the newspaper about an accident or an illness involving this item, in which people were seriously harmed, to what degree would this mishap serve as a warning sign, indicating that the risk of this item might be greater than was thought before the problem occurred? (1 = not a warning sign; 7 = very strong warning sign)

Source: Slovic et al. (1989)

Table 4

Associations with 'prescription drugs'

Rank	Association	Count
1	Names of drugs (i.e., valium, etc.)	549
2	Names of illnesses	465
3	Types of drugs, e.g., antibiotics, vitamins	412
4	'Medicine,' i.e., liquid form, syrup	299
5	Pills	261
6	Hospital	258
7	Doctor	222
8	Helpful	188
9	Industry, research, company	161
10	Side effects	136
11	Pharmacy	132
12	Natural, herbal medicine	92
13	Abuse	81
14	Dangerous	78
15	Recovery, healing	60
16	Addiction, dependence	45
17	Prescriptions	42
18	Price, money, cost	33
19	Overdose, overconsumption	26
20	Hypodermic needle	24
21	Bottles, jars, boxes	23
22	Warning	22
23	Profit	21
24	Paraphernalia (general)	18
25	Allergy, reactions	10
26	Preservatives	9
27	Death	7
28	Effective	7
29	Reliable, guaranteed	4

Source: Slovic et al. (1989)

Figure Captions

Figure 1. Location of 31 hazards on factors 1 and 2 derived from the interrelationships among 18 risk characteristics. Each factor is made up of a combination of characteristics, as indicated by the lower diagram. Source: Slovic, Fischhoff, & Lichtenstein, 1985.

Figure 2. A preliminary model of impact for unfortunate events. Development of the model will require knowledge of how the characteristics (E_c) associated with a hazard event interact to determine the interpretation or message drawn from that event. The nature of the interpretation is presumed to determine the type and magnitude of ripple effects. Source: Slovic, 1987.

Figure 3. Relation between signal potential and risk characterization for 30 of the hazards shown in Figure 1. The larger the point, the greater the degree to which an accident involving that hazard was judged by raters to "serve as a warning signal for society, providing new information about the probability that similar or even more destructive mishaps might occur within this type of activity." The higher-order costs of a mishap are likely to be correlated with signal potential. Source: Slovic, Lichtenstein, & Fischhoff, 1984.

Figure 4. Attitudes toward health, risk, fate, and medicines.
Source: Slovic, et al., 1989.

Figure 5. Risk today versus 20 years ago. Source: Slovic et al., 1989.

Figure 6. Reasons for side effects: prompted responses. Source: Slovic, et al., 1989.

Figure 7. Reactions to a drug crisis: Modification of opinion in view of additional evidence. Source: Slovic et al., 1989.

Figure 8. Perceived risk. Source: Slovic et al., 1989.

Figure 9. Perceived benefit. Source: Slovic et al., 1989.

Figure 10. Perceived risk and perceived benefit. Source: Slovic et al., 1989.

Figure 11. Perceptual map of risk factors. Source: Slovic et al., 1989.

FACTOR 2
UNKNOWN RISK

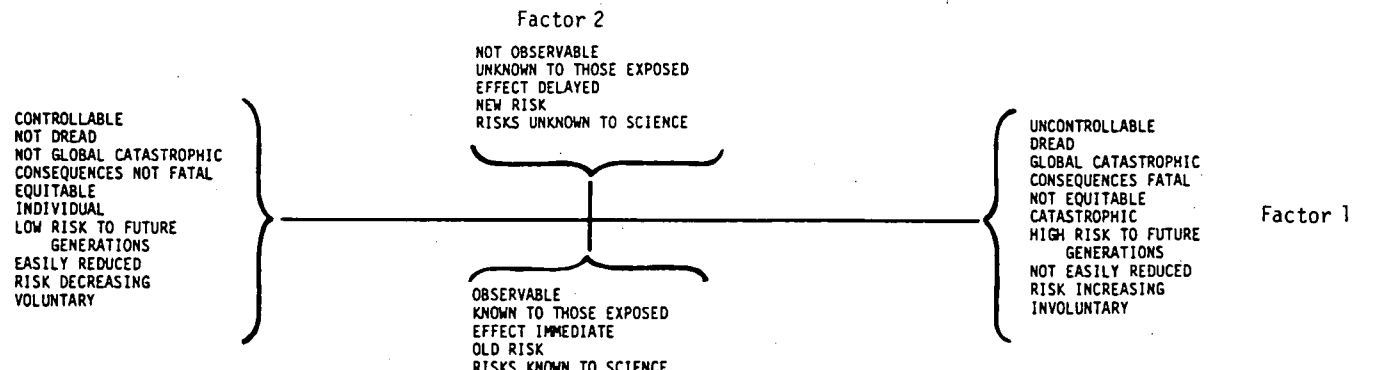
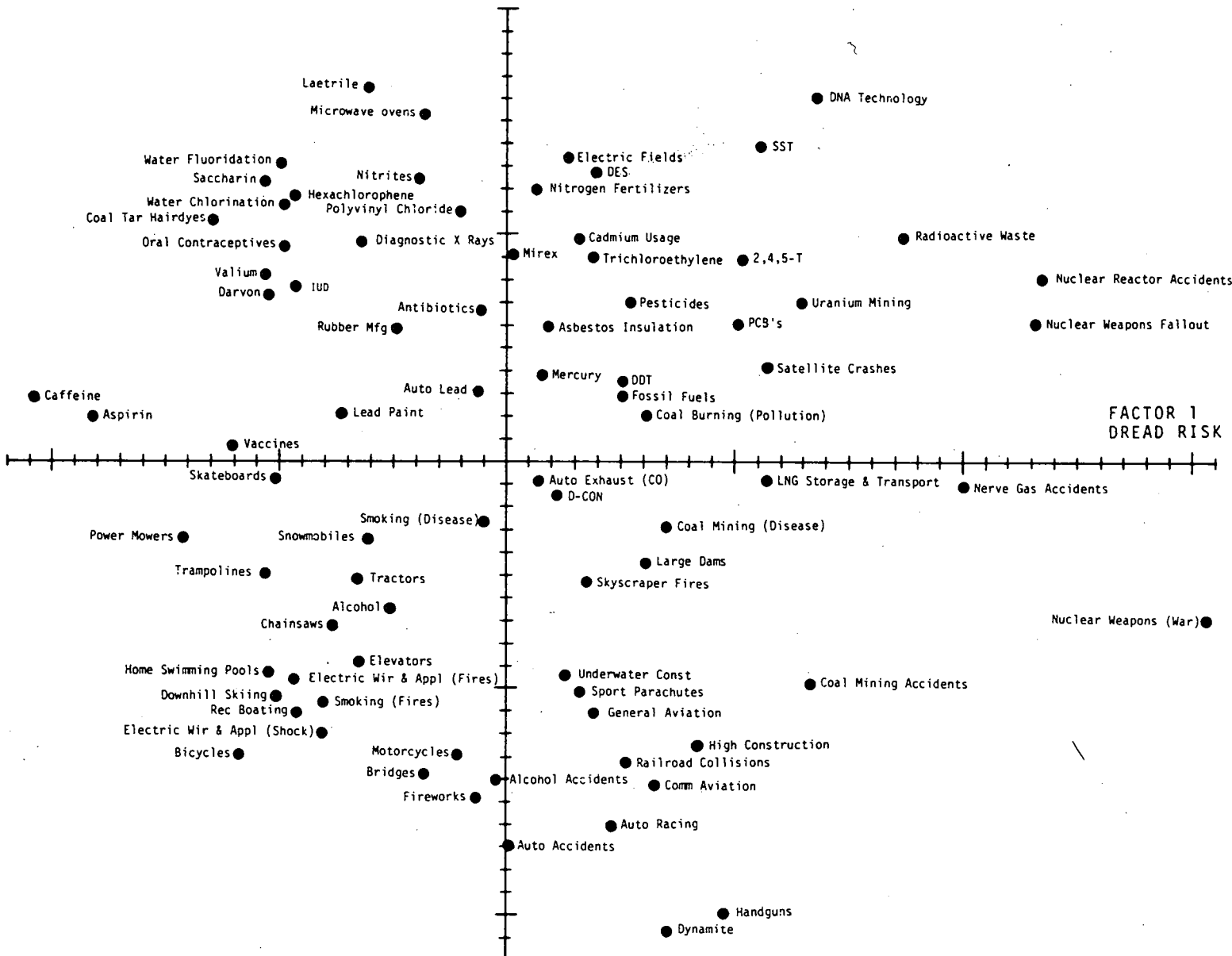


