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The role of conviction in personal disease risk perceptions: What can we learn from research on attitude strength?

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Abstract

Perceived risk for disease is included as a predictor of intentions and behavior in many health behavior theories. However, perceived risk is not always a strong predictor of intentions and behaviors. One reason may be suboptimal conceptualization and measurement of risk perceptions; in particular, research may not capture the conviction and certainty with which a risk perception is held. The rich and independent literature on attitudes might be leveraged to explore whether conviction is an important moderator of the effects of risk perceptions on intentions and behavior. Attitudes are more predictive of intentions when they are high in multiple aspects of attitude strength, including attitude certainty and being more accessible and stable over time. Working from the assumption that risk perceptions have a similar structure and function to attitudes, we consider whether factors known to strengthen the attitude-behavior correspondence might also strengthen the risk perception-behavior correspondence. Although by strict definition risk perceptions are not evaluations (a critical component of attitudes), the predictive validity of risk perceptions may be increased by attention to one's "conviction" or certainty of perceived risk. We also review recent strategies designed to improve risk perception measurement, including affective and experiential assessments of perceived risk and the importance of allowing people to indicate that they "don't know" their disease risk. The aim of this paper is to connect two disparate literatures—attitudes and persuasion in social psychology with risk perceptions in health psychology and decision science—in an attempt to stimulate more work on characteristics and proper measurement of risk perceptions.

Introduction

Why would someone decide to wear sunscreen? One primary reason is a belief that one is at risk for and could actually get skin cancer. Researchers tend to expect that this perceived risk should predict whether someone engages in a behavior that might decrease that risk. However, people may be unsure of their risk or may consider it impossible to know whether they will develop a disease (Hay, Shuk, Cruz, & Ostroff, 2005; Hay et al., 2014). This uncertainty may be consequential, because when people are uncertain about their disease risk, their responses to questions assessing perceived risk should be less likely to predict performance of important prevention and screening behaviors.

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When people are uncertain about their disease risk, their responses on surveys may not represent their true beliefs. Consider a typical risk perception question: “How likely are you to get skin cancer in your lifetime?” People who are uncertain may select a response indicating their best guess, yet one they do not strongly endorse. Alternately, they could skip the question entirely or select “don’t know” if that is an option, probably resulting in exclusion from data analyses (Waters, Hay, Orom, Kiviniemi, & Drake, 2013). They may select 50% if offered a percentage scale, a response that may simply represent belief in an uncertain “50-50” chance (Bruine de Bruin & Carman, 2012; Bruine de Bruin, Fischhoff, Millstein, & Halpern-Felsher, 2000; Fischhoff & Bruine De Bruin, 1999). People also tend to consider hazard risks anywhere between 20% and 80% to be essentially equivalent (Cameron, Sherman, Marteau, & Brown, 2009). To address these issues, there is growing interest in identifying novel ways of measuring disease risk perceptions to improve how well the construct of perceived risk predicts behavior. We present a new approach aimed at assessing “risk perception conviction” (“risk conviction” in short), or the subjective sense that one knows what one’s risk belief is and confidence that this risk belief is accurate. We argue that “conviction” about the degree of one’s risk may matter as much or more than actual risk perceptions. This novel “risk conviction” approach is informed by research on attitude strength and certainty that emerged from the field of social psychology. We discuss two possible ways to use risk conviction assessments: 1) assessing risk conviction as a characteristic of risk perceptions, and 2) assessing risk conviction as an alternative to traditional risk perception items. We review other novel approaches to assessing disease risk perceptions and discuss how the risk conviction approach is both complementary to and distinct from these approaches.

Prior Research on Disease Risk Perceptions

Perceived disease risk, also referred to as perceived likelihood, susceptibility or vulnerability, is a predictor of intentions and behavior in many health behavior theories (Ferrer & Klein, 2015), including the Health Belief Model (Rosenstock, 1990) and the Parallel Processing Model (Witte, 1992). These theories posit that people who believe they are at higher risk for disease will be more likely to engage in health behaviors to mitigate this risk. Consequently, many risk communication strategies are aimed at increasing perceived risk. However, one meta-analysis found that increasing perceived risk experimentally had only a small effect on intentions and health behaviors, although the effect was enhanced when response efficacy and self-efficacy were also increased (Sheeran, Harris, & Epton, 2014). Risk perceptions are often modestly (or not at all) associated with intentions and behavior, as demonstrated by multiple meta-analyses that included observational and descriptive studies (Brewer et al., 2007; Gerrard, Gibbons, & Bushman, 1996; McCaul, Branstetter, Schroeder, & Glasgow, 1996).

