The Perception of Risk in Medical Decision Making

Amanda Baker
Psychology H508
Professor Arkes
December 5, 2008
As patients increasingly share responsibility with their doctors for making medical decisions, it has become increasingly important for them to be able to understand the risks associated with particular decisions and to assess how these compare with the potential benefits. For a variety of reasons, however, including insufficient mathematical knowledge, problems with the presentation of information about risk, and distractions of various kinds, the average patient is poor at assessing risk. Methods that could potentially improve patient risk assessment include providing better mathematics instruction in schools, counseling patients about how to assess risks appropriately, and changing the ways in which risk information is presented to them.
The Perception of Risk in Medical Decision Making

Once upon a time, doctors knew everything there was to know about being well and getting well, and patients simply accepted the decisions of their doctors without question. That time has passed. Today, people are embracing the concept that decision making is something that should be shared between the doctor and the patient. In the perfect shared decision-making scenario, the doctor shares his or her expertise with a patient, who then takes that information and carefully considers both the risks and the benefits in order to make the optimal decision.

As with all ideal situations, though, this one is not wholly realistic. The fact is that things can and will go wrong, especially given the complex human decision-making process. How can we make sure patients are fully equipped to make the best choices when it comes to their health?

Shared decision making includes everything that happens between a doctor and patient that leads to a medical decision. There are a number of factors that must be considered in making such a decision, and one major one is risk assessment. Often patients and doctors are faced with several treatment options that have varying levels of risk to the patient’s health and, in some cases, his or her life. Both patients and doctors need to be able to assess and understand these risk levels in order to make a decision with good cost-to-benefit ratios. Just as a smart entrepreneur would not invest money in something without knowing how risky it was, so patients should not invest their health in something without knowing its risks as well as its potential rewards. The goals of this paper are first to assess the average patient’s ability to understand risk,
then to discuss some of the barriers that stand in the way of proper risk assessment, and finally to present some potential methods for eliminating this misunderstanding.

Because risk assessment is so important to shared decision making, it is very important to know to what extent the average patient is able to understand risk properly. Unfortunately, research suggests that the risk perceptions of the common patient are not very good. A recent study by van der Weijden, van Steenskiste, Stoffers, Timmermans, and Grol (2007) looked at patients aged 40-70 who discussed the risk of cardiovascular disease (CVD) with their doctor. All of the patients had received accurate risk information from the physician. Yet of those who were found to be at high risk for CVD, 4 out of 5 were overly optimistic and perceived themselves as having lower risk than they did.

To our surprise, diabetes and a positive CVD family history were not determinants of high perceived risk, even though the patients with diabetes have a high actual risk by definition, and patients with a positive CVD family history often have a high actual risk. (van der Weijden et al., 2007, p. 759)

Meanwhile, of the low-risk patients, 1 in 5 were overly pessimistic and perceived themselves as being at higher risk for CVD than they actually were.

**Causes of Poor Risk Assessment**

So we know that even with a doctor’s help, people are not so good at perceiving risk properly. What is causing this poor risk assessment? There is no one correct answer. Research has uncovered a number
of potential causes for the distortion of risk information, and no one of them seems more plausible than another. The leading candidates are simple mathematical misunderstanding, problems with the presentation of risk information, and just plain distractions that keep people from understanding the information accurately. This paper will explore each of these three types of risk-distorting phenomena, starting with mathematical misunderstandings.

Mathematical Misunderstanding

Risk is often presented as probability or chance. That means that if people do not fully understand the mathematical principles involved in ratios and decimals or in proportions and probabilities, they will most likely struggle to understand risk information in even the simplest terms. Unfortunately, research suggests that many adults have issues with the math necessary to proper risk assessment. Theories such as fuzzy trace theory suggest that this is because people do not attend properly to numerical data; even if they remember it, in making decisions they tend to rely instead on the “vague gist” of what they recall (Reyna & Brainerd, 2008, p. 91). This tendency often prevents them from fully understanding the risk information they are given. A more basic problem is that some patients simply lack the mathematical knowledge of ratios, decimals, and fractions necessary to interpret these probabilities. Zikmund-Fisher, Smith, Ubel, and Fagerlin (2007) suggested that higher numeracy, or numerical aptitude, leads to better risk comprehension. A person with deficient numeracy skills will find it more difficult to make a good risk-based decision.
THE PERCEPTION OF RISK