Figure 1. Location of 31 hazards on factors 1 and 2 derived from the interrelationships among 18 risk characteristics. Each factor is made up of a combination of characteristics, as indicated by the lower diagram. Source: Slovic, Fischhoff, & Lichtenstein, 1985.

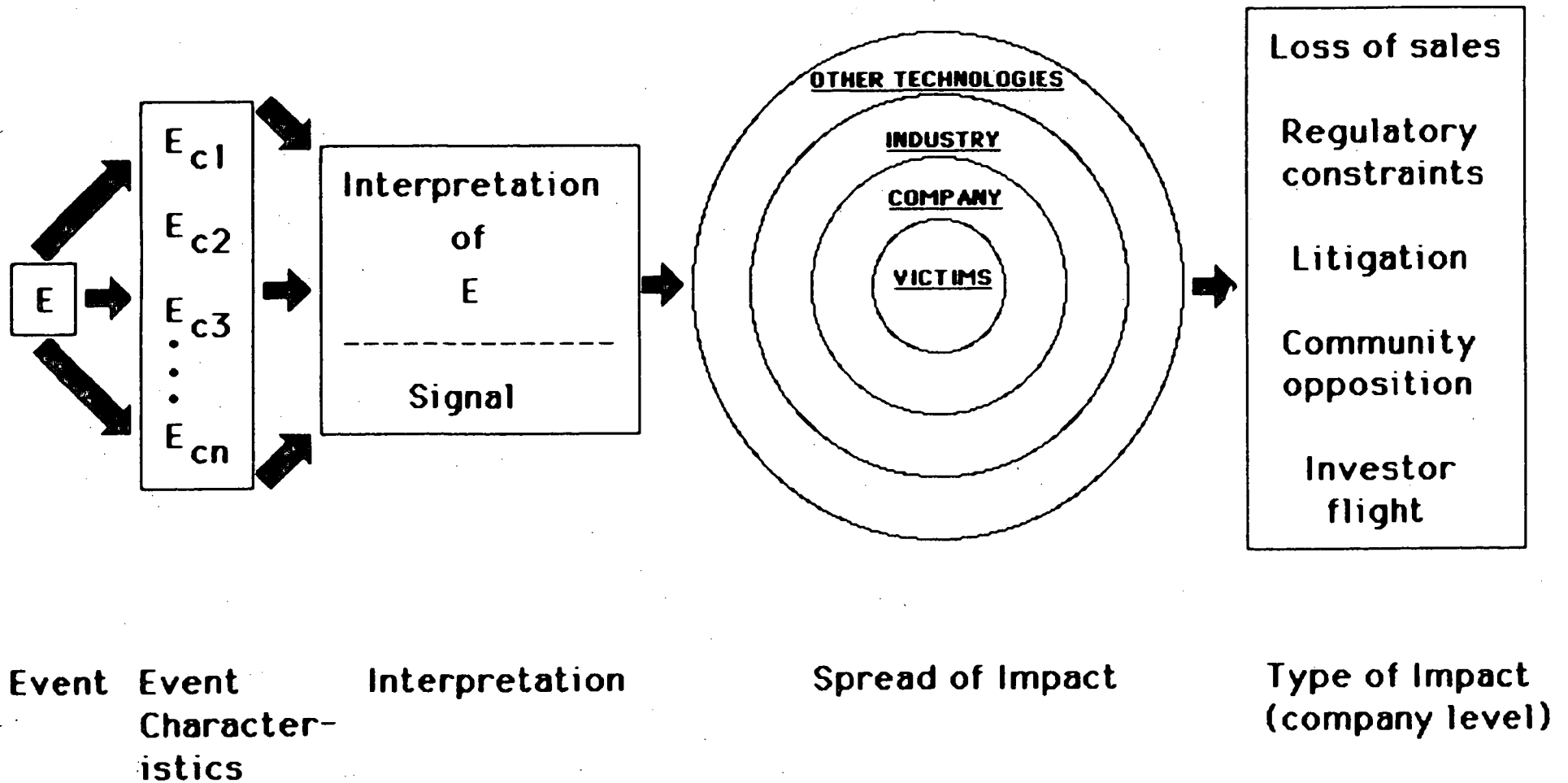


Figure 2. A preliminary model of impact for unfortunate events. Development of the model will require knowledge of how the characteristics (E_c) associated with a hazard event interact to determine the interpretation or message drawn from the event. The nature of the interpretation is presumed to determine the type and magnitude of ripple effects. Source: Slovic, 1987.