There are multiple reasons for the low correspondence between risk perceptions and behavior. Some behaviors – such as sexual behavior and smoking – may result from factors such as appetitive drive rather than cognitive factors such as perceived risk (Gerrard et al., 1996). Additionally, risk perceptions are often deductive judgments that are influenced by self-esteem and global self-evaluations rather than a reasoned consideration of personal risk factors (Klein & Monin, 2009; Klein, Blier, & Janze, 2001). In other words, people may rate

their risk for disease as lower when they feel good about themselves, and higher when they feel worse about themselves. A third reason is that correlations between risk perceptions and behavior are difficult to interpret; behavior may alter risk perceptions rather than the reverse (Weinstein, Rothman, & Nicolich, 1998). Although this is less of a problem for experimental studies, it is nevertheless very difficult to change risk perceptions (Weinstein & Klein, 1995), and post-manipulation risk perceptions may simply be a by-product of *a priori* risk perceptions. Finally, many perceived risk measures do not account for whether individuals plan to engage in risk-reducing behavior, making it difficult to know what assumptions people make when reporting their risk (Ronis, 1992). For example, irrespective of their current smoking behavior, young smokers who *plan* to quit may believe they are at low risk for lung cancer.

We consider another explanation – namely, that risk perceptions are often not held with conviction or certainty, and do not fully capture the way that people think about risk. When people are uncertain of *what their beliefs are* and *whether these beliefs are accurate*, risk perceptions are unlikely to be particularly strong predictors of behavior.

Attitude Strength

Just as risk perceptions often weakly predict behavior, researchers have long recognized that attitudes are often not strong predictors of behavior (see, for example Glasman & Albarracín, 2006; LaPiere, 1934; Wicker, 1969). Importantly, attitudes are more predictive of both intentions and behavior when the attitudes have certain characteristics, including being held with greater certainty and being more accessible and stable over time (Cooke & Sheeran, 2004; Glasman & Albarracín, 2006; Kraus, 1995). The greater attitude-behavior correspondence when attitude certainty is higher is due to increased attitude stability (Glasman & Albarracín, 2006). Researchers have generally not applied insights from this research to the conceptualization or measurement of risk perceptions (but see Fischhoff & Bruine De Bruin, 1999).

Attitudes are preferences or evaluations of an object indicating some degree of favor or disfavor (Banaji & Heiphetz, 2010; Eagly & Chaiken, 1993, 1998). For example, “I hate snakes” is an attitude. Attitude strength is one dimension of attitudes, defined as the “extent to which attitudes manifest the qualities of durability and impactfulness” (Krosnick & Petty, 1995, p. 3). Attitude certainty is one dimension of attitude strength that we believe could be particularly informative with respect to risk perceptions, because as we will argue there are many reasons people may be uncertain of their disease risk. In addition to certainty, stronger attitudes are higher in accessibility, extremity, importance or centrality, and consistency (see definitions in Table 1), and thus measuring these factors as moderators of the association between risk perceptions and behavior might also improve the predictive validity of perceived risk.

Attitude certainty is “the subjective sense of conviction one has about one’s attitude, or the extent to which one is confident or sure of one’s attitude” (Tormala & Rucker, 2007; see also Abelson, 1988; Gross, Holtz, & Miller, 1995 for earlier conceptualizations). Attitude certainty is a meta-cognitive aspect of attitudes because it is a subjective understanding of one’s attitude, distinct from whether the attitude is objectively correct (Tormala & Rucker,

2007). Attitude certainty consists of two dimensions (Petrocelli, Tormala, & Rucker, 2007; Tormala & Rucker, 2007). Attitude *correctness* refers to confidence that one's attitude is "correct, valid, or justified" (Petrocelli et al., 2007, p. 31). Attitude *clarity* refers to "the subjective sense that one knows what one's attitude really is" (Petrocelli et al., 2007, p. 30). The dimensions of correctness and clarity can be assessed with items such as "How certain are you that your attitude toward capital punishment is the correct attitude to have?" and "To what extent is your true attitude toward capital punishment clear in your mind?", respectively (Petrocelli et al., 2007).

What is Risk Perception Conviction?