Problems with Presentation

Mathematics is not the only thing preventing people from comprehending risk accurately. Often, people make different decisions about identical data just because the data are presented in different ways. Obviously, this is not a desirable way to make medical decisions. The only things that should factor into these decisions are risks (and/or costs) and benefits. However, research suggests that there are a number of ways in which presentation affects risk perception and shared decision making, including the presence of irrelevant anchors, framing effects, and graphing differences. Each of these is important and will be discussed in turn.

Anchoring. Anchoring refers to the phenomenon in which a person uses a numerical “anchor” as a mental starting or reference point for estimating something (such as benefits, risks, and so on) and then adjusts the anchor to arrive at what he or she considers an appropriate quantity. Anchoring becomes a problem when people use anchors that are irrelevant to the issue they are considering and do not adjust them sufficiently based on the information they know. Research done by Brewer, Chapman, Schwartz, and Bergus (2007) suggested that anchoring effects can change judgments of medical risks a good deal. In one experiment, they had HIV-positive men estimate the chances that their partner would be infected with HIV after sex with a failed condom. Before making their prediction, the men were asked whether they thought that chance was higher than 1% (low anchor) or whether it was lower than 90% (high anchor). The low-anchor condition produced an
average estimate of 43% whereas the high-anchor condition produced an average of 64%—a huge 20-point difference in risk perception just from anchoring effects alone. They repeated this experiment, this time using doctors as participants and asking them to assess the risk of a pulmonary embolism. The anchoring effect in this case was even greater, increasing risk estimates from 23% for the low-anchor group to 53% for the high-anchor group. The experimenters also asked people from each anchoring group about treatment decisions based on their risk estimates and got some interesting results, which will be discussed later in this paper. The main point to take from this research, though, is that irrelevant anchors can destroy good risk assessments. This is naturally undesirable because anything keeping a person from knowing the true risk of his or her situation can lead to dangerously bad decision making.

Framing. Another aspect of presentation that can affect risk assessment is framing. Framing occurs when people react not to a set of statistics alone but to whether they are presented in a positive or a negative “frame valence”—for example, the difference between an 80% chance of survival (positive) or a 20% chance of death (negative). The statistics are the same; only their frame valence differs. Research by Ferguson and Gallagher (2007) suggested that the effects of frame valence on risk judgment depend on two aspects of perceived risk—personal outcome effectiveness, or how effective you think the outcome will be for you, and procedural risk. Meanwhile, Zikmund-Fisher, Fagerlin, Roberts, Derry, and Ubel (2008) suggested that merely framing a medication’s risks as incremental risks or as total risks can change
THE PERCEPTION OF RISK

a person’s risk assessment. Those receiving risk information framed in incremental terms (who were told, for example, that 5% of patients taking a placebo experience dizziness, whereas 10% of those taking the medication do) reported less worry about side effects than those receiving it framed as total risk (who were simply given the 10% figure). Clearly, the way in which risk information is framed holds a great deal of sway in medical judgments and decision making. Again, this is not desirable because it only detracts from the real risks and benefits that should be what a patient considers.

Graphing differences. Even small visual differences in the way probabilities are presented can make a good deal of difference in how people assess and understand them. For example, it has been found that there is a great deal of difference in how people perceive a certain treatment depending on whether it is described using graphs showing mortality rates after the treatment or survival rates after it and on whether the graphs show 5 years’ worth of data or 15 years’ worth. Ratings of effectiveness for survival graphs varied greatly based on whether there were more years’ worth of data available, even though the data itself were very similar for the two periods. Meanwhile, effectiveness ratings were less varied with mortality graphs (Zikmund-Fisher, Fagerlin, & Ubel, 2007). This means that patients may see a treatment as more effective or less so depending on what type of graph a doctor gives them (survival vs. mortality) or how many data points it has. Although this study did not deal specifically with risk perception, it is plausible to imagine that such an effect of presentation could carry
THE PERCEPTION OF RISK

over to risk communication, in which case a person’s assessment of the risks and benefits could vary based on small unconsidered visual differences.