ACCIDENTS AS SIGNALS

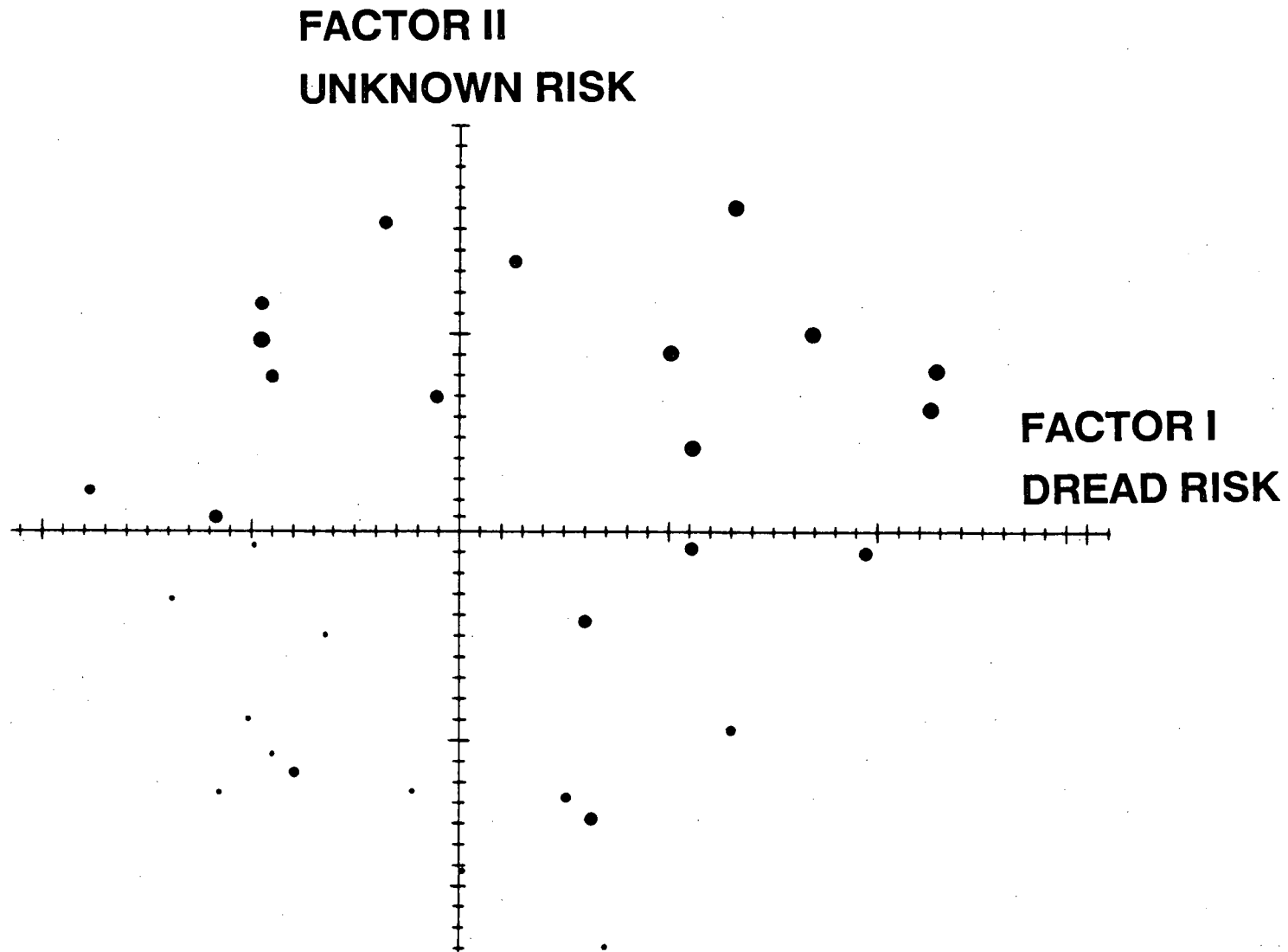


Figure 3. Relation between signal potential and risk characterization for 30 of the hazards shown in Figure 1. The larger the point, the greater the degree to which an accident involving that hazard was judged by raters to "serve as a warning signal for society, providing new information about the probability that similar or even more destructive mishaps might occur within this type of activity." The higher-order costs of a mishap are likely to be correlated with signal potential. Source: Slovic, Lichtenstein, & Fischhoff, 1984.