We propose that measuring "risk perception conviction" could improve conceptualization and measurement of risk perceptions. As previously noted, we define risk perception conviction as the subjective sense that one knows what one's risk belief is, as well as confidence that this risk belief is accurate. We contend that risk perceptions share many of the same properties as attitudes and could be evaluated on many of the same dimensions, although we note two specific distinctions between these constructs. Risk perceptions are not, by definition, attitudes; rating how likely one is to get a disease is not an evaluation indicating favor or disfavor. Another distinction is that risk perceptions can (in theory) be evaluated for accuracy, whereas attitudes are typically correct only by virtue of agreement with others or strength of evidence supporting an attitude, as indicated by items used to measure attitude correctness (Petrocelli et al., 2007). It is unlikely that these differences would limit the ability to extrapolate research on attitudes to that on risk perceptions.

The consideration of conviction with respect to perceived risk is not entirely new. Over 10 years ago, Weinstein (2003) used the word "conviction" with respect to risk perceptions: "In addition to what people state about their beliefs [about their disease risk], are there degrees of conviction that need to be recognized?" Despite this foreshadowing in language, Weinstein's conceptualization seems to refer to whether risk judgments are based on experience, and to the distinctions among cognitions versus feelings about vulnerability to disease (an approach utilized in Weinstein et al., 2007 that we discuss later). Additionally, Fischhoff and colleagues (1999) have assessed confidence about risk perceptions, but this approach is infrequently taken.

A note on terminology—Certainty, conviction, and confidence are often used interchangeably in the attitude literature, although attitude certainty is used most commonly (see Gross et al., 1995 for a list of synonyms). We carefully selected the term "risk conviction" because we expect it to be less confusing than the term "risk certainty." When rating perceived risk, a person is in many respects rating the certainty that an outcome will occur. This is evident, for example, by the response options on some risk perception scales that range from "almost zero" or "impossible" to "almost certain" (see, for example Dillard, Ferrer, Ubel, & Fagerlin, 2012; Windschitl & Wells, 1996). Thus, certainty could be a synonym of perceived risk as well as a characteristic of perceived risk. We chose conviction because it does not have multiple meanings in this context, whereas certainty does.

How do people become certain of their perceived risk for disease?—The attitude literature provides insights into when and why people should be more certain about their perceived risk for disease (Gross et al., 1995; Rucker, Tormala, Petty, & Briñol, 2014; Tormala & Rucker, 2007). We highlight several antecedents of attitude certainty that may be particularly relevant to risk perception conviction: direct experience, and greater consistency, relevance, and completeness of the information (e.g., information about risk factors) used to generate the belief (Figure 1).

First, risk perceptions might be held with greater conviction if an individual's *experience* with disease is direct (e.g., caring for a family member during a diagnosis) rather than indirect (e.g., hearing about a diagnosis second-hand). More direct and greater experiences have been posited as antecedents of attitude certainty, likely because they result in greater knowledge (Gross et al., 1995; Rucker et al., 2014; Tormala & Rucker, 2007; see for example, Fazio & Zanna, 1978).

Next, risk conviction should be higher when all risk factors *consistently* confer either increased or decreased risk; a person at elevated genetic risk for melanoma who has a low-risk phenotype (e.g., dark hair, no moles) may have less conviction than a person with elevated genetic risk and a high-risk phenotype. When people have information about an attitude object that is "evaluatively congruent"—this is, all positive or all negative—they have greater attitude certainty (Rucker et al., 2014; see for example, Smith, Fabrigar, MacDougall, & Wiesenthal, 2008).

Risk conviction should also be higher when individuals understand which risk factors are *relevant* to disease (e.g., knowledge that UV exposure is a risk factor for skin cancer), and thus can evaluate how these risk factors relate to their own risk. If people think their attitudes are based on relevant information, they are posited to have greater attitude certainty (Rucker et al., 2014).

If people are given a risk estimate, risk conviction should be higher when people believe their risk estimate is *complete*, for example if it encompasses multiple risk factors or if one factor is completely deterministic (such as genetic risk information for Huntington disease). Indeed, people often disbelieve output from risk calculators if factors such as their prior behavior do not appear to have been considered (Scherer et al., 2013). Completeness is posited to be relevant to attitude certainty because it suggests that there are fewer unknown factors that could change one's attitude (Rucker et al., 2014). In general, by drawing on the previously identified antecedents of attitude certainty, predictions can be made about factors that will be associated with greater risk conviction.

Perceived ambiguity of any information about one's risk may also influence risk conviction (Gross et al., 1995). Ambiguity refers to uncertainty arising from limitations in the reliability, credibility, or adequacy of information (Ellsberg, 1961; Han, Klein, & Arora, 2011). If people think experts do not have accurate information about their risk, they should have lower risk conviction. For example, if people receive ambiguous information involving a range of probabilities (e.g., "Your risk for bladder cancer is between 10% to 25%") they

should perceive the information to be less legitimate and accurate, and thus have less risk conviction.

