Measuring and Conceptualizing Perceptions of Vulnerability/Likelihood

Paul D. Windschitl

University of Iowa

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In theories of risk and health behavior, the construct of perceived risk is typically defined as a joint function of perceived susceptibility to a negative event and perceived severity of the consequences of the event (see discussion by Aiken, Gerend, & Jackson, 2001). These theories also typically assume, either implicitly or explicitly, that the construct of perceived susceptibility (also called perceived likelihood or perceived vulnerability) can be conceptualized and measured as a unitary construct. Although researchers have identified a variety of constructs other than perceived susceptibility and severity that influence risk behavior and perception (see e.g., Loewenstein, Weber, Hsee, & Welch, 2001), researchers have not explored the possibility that the construct of perceived susceptibility might be best conceptualized as having two distinct components. One of the main goals of my presentation is to argue that perceived susceptibility might be fruitfully conceptualized as having two distinct components and to speculate on how a researcher might go about measuring these distinct components.

The presentation is organized in three parts. In Part 1, I briefly describe some problems with measuring perceived susceptibility as a numeric subjective probability and then comparing subjective probability to objective probability in order to draw conclusions about people's sensitivity to risk. In Part 2, I discuss why and how the construct of perceived susceptibility or perceived likelihood should be treated as having two separate components. In Part 3, I briefly mention some underutilized attributes of perceived likelihoods that might serve as predictors of health-relevant behaviors.

Part 1: Problems with Drawing Conclusions from Subjective Probabilities

One method for measuring perceived susceptibility is to solicit numeric subjective probabilities (on either a 0-1.0 scale or 0-100% scale) from research participants. An apparently attractive aspect of this form of measurement is that a researcher can compare participants' subjective probabilities to relevant objective probability values. When participants' subjective probability responses about suffering a hazard exceeds (falls short of) the objective probability value, researchers sometimes claim that people are oversensitive (undersensitive) to the risk posed by the hazard (e.g., Viscusi, 1990). There are three problems with using such comparisons to draw conclusions about people's sensitivity to a given risk (see more detailed discussion in Windschitl, 2002).

The first problem is that people often misuse and/or misinterpret a numeric probability scale. A variety of research findings suggest that a notable portion of participants use the 0-1.0 or 0-100% scale in ways not intended by researchers or in ways that indicate the participants do not understand the constraints of the scale (e.g., Black, 1995; Borland, 1997; Fischhoff & Bruine De Bruin, 1999; Lipkus, Samsa, & Rimer, 2001; Teigen, 1974; Windschitl, 2002). For example, in their research on the 50% "blip", Fischhoff and Bruine De Bruin (1999) showed that many respondents use the 50% response as an indication that they have no idea as to the answer (see also Bruine De Bruin, Fischhoff, Millstein, & Halpern-Fleshner, 2000). Another example comes from research showing that participants' subjective probability responses for a set of mutually exclusive and exhaustive events often greatly exceed 100% (e.g., Robinson & Hastie, 1985; Teigen, 1983; Tversky & Koehler, 1994; Wright & Whalley, 1983). This pattern of responses is especially noteworthy in cases when participants provided probability estimates for each event in a successive fashion, making it possible for participants to easily assess and monitor the

additivity of their responses (e.g., Teigen, 1974; Windschitl, 2002). These findings suggest that participants either lack awareness about the additivity constraint or blatantly disregard it. Another type of misinterpretation issue is that some participants might interpret a probably scale as a scale of concern rather than a scale of probably (Borland, 1997; Eiser, 1994). If so, then a respondent might give a very high response (.60) to a hazard that garners more concern than other hazards even though the respondent thinks the hazard has a low absolute probability of happening. Given all of these types of misuse and misinterpretation problems, it is questionable for a researcher to claim that, when respondents' subjective probabilities don't match a relevant objective probability, the respondent is not appropriately sensitive to the possibility of the hazard occurring. Instead, it might be more reasonable to acknowledge that participants might simply have used the probability scale in a way that was not intended by the researcher. There is another related interpretation, which was discussed in more detail by Windschitl (2002). Namely, a response bias that influences an entire class of responses (not just responses about the hazard in question) might be merely operating at the level of the response; it is not necessarily a good reflection of whether internal representations of likelihood are also affected.