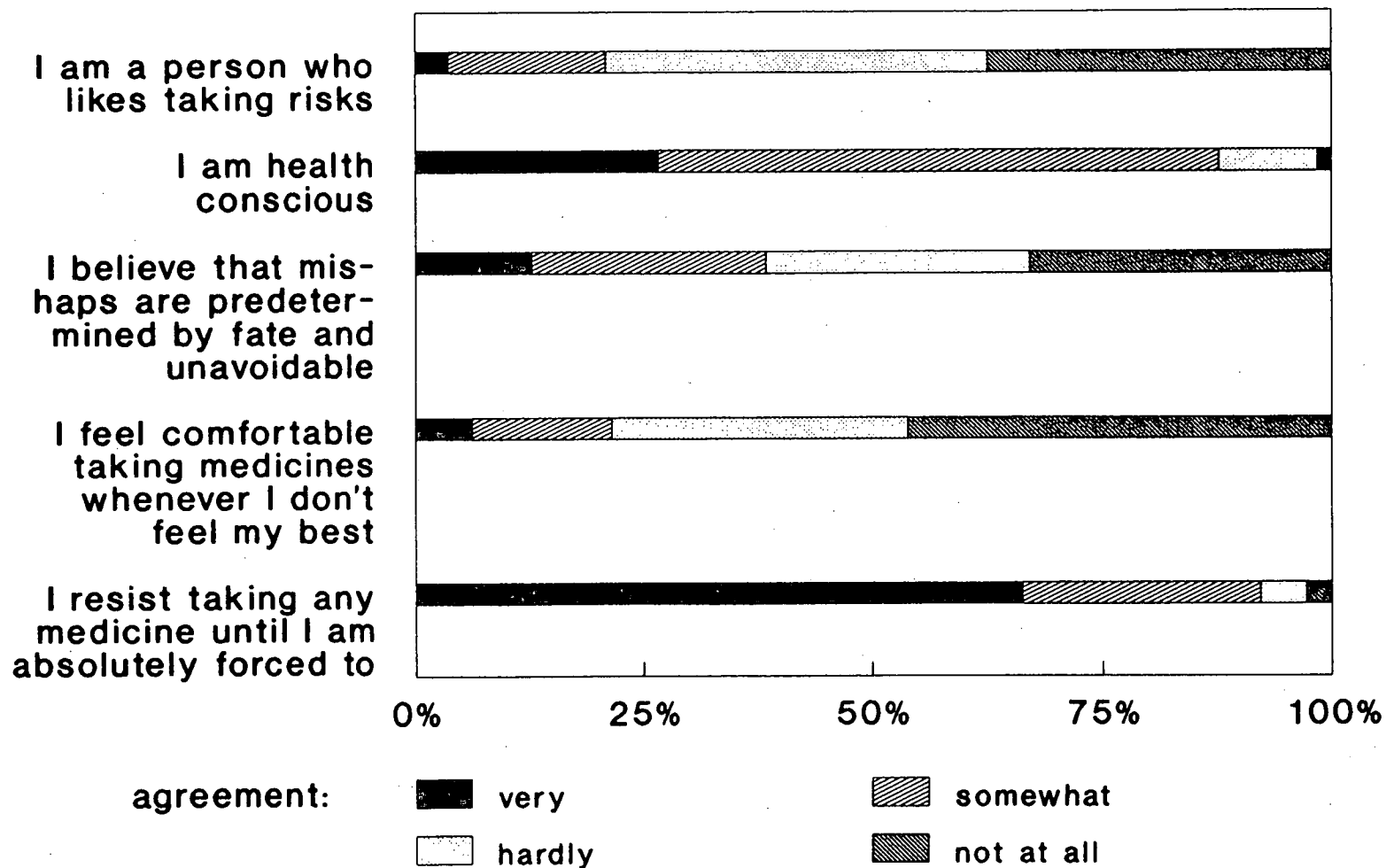


Figure 4. Attitudes toward health, risk, fate, and medicines.
 Source: Slovic, et al., 1989.

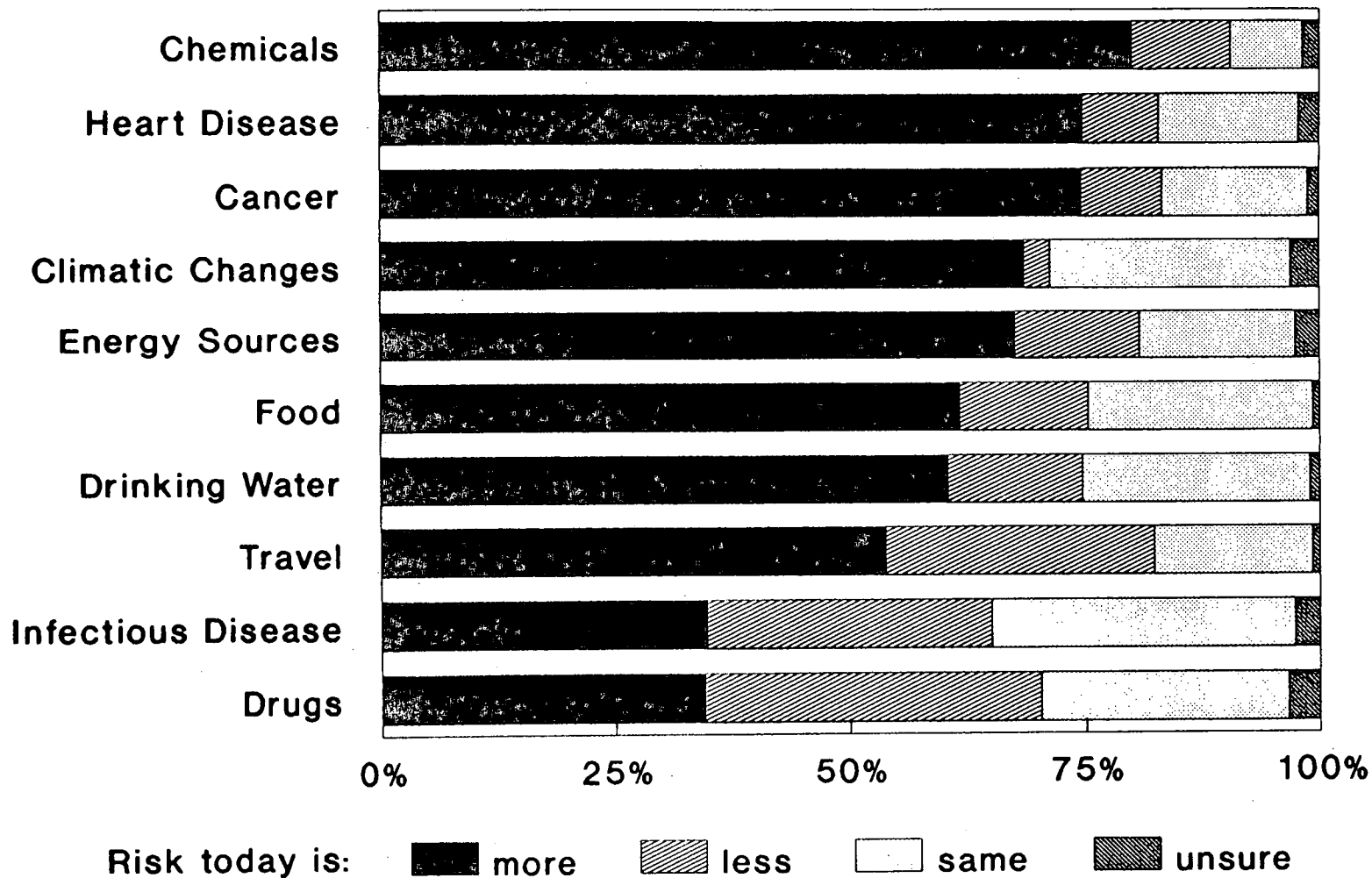


Figure 5. Risk today versus 20 years ago. Source: Slovic et al., 1989.