Risk conviction as a dimension of perceived risk—Risk conviction might be measured and used in two different ways: as a *moderator* designed to accompany assessments of perceived risk or as an *alternative* to existing measures of perceived risk. We discuss each possibility in turn.

One approach is to measure both perceived risk and risk perception conviction and to look at the interactive effects of these constructs. Attitudes held with greater certainty are more stable and persistent, more resistant to persuasive attacks, and show greater correspondence with behavior (Abelson, 1988; Cooke & Sheeran, 2004; Glasman & Albarracín, 2006; Gross et al., 1995; Kraus, 1995; Tormala & Rucker, 2007; Figure 1). These data suggest that risk perceptions will be more predictive of intentions and behaviors for people with greater risk conviction. Because risk perceptions are difficult to change in the long term (Aspinwall, Taber, Kohlmann, Leaf, & Leachman, 2014; Dieng et al., 2014), by measuring risk conviction as a moderator we might also be able to better predict whether and for whom risk perceptions are likely to change following health communications targeting perceived risk. People with less risk conviction should be more responsive to these interventions.

Researchers could also assess risk correctness and clarity, consistent with the approach taken in the attitude literature. However, what would it mean to say that one's perceived risk (and especially one's feeling of vulnerability) is correct? In the attitude literature, attitudes are deemed "correct" when other people agree (Petrocelli et al., 2007). In the case of diesease risk, the objective estimate is the number that would be given by a medical professional or risk calculator. However, people may not think these estimates are accurate if they believe disease risk is unknowable or that medical professionals do not have enough information to provide risk estimates. Indeed, people often disagree with objective risk estimates such as those provided through genetic testing (Aspinwall et al., 2014), determined through risk assessment tools (Scherer et al., 2013), or obtained through laboratory tests (Jemmott, Ditto, & Croyle, 1986). This may be due to reasoned, potentially rational responses (i.e., "I plan to quit smoking, so my lung cancer risk is not so high") or to more defensive processes aimed to minimize risk (McQueen, Vernon, & Swank, 2012; van't Riet & Ruiter, 2013). Thus, asking people whether they think their perceived risk aligns with such information may not truly measure perceived risk correctness. With these considerations, an item used to assess risk correctness might be:

> Consider your response to [the perceived risk question]. How certain are you that this belief would be similar to what you might learn from a calculator that takes into account every factor that determines how likely you are to get cancer in your lifetime (for example, your past and future behavior, your genetics, your environment, and/or any other factors you might think are important)?

Risk clarity, or the extent to which people believe their perceived risk is clear in their mind, should be more straightforward to assess. One might ask, "Consider your response to [the perceived risk question]. To what extent is this belief clear in your mind?"

Measuring risk conviction as an alternative to perceived risk—Perceived risk estimates are susceptible to contextual factors and often constructed *ad-hoc* (Windschitl, 2002) based on overall self-evaluations of the self rather than a deliberate consideration of one's risk factors (Klein et al., 2001). Moreover, perceptions of either low risk or high risk could lead to the identical behavior for different reasons (Lipkus & Klein, 2006). Thus, in addition to measuring conviction as a moderator, another possible approach is to replace conventional risk perception measures with alternative measures of conviction. Hypotheses as to how risk conviction might have main effects on three types of health behaviors (i.e., screening to determine disease risk, screening to determine presence/absence of illness, and prevention behaviors) are outlined in Table 2. If people are certain of their risk, they should be less likely to engage in risk predictive screening tests such as cholesterol tests because they already hold risk beliefs high in certainty and do not require additional information. In the case of screening for the absence/presence of disease, people certain of their low risk may screen for reassurance, whereas people certain of their high risk may screen to identify disease so they can then act appropriately on the information. Indeed, one study showed that people told they were either at low or high risk for colorectal cancer were more likely than controls to intend to get a screening test (Lipkus & Klein, 2006). Conversely, prevention behaviors such as aspirin use to reduce stroke risk may *not* be predicted better by risk perception than by risk conviction, because what matters more in driving these behaviors may be believing oneself to be at high risk. These hypotheses represent important avenues for future research, as little data exists as to whether and for what behaviors risk conviction may be a stronger predictor of health behaviors than risk perceptions.