The second type of problem with comparing subjective and objective probability to gauge whether people are appropriately sensitive to their susceptibility to a hazard is that numeric likelihood measures might not tap the component of the likelihood construct that drives the behavior of interest. This will be discussed in greater detail in Part 2 of the presentation. The basic point, however, is that numeric measures tend to prompt deliberative rule-based thinking, whereas behaviors and responses to nonnumeric measures are typically mediated by spontaneous and intuitive thinking (Windschitl & Wells, 1996). Hence, if a researcher is interested in predicting behavior, a nonnumeric measure might be more effective than a numeric one for measuring the component of perceived susceptibility that actually drives behavior. For example,

a smoker's report that he has a 45% chance of dying from lung cancer might represent an isolated belief about numeric probability rather than a more intuitive or gut-level perception that will influence his/her behavior.

Finally, the third type of problem is that probability responses are often ad hoc beliefs and are easily influenced by context. For example, in a recent study, smokers' estimates of their chances of dying from lung cancer varied as a function of whether alternatives to lung cancer were or were not explicitly listed (Windschitl, 2002; see also Hanson & Kysar, 1999; Slovic, 2000). In another study, participants' estimates of half-pack smokers' chances of dying from lung cancer were substantially influenced by whether the preceding question was about nonsmokers or about 2-pack-per-day smokers (Windschitl, 2002). If context manipulations can produce such dramatic shifts in subjective probability responses (even among smokers being asked about smoking-relevant outcomes), this suggests that the subjective probability responses don't reflect well-formed stable beliefs. Instead, the responses reflect temporary constructions.

Given the three types of problems mentioned above, researchers should use extreme caution when comparing people's subjective probabilities about an event to a relevant objective probability. Mismatches between the two cannot necessarily be interpreted as reflecting an over or undersensivity to a risk.

Part 2: Two Components of Perceived Likelihood

Studies that attempt to predict and understand health behaviors often assess a variety of risk-related constructs beyond the basic constructs of perceived susceptibility and perceived severity of outcomes. For example, affective constructs such as worry and anxiety have been found to have important roles in predicting health behaviors (e.g., Cameron & Diefenbach, 2001; McCaul, Branstetter, Schoeder, & Glasgow, 1996). Also, recent conceptualizations of risk include various affective components (e.g., Loewenstein, Weber, Hsee, & Welch, 2001; Peters &

Slovic, 1996). However, most researchers still seem to treat the core construct of perceived likelihood or susceptibility as a unitary construct.

I propose that perceived likelihood is better conceptualized as having two distinct components—beliefs about the objective probability of a hazard and intuitive feelings about one's vulnerability to the hazard. Before explaining more about this distinction, I should clarify that this distinction is not a distinction between personal (How vulnerable am I to X?) and general vulnerability (How vulnerable are people to X?). Nor is it a distinction between absolute vulnerability (How vulnerable am I to X?) and comparative vulnerability (Am I more vulnerable to X than are other people?). Instead, this is a distinction about a person's beliefs about the true likelihood of some hazard befalling them and his/her intuitive or gut-level feelings about whether the event will befall them. These two components will usually correspond, but sometimes will not. This distinction is related to a broader distinction between two types of processes systems—the rule-based system and the associative/intuitive system (see Epstein, 1990; Sloman, 1996; Smith & DeCoster, 2000). It also fits with some people's experiences in which they have an inclination to be quite uneasy about a hazard but at the same time they know at a "rational" level that the hazard is so unlikely that it does not warrant special concern. For example, some people feel very uneasy about flying even though they know and believe that flying is safer than driving.