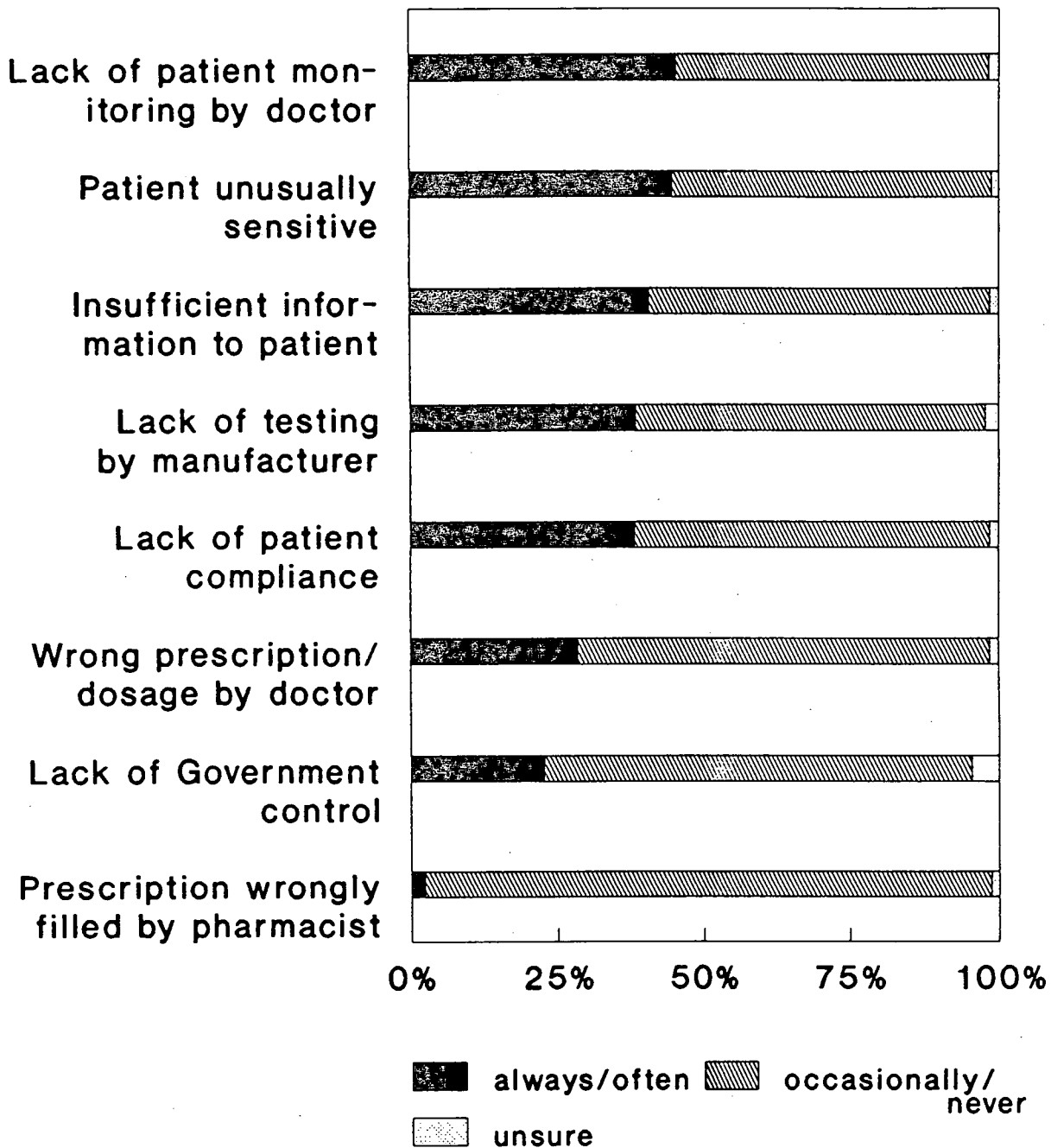


Figure 6. Reasons for side effects: prompted responses.
 Source: Slovic, et al., 1989.