Complementary but Distinct Approaches to Improving Risk Perception Measurement

For some time now, researchers have recognized various limitations of survey items assessing perceived risk. For example, people's ratings of their perceived risk using numeric probability scales ranging from 0 to 100% risk are less predictive of intentions than verbal response scales ranging from "certain" to "impossible" (Windschitl & Wells, 1996). These researchers argue that numeric probability scales may evoke deliberative processes, whereas verbal response scales evoke more intuitive processes. Numeric probability scales can also be undesirable because people have difficulty understanding numeric information (Nelson, Reyna, Fagerlin, Lipkus, & Peters, 2008; Reyna, Nelson, Han, & Dieckmann, 2009). Several innovative approaches to risk perception measurement have improved understanding of how people arrive at risk estimates and the degree to which perceived risk predicts intentions and behavior (outlined in Table 3). We review some below, and consider how assessing risk perception conviction is a related but distinct strategy.

Alternatives to cognitive/deliberative assessments of perceived risk—People make judgments and decisions – including risk judgments—based on cognitive and affective factors (Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, Peters, Finucane, & MacGregor, 2005; Windschitl, 2003). Measures designed to tap into affective factors have had substantial success in predicting behavior. It is important to note that researchers have inconsistently used multiple terms to describe different types of risk beliefs. We use terminology from the tripartite model of Ferrer, Klein, Persoskie, Avishai-Yitshak, and Sheeran (2015) in which perceived risk is composed of deliberative (i.e., rational judgments of likelihood), affective

(e.g., worry and fear about the possibility of disease), and experiential (i.e., gut feelings of vulnerability) beliefs about disease risk. We also discuss comparative and multi-level intuitive beliefs about risk.

Affective and experiential perceptions of risk: Researchers have found that affective perceptions of risk – such as worry about a future health risk (as opposed to *thinking* one is at increased risk) – are reliable predictors of intentions and health behavior. One meta-analysis showed that breast cancer worry was associated with screening; the effect was small ($r = .12$) but reliable (Hay, McCaul, & Magnan, 2006). Worry about getting heart disease in a sample of people with diabetes was more predictive of their exercise intentions than were perceived absolute, comparative, or conditional risk (Portnoy, Kaufman, Klein, Doyle, & de Groot, 2014).

Experiential perceptions of risk refer to "gut" feelings of vulnerability to a future health risk (e.g., "I feel that my chances of getting cancer at some point in my life are small"). We note that in prior work these "experiential" risk beliefs have been referred to both as "feeling at risk" (e.g., Weinstein et al., 2007) and "affective risk" (e.g., Janssen, van Osch, de Vries, & Lechner, 2011). Windschitl (2003) argued that beliefs about the likelihood of an outcome have two distinct components: beliefs about the objective probability and "gut-level" feelings about vulnerability. Although "gut-level" beliefs about disease risk have been captured by instructions concerning "your initial impressions and your gut-level responses" (Windschitl & Young, 2001), this wording is infrequently used. Some studies have shown that experiential measures are better predictors than conventional risk perception measures such as subjective likelihood (e.g., Dillard et al., 2012; Janssen et al., 2011; Janssen, van Osch, Lechner, Candel, & de Vries, 2012; Janssen, Waters, van Osch, Lechner, & de Vries, 2014; Schmiege, Bryan, & Klein, 2009; Weinstein et al., 2007). For example, Weinstein and colleagues (2007) found that "feeling at risk" for the flu was more predictive of getting vaccinated than were subjective likelihood and comparative risk perceptions.

It is possible that people systematically hold affective and experiential risk judgments with greater conviction than deliberative risk perceptions. This possibility is consistent with the construct of "affective validation" in which people are more certain of attitudes that they "feel" are correct (Rucker et al., 2014). If this were the case for risk perceptions, it can explain why affective and experiential risk assessments are often more predictive of behavior than deliberative risk assessments. We are not aware of any arguments positing that experiential judgments of risk better predict behavior because they are held with greater conviction; relying on affect is said to be "quicker, easier, and more efficient" (Slovic et al., 2005, p. S35). Importantly, risk perceptions held with greater confidence and accessed more quickly and easily might all be indicators of more meaningful risk beliefs, and we expect that these factors would likely co-occur.