Distractions

“Distractions,” the last type of potential causes for distorted risk perceptions, are for the most part just things people should not base their medical decisions on but do anyway. In other words, as their name suggests, they distract patients from the valuable information that should be guiding their decisions and lead them to consider irrelevant factors that may skew their risk assessments. Distractions include prior probability estimation, comparative risk information, social and personal comparison information, and purpose-driven estimation.

Prior probability estimation. Prior probability estimation simply refers to a person having made his or her own estimate of risk before receiving risk information from medical authorities. Because prior probability estimations are not based on real data, they become worthless and should not be considered once real risk information becomes available. This idea sounds simple enough: Uninformed judgments no longer matter once information is provided. The problem is that people do not follow this rule. Fagerlin, Zikmund-Fisher, and Ubel (2005) demonstrated this statement with their study of women’s attitudes toward the risk of breast cancer. They asked some women to estimate an average woman’s risk of breast cancer, then gave them the actual statistics and asked for their reaction. Other women were simply given the statistical risk information and then asked whether the actual
risk was higher or lower than they had expected and how they reacted to it. Women who estimated the risk before getting the statistics tended to overestimate it. Naturally, they were relieved to find that their original estimate was too high, and that relief led them to react to the real risk more positively than did women who had not made prior estimations; those women were much more likely to perceive it as high and to feel anxious about it. In other words, a prior risk assessment changed the “feel” of the actual risk by introducing relief, which led some women to actually underestimate their risk.

Comparative risk information. Another thing that can distract people from perceiving risk information appropriately is comparative risk information. In one study, women were told what their breast cancer risk was and also told that it was either “lower than average” or “higher than average,” although the risk was actually the same for both groups. The “lower than average” women were less likely to accept a preventative treatment for breast cancer than were the “higher than average” group (Fagerlin, Zikmund-Fisher, & Ubel, 2007).

Social and personal comparison information. In addition to comparative risk information, social and personal comparison information can also detract from proper risk assessment. French, Sutton, Marteau, and Kinmonth (2004) had 970 adult participants respond to a series of vignettes involving risk perception. Some of the variables involved in the vignettes included using a “real world” analogue (a cardiac event such as a heart attack) versus none (a fictional
THE PERCEPTION OF RISK

pancreatic disease), telling participants that they had high or low levels of personal risk, and telling them that their risk was high or low compared to others of their age and sex. The researchers found that both the respondents’ emotional responses and their estimates of personal risk were influenced by social comparison information (about risk compared to that of others) and personal comparison information (about high or low levels of personal risk). Furthermore, this influence was found to be more prominent for the real-world condition.

Purpose-driven estimation. Ideally, risk assessment should be the determining factor for a patient’s preferred choice of treatment. It makes sense that information about risk should be gathered before the decision is made. People do not, however, always work that way. Not only do we not base our decisions on risks (and benefits) alone, but we often inadvertently make decisions before we have much information at all. Research suggests that this pattern could inadvertently lead to distorting the risk information to fit with a previous preference. One study done gave about 300 participants three different levels of motivation to choose to undergo a particular treatment. The study found that when people had more (or less) motivation to justify their preference for (or against) treatment, they adjusted what they perceived to be the probability of the treatment’s success to match (Levy & Hershey, 2006). This adjustment, known as purpose-driven estimation, was not apparently conscious or intentional. People simply like to justify their preferences, and most likely their minds automatically adjust outcome probabilities to match what they want.
Impact of Risk-Perception Assessment Research

Given the many factors that can distort risk assessment, it is easy to see that research into shared medical decision making has very serious real-life applications. The studies discussed in this paper alone address risk perception about such conditions as HIV infection and breast cancer (Brewer et al., 2007; Fagerlin et al., 2005, 2007). Specifically, Bonari et al. (2005) found that pregnant women are more likely to discontinue using antidepressants during pregnancy if their risk assessments are too high. This finding suggests the likelihood of a substantial number of women whose mental health has been needlessly put in jeopardy.