The proposed distinction between beliefs about objective probability and gut-level feelings of certainty is generally compatible with findings from recent lab experiments showing that numeric and nonnumeric measures differ in their sensitivity to various manipulated factors (e.g., contextual factors, social comparisons, intergroup comparisons, absolute evidence) (see e.g., Kirkpatrick & Epstein, 1992; Flugstad & Windschitl, in press; Klein, 1997; Teigen, 2001; Windschitl, 2000; Windschitl and Wells, 1996; 1998; see discussion by Windschitl, 2002). In one experiment providing support for this distinction, participants read about various diseases'

prevalence rates for a target group (women) and a context group (men). The prevalence rate for a given disease among women was held constant (12%), but the rate for the disease within the context group was manipulated (either 4% or 20%). Participants used the prevalence rate for the context group as a comparison standard when interpreting the rate for women. Consequently, participants intuitively perceived women as more vulnerable to the disease when the prevalence rate for the context group was low (4%) rather than high (20%). In another study, these contrast-induced shifts in intuitive perceptions were shown to lead to situations in which participants' beliefs about which of two diseases had a higher objective probability for women conflicted with their own intuitive expectations about which of the events was more likely for women. In other words, a context manipulation was used to create a situation in which people's beliefs about objective probability contradicted their own intuitive feelings about likelihood.

Below are some common types of measures of perceived vulnerability/likelihood that are used in studies investigating and predicting risk behavior.

> How likely is it you will get skin cancer…? (1-7)
> How likely do you think it is that you will get skin cancer… (1-3)
> How vulnerable do you think you are to getting skin cancer…? (1-7)
> What are your chances of getting skin cancer… (0-100%)
> What is the likelihood that you will get skin cancer…? (0-100%)

I suggest that for each of these measures, respondents can formulate two quite different interpretations of what the researcher is asking. Namely, the respondent might assume that the researcher is essentially asking A) "What is the objective probability that the hazard/disease will happen?" or B) "Intuitively, how likely does it feel or seem that the hazard/disease will happen?" For any given question, the responses from a group of participants probably reflect an unknown blend of the two interpretations/components. That is, some participants interpret a given question as if it were a type A question and some interpret it as if it were a type B question.

If indeed respondents differ in whether they make a type A or type B interpretation of these common susceptibility questions, then these differing interpretations can lead to quite different responses. Instead of being unsure what proportion of respondents are making a type A or type B interpretation, it seems sensible for researchers to attempt to design measures that separately evaluate beliefs and intuitive feelings about likelihood. Why? First, the two types of components might be differentially influenced by a variety of factors such as persuasion attempts, information about social consensus, contextual cues in the questionnaire, and ego-protection mechanisms. Second, I suspect that beliefs about objective probability are more stable over short periods of time than are intuitive feelings about whether a hazard will occur. For example, seeing a vivid news story about a hazard might have a small effect on people's beliefs about how likely it is that the hazard will happen to them but a very large effect on their intuitive feelings of vulnerability to the hazard (at least until the salience of the news story wears off). Third, it seems plausible to assume that either or both components can drive behavior, depending on various factors. For example, under cognitive distraction, a person might not consult or formulate their beliefs about objective probability, but instead act in accordance with their gut-level intuitions about the potential for a given hazard.

How might researchers go about measuring the two components separately? In my own previous research, I've usually tried to solicit responses reflecting either one or the other component. That is, I either used instructions and scales that maximized the number of participants who provided intuitive gut-level responses, or I used instructions and scales that maximized the number of participants who provided their objective beliefs. However, another approach would be to ask participants to provide both types of responses. The key to this approach would be to ensure that participants understand what is being asked of them. To help respondents achieve this understanding, there may be some benefit to juxtaposing the two

requests—one asking for beliefs about objective probability and one asking about intuitive perceptions. Figures 1 and 2 illustrate two ways in which this might be accomplished. As far as I know, the usefulness of this type of juxtaposition of likelihood questions has not been tested.

Figure #1

What is the objective likelihood that you will get skin cancer? [with detailed instructions on how to use the numeric scale]

_____

0% 100%

You just indicated your beliefs about how objectively likely it is that you will get skin cancer. However, at a *gut-level*, you might *feel* somewhat more or less vulnerable than your response above suggests. Place a mark on the scale below to indicate how you *feel* about your chances of getting skin cancer.