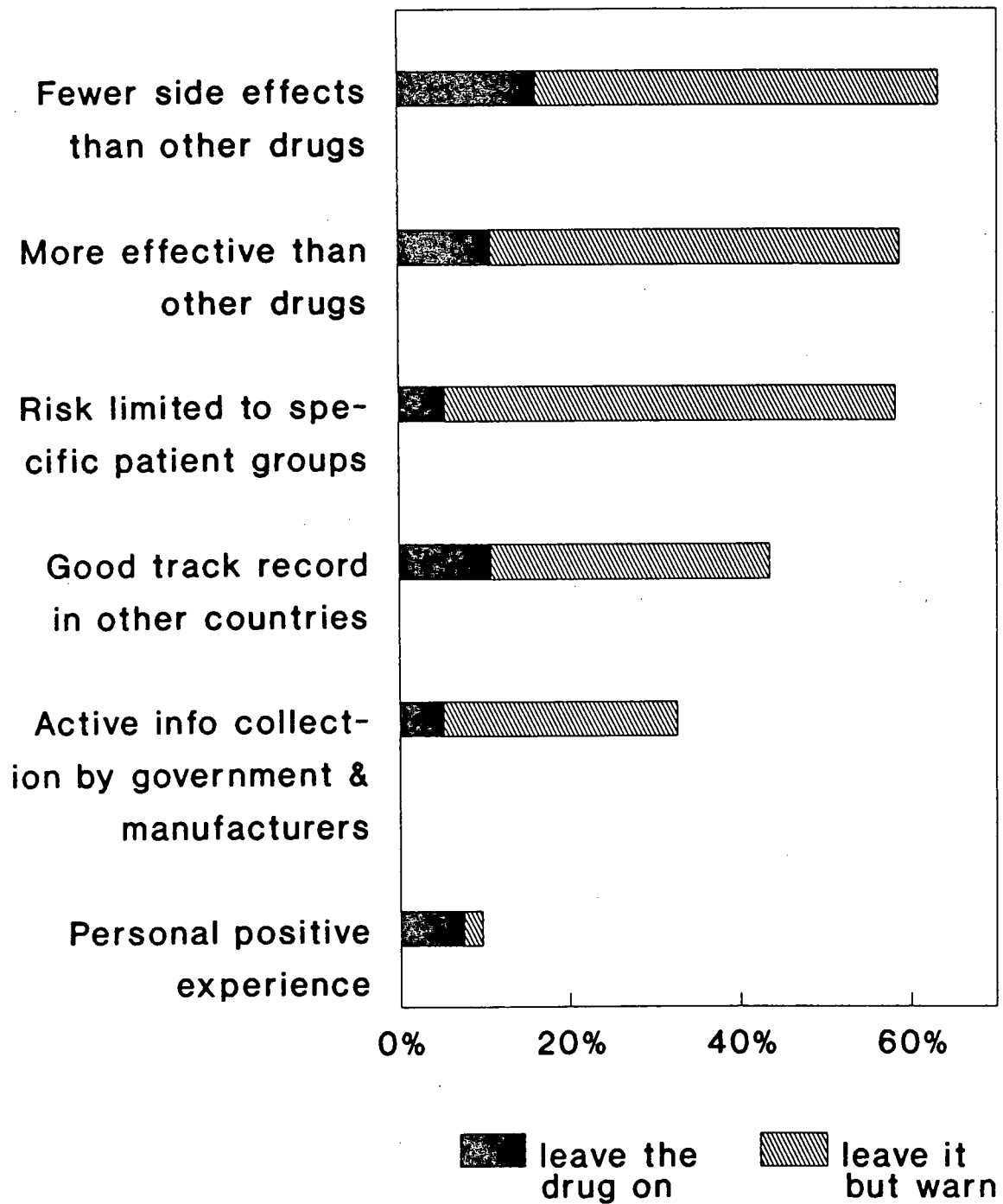


Figure 7. Reactions to a drug crisis: Modification of opinion in view of additional evidence. Source: Slovic et al., 1989.

PERCEIVED RISK

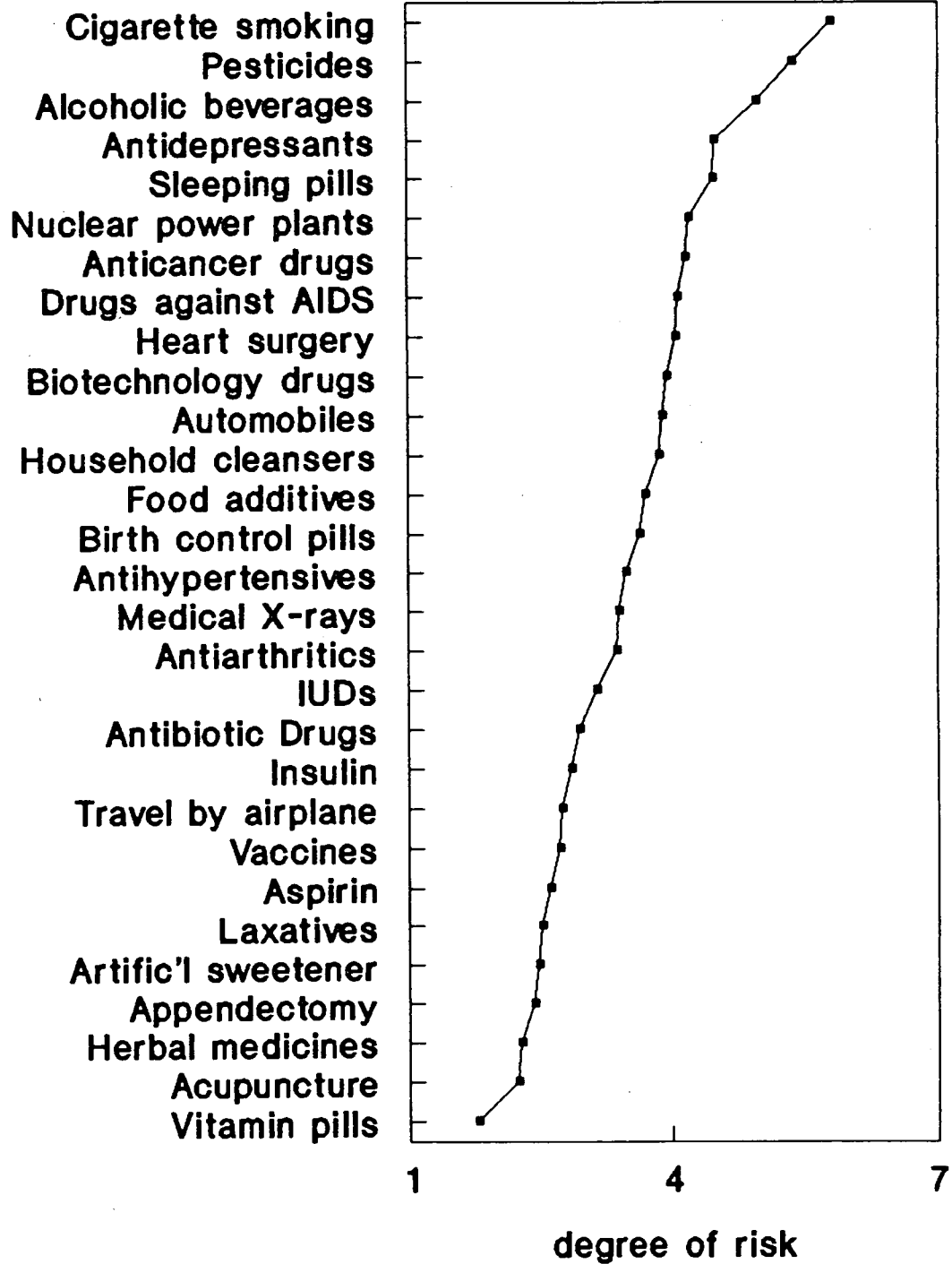


Figure 8. Perceived risk. Source: Slovic et al., 1989.