A typical experiential risk item asks, "Select one answer that best represents your opinion about the statement: 'I feel that my chances of getting skin cancer at some point in my life are small'" with response options from "Completely agree" to "Completely disagree" (Janssen et al., 2011; although we note again that Janssen refers to this construct as affective risk beliefs). These response options capture the certainty with which a person thinks an

event will happen. Contrast this with a deliberate risk perception item such as “How likely are you to get cancer in your lifetime?” with response options from “Very likely” to “Very unlikely.” These response options capture perceived likelihood but not the certainty with which these beliefs are held. These potentially systematic differences in the way deliberative versus experiential risk questions are phrased raise the possibility that experiential risk assessments are more predictive because they capture risk conviction. Although this confound does not exist for affective beliefs about risk (e.g., worry and fear) we similarly believe that these affective beliefs are held with greater conviction, as it seems likely that people know how much they worry about or fear an event.

Comparative perceptions of risk: So far, we have been referring primarily to conventional subjective likelihood estimates that are assessed on numeric (e.g., 0% to 100%) or verbal scales (e.g., unlikely to likely). Research on social comparison theory (Festinger, 1954) shows that people making self-judgments find comparisons useful because they provide context. Accordingly, comparative risk is another commonly-used measure of perceived risk that measures how one’s risk compares with a reference group such as the “average person” or people of similar age. It is unclear whether comparative judgments are more difficult to make. On one hand, they may require more thought because people must rate their own risk, the referent group’s risk, and compare the two. On the other hand, they may require less thought if people find it easier to judge their risk when they have a comparative referent. Indeed, some social comparisons are virtually automatic (Gilbert, Giesler, & Morris, 1995). At times, comparative risk judgments may be proxies for absolute risk judgments because people focus egocentrically on their own risk (Chambers & Windschitl, 2004).

Comparative risk judgments often (but not always) predict intentions and behavior more reliably than absolute judgments (see, for example Blalock, DeVellis, Afifi, & Sandler, 1990). The risk perceptions of participants given comparative risk information indicating that they were at higher or lower risk than similar peers were more likely to influence behavioral intentions than those of participants given standard risk information (Lipkus & Klein, 2006). In a study in which absolute and comparative risk were experimentally manipulated, only comparative risk influenced intentions to change behavior (Klein, 1997). With these observations in mind, one might expect comparative risk perceptions to be held with *more* conviction because social comparisons create context, and because comparative risk perceptions are highly resistant to change (Weinstein & Klein, 1995). On the other hand, because both the assessments of own and referent risk could be fraught with error, comparative risk judgments may be held with *less* conviction. This question is currently unanswered.

Multi-level intuitive risk perceptions: Researchers have also attempted to comprehensively incorporate “gut-level reactions” about risk as well as affect and thoughts about risk into perceived risk assessments (Hay et al., 2005; Hay et al., 2014). This work provides fascinating insights into why people may be unsure of their disease risk and why current risk perception measures lack predictive validity.

A scale consisting of five factors underlying “intuitive risk perceptions” (Hay et al., 2014) was developed based on findings from qualitative work with 15 smokers (Hay et al., 2005).

A “cognitive causation” factor consisted of superstitious beliefs in which participants believed they might invoke bad luck or disease just by thinking their disease risk is high or by thinking about their risk at all (this item was endorsed by 6–19% of various samples). In addition, 70–79% of various samples endorsed a “defensive pessimism” belief that being overconfident about avoiding cancer could cause cancer.

Participants also endorsed beliefs that cancer risk is uncertain or unknowable (Hay et al., 2014); approximately 70% of multiple samples agreed that, “There is no way to know whether I might get cancer in the future.” These beliefs may be consequential: some participants who believed that cancer risk is unknowable thought they were less responsible for their behavior (Hay et al., 2005). This suggests that people with less risk conviction may be less likely to engage in preventive behaviors. In general, these studies suggest that there are varied and complex reasons why people’s risk estimates may not reflect their true beliefs, and why people may be uncertain of their risk for disease. This approach is complementary to the risk conviction approach.

Don’t know responses—Researchers are also examining why and how often people respond “don’t know” when asked to report their perceived risk (LeMasters et al., 2014; Orom, O’Quin, Reilly, & Kiviniemi, 2014; Waters et al., 2013). Many people select “don’t know” or “no idea” if it is an option. 69% of respondents in one study indicated that they did not know their risk of developing colorectal cancer (Waters et al., 2013), although the proportion has been smaller in other studies (Orom et al., 2014). People with characteristics often associated with health disparities (e.g., less education) are more likely to select don’t know (Waters et al., 2013), as are those with lower knowledge about cancer prevention and screening (Hay, Orom, Kiviniemi, & Waters, 2015). These data suggest that when researchers exclude people who select “don’t know” from analyses