_____

0 100

Figure #2

For each event, we want you to indicate two things:
1) what you think is the actual or objective chance that this event will happen to you
2) how vulnerable you feel at a gut level about the chances that this event will happen to you

These two responses can be the same or different. Sometimes you might know that your objective chance of experiencing an event is low, but you feel more vulnerable than your objective chance would suggest. And sometimes… For each event, start by marking a slash labeled "OC" on the point of the scale that reflects your estimate of the *objective chance* that this event will happen to you. [Instructions here] After making your "OC" response, mark a slash labeled "GF" to indicate your *gut feeling* about the chance that this event will happen to you.

_____

0% 100%

Part 3: Additional Attributes to Measure

This final part of my presentation contains a brief mention of two attributes related to perceived likelihood that seem to be underutilized. The first is the accessibility of thoughts about likelihood. Just as work on attitudes has revealed that attitude accessibility is an important mediator and predictor of some behaviors (see e.g., Fazio & Towles-Schwen, 1999), it is possible that the accessibility of thoughts about the possibility of a hazard occurring might play an important role in mediating and predicting health behavior. One way of measuring accessibility would be to measure reaction times for people's responses to likelihood questions. However, given that reaction times are sometimes quite noisy and they require computer responses, an alternative would be to ask people how often they think about possibility of a hazard/disease. For example, participants in a study relevant to breast-cancer exams might be asked "Over the past month, how many times have you thought (even briefly) about the possibility of getting breast cancer?_____." Participants in a smoking study might be asked "How many occasions in the past week did you smoke or consider smoking a cigarette?_____ On how many of those occasions did you think about some potential health risks that you might someday suffer because of smoking?_____ On how many of those occasions did you not have any thoughts about potential health risks?_____."

Another attribute that should be further investigated is the self-reported trajectory of people's feelings about the likelihood of a hazard. For example, a participant might be asked "Over the recent past, would you say your gut-level feelings of vulnerability to breast cancer have increased, decreased, or remained the same?" or "How vulnerable do you feel to breast cancer compared to how you felt one year ago?" Trajectory, which could potentially be inferred using a longitudinal design, might have some important predictive properties. However, one advantage of asking people for their *self-reported* trajectory is that a longitudinal design is not

required. A second advantage is that *perception* of trajectory might actually be more predictive of future behavior than is actual trajectory. A third and related advantage concerns the comparison standards that people use when they respond to "absolute" intuitive vulnerability questions that an experimenter would analyze in order to calculate trajectory ("How vulnerable do you feel at a gut-level about getting breast cancer?"). "Absolute" questions about feelings of vulnerability lack an explicit comparison standard. Yet, when a person decides how to respond to such a question, some form of comparison must be made. A person reading the question must decide for himself/herself what to compare their feelings of vulnerability to (e.g., to their feelings about other diseases? to other people's feelings about the same disease? to some vague intrapersonal baseline level? to their previous feelings of vulnerability to the same disease?). Given that people might use different comparison standards when answering such questions, there may be substantial noise in the resulting data, which would also lead to substantial noise in trajectories calculated from the data by an experimenter. The self-reported trajectory questions include a comparison standard within the question itself (e.g., "How vulnerable do you feel to breast cancer *compared to how you felt one year ago*?"). This might reduce noise, thereby making self-reported trajectory data more useful than trajectories calculated by an investigator.

Summary

In summary, I proposed and supported three arguments/ideas in my presentation. First, comparing subjective probabilities to objective probabilities can often lead to problematic conclusions; numeric scales can lend a false sense of precision. Second, attempting to find the best single measure of perceived likelihood or vulnerability may be less fruitful than measuring two distinct components of perceived likelihood. One way of measuring these components might be to juxtapose questions about them within the same survey, thus highlighting for respondents the distinction between the components. Third, measuring the accessibility of

thoughts about susceptibility and measuring self-reported trajectory of perceived susceptibility may add to the predictive power that is achieved when measuring perceived susceptibility and related constructs. The ideas in the last two parts of my talk are speculative but nonetheless might prove useful through empirical investigation.

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