PERCEIVED BENEFIT

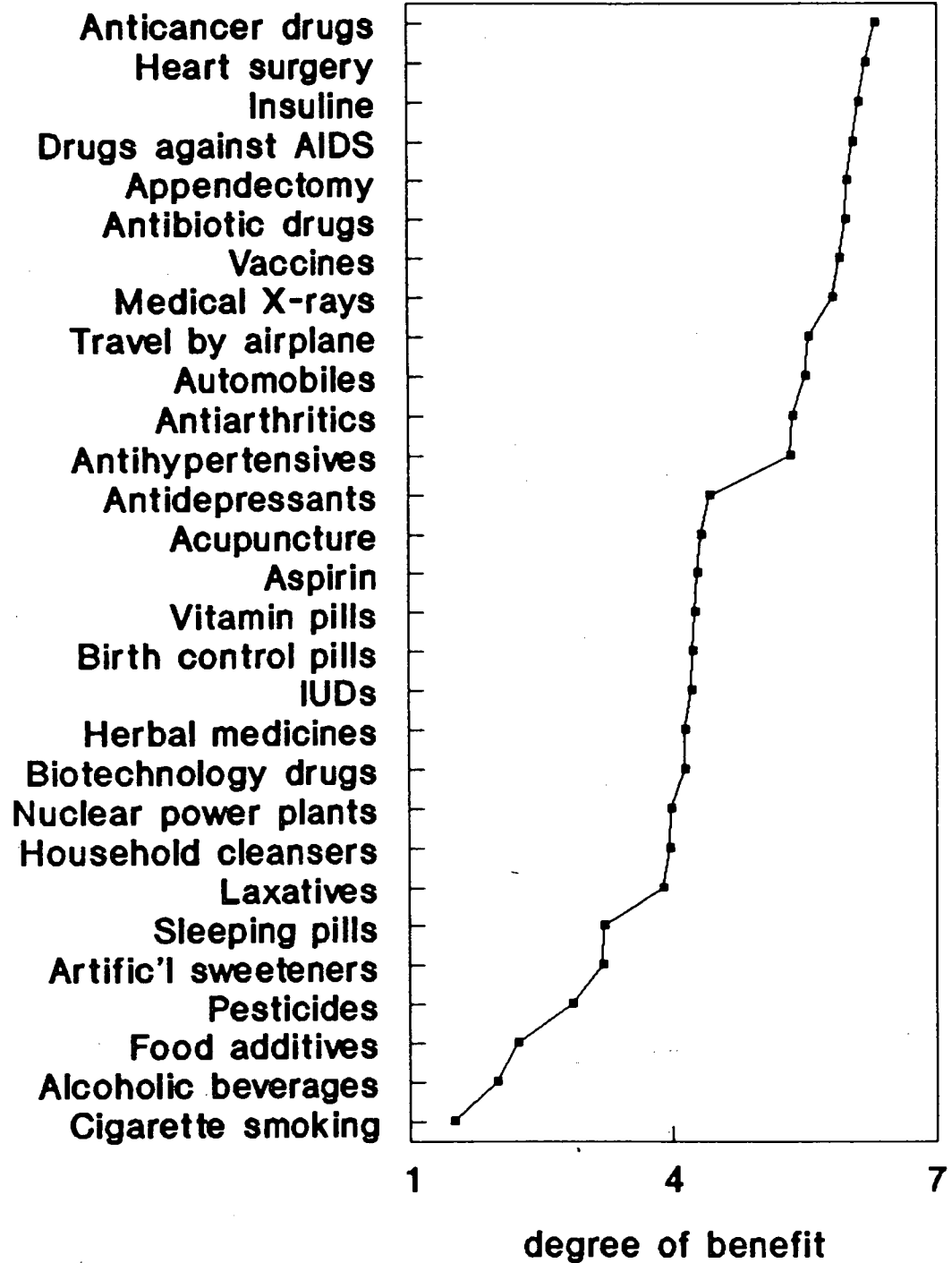


Figure 9. Perceived benefit. Source: Slovic et al., 1989

RISK AND BENEFIT

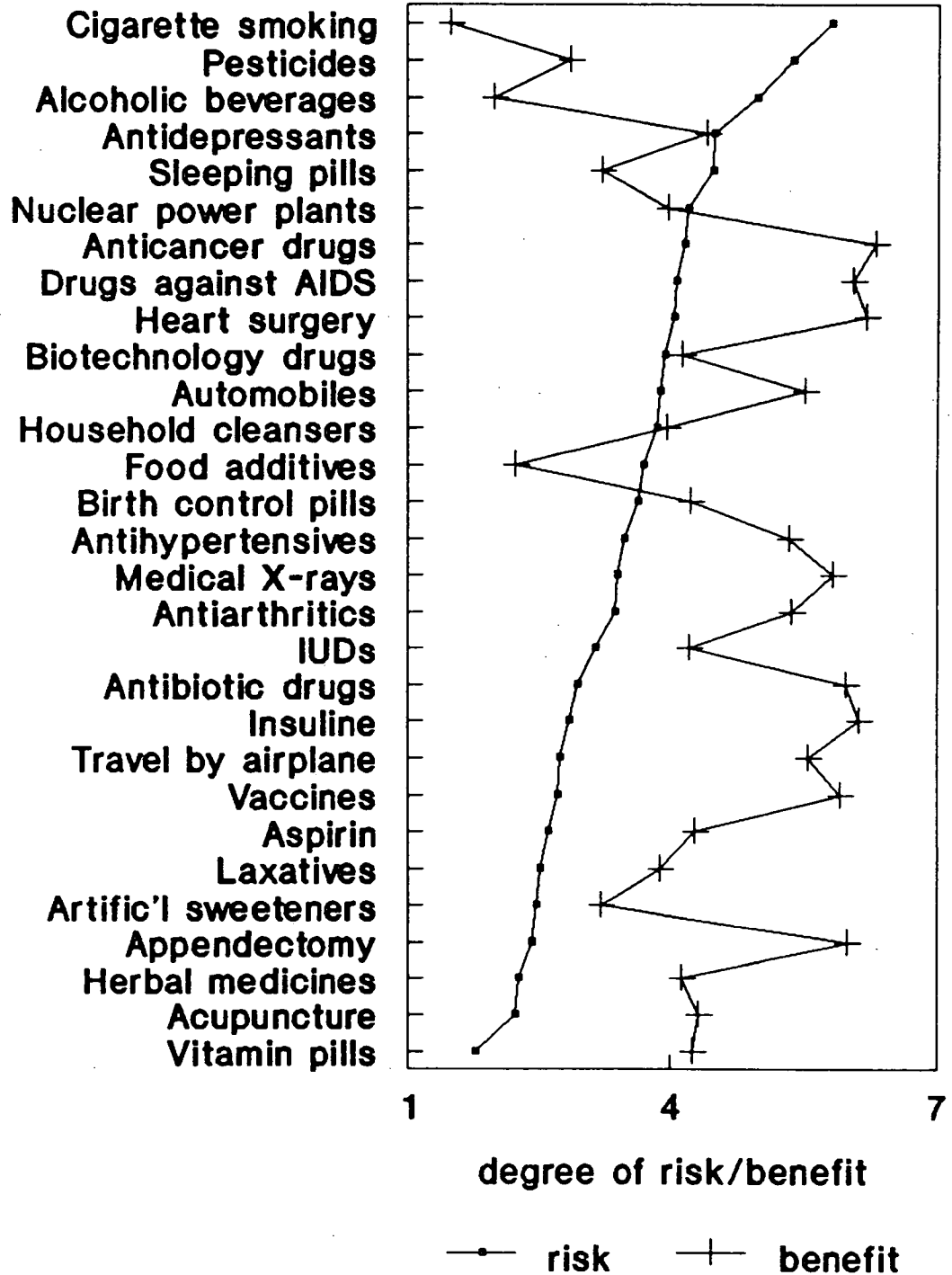