Too-low risk assessments of a condition may lead to delay of treatment if a person does not feel that his or her condition is serious enough to warrant immediate attention. Meanwhile, too-low risk assessments of a treatment may lead to someone taking risks they aren’t aware of. Too-high risk assessments of a condition can lead to unnecessarily risky treatments whereas too-high risk assessments of a treatment may lead to an avoidance of the treatment that is, in fact, the best decision.

So the research news regarding medical risk assessment so far is generally bleak. For a number of reasons, humans are basically not very good at evaluating risks. The good news, however, is that although risk perceptions are frequently incorrect, the extent to which they actually affect treatment decisions is unclear. When Brewer et al. (2007) did the study on the effects of anchoring, they found that although irrelevant anchors affected risk assessment drastically, they didn’t seem to make any difference at all in the treatment choices for hypothetical HIV...
THE PERCEPTION OF RISK

infection. This does not mean that risk assessment is not important, given that studies such as Bonari et al. (2005) found that distorted risk perceptions had a very real and immediate effect on women’s decisions to discontinue antidepressants during pregnancy. The link between risk perception and decision making may, however, be less direct in some instances than in others. Chances are that the Brewer et al. study points to a greater complexity in the shared decision-making process than we currently understand.

Possible Ways to Improve Risk Assessment

We have established how and why people are bad at risk assessment, but one big question remains. What can we do to improve risk communication so that people can make better medical decisions? As of now, there is no one solution that will eliminate improper risk assessment forever. However, a number of methods have been proposed to help reduce some of the effects of taking extraneous variables into account, and so increase the emphasis that is put on appropriate risk-to-benefit analysis.

The Subjective Numeracy Scale

The first method addresses the numeracy problem. It has been established that higher mathematical aptitude leads to higher achievement on risk comprehension tasks (Zikmund-Fisher, Smith, et al., 2007). There are ways to improve a person’s math skills, but first it is necessary to know what his or her current skills are. The subjective numeracy scale is designed to do just that. Created by Zikmund-Fisher, Smith, et al. (2007), this scale was developed with the specific intention
of assessing the numeracy skills of the general population so that physicians will know what methods of communication about risk will be most effective. In addition, any improvement in the mathematical skills of the general population should, it would seem, lead to an improvement in numeracy skills. This is perhaps one more reason to encourage strong math instruction in the U.S. educational system, so that the number of adults who do not understand basic mathematical principles like decimals will go down.

**Evidence-Based Counseling**

In addition to improving the numerical aptitude of the general population, there is some suggestion that counseling a person to correctly assess risk levels could lead to better risk assessment and better overall shared decision making. Bonari et al. (2005) got mixed results with this approach. They found during the study on discontinuation of antidepressant use during pregnancy that evidence-based counseling was *somewhat* effective in reducing distorted risk perceptions. This success, however, was very limited. Despite evidence-based counseling that pregnancies were not harmed by antidepressants, a large number of women still chose to discontinue them during pregnancy, and some went so far as to avoid getting pregnant so they could continue taking them. These findings suggest that some inappropriate risk perceptions may be very robust. It seems likely that there are a number of “roadblocks” skewing risk perceptions, and counseling in this area would have to address a wide variety of issues in order to be effective in this particular area.
Targeted Presentation Style

Finally, because a large number of inappropriate risk assessments seem to be caused by differences in presentation, understanding just which forms of presentation create which errors would allow medical professionals to carefully construct presentations that do not adversely affect shared decision making. The drawback to this approach is that having a greater understanding of how presentation affects risk assessment also opens up the process to manipulation. Would it be ethical for doctors to present risks in a certain way if they knew it would most likely lead to a certain result? This is a question that will need to be answered as we gain a deeper understanding of how risk perceptions are affected by things that can easily be manipulated, like presentation.

Conclusion

The study of shared decision making may occasionally present a bleak picture, but it also presents some opportunities. Yes, patients are very limited in their abilities to understand and account for risk in their medical decisions. But as the Brewer et al. (2007) study showed, doctors themselves are hardly immune to these limitations. The personal stake of patients in decisions offers additional incentive for them to improve. And although some causes of inappropriate risk assessments may be nearly impossible to eliminate (Bonari et al., 2005), others like numeracy may just require a little extra instruction. As in-depth studies of shared decision making and its difficulties continue, new and exciting solutions could be in the future.
References


THE PERCEPTION OF RISK