Figure 10. Perceived risk and perceived benefit.
Source: Slovic et al., 1989.

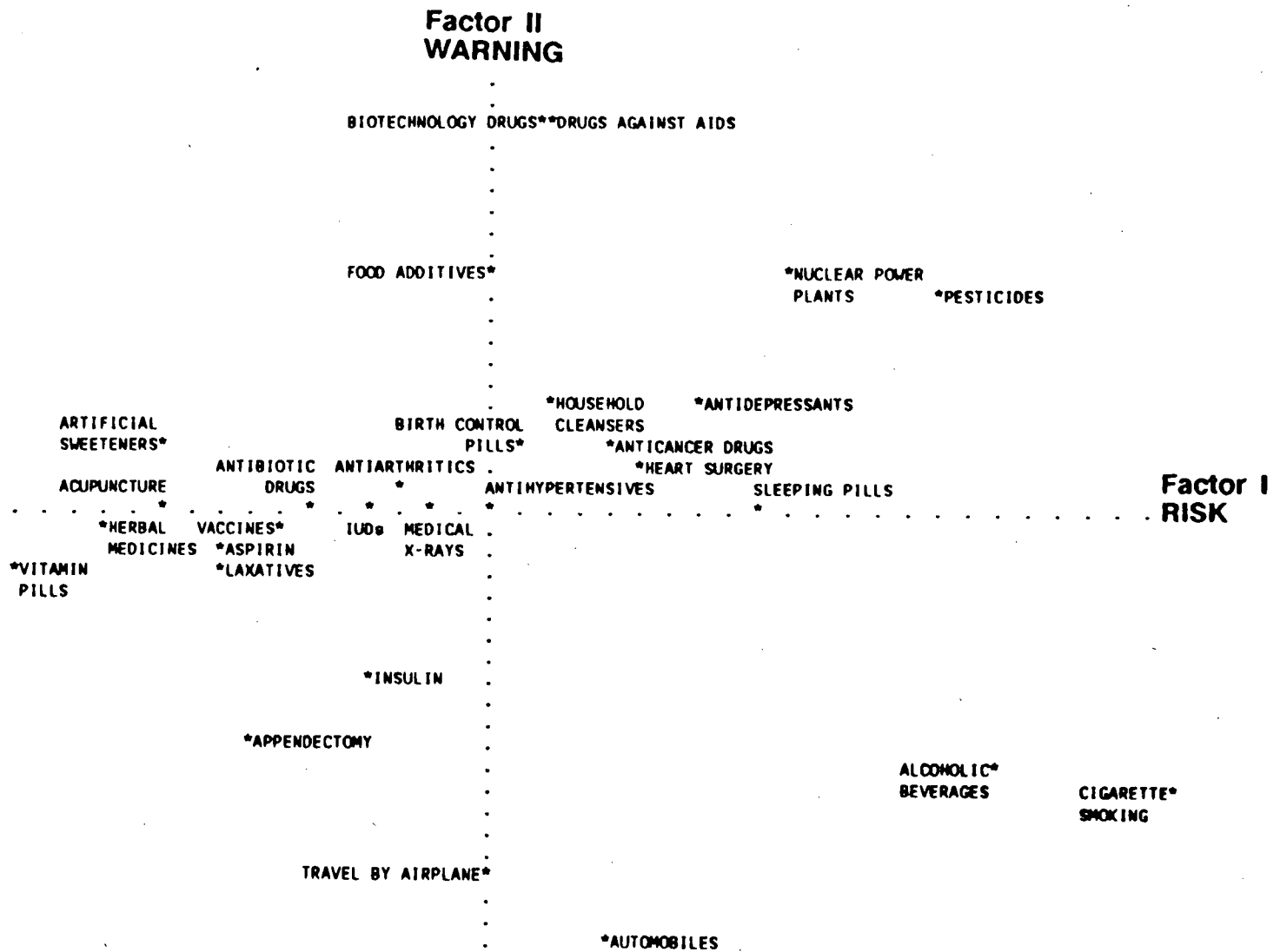


Figure 11. Perceptual map of risk factors. Source: Slovic et al., 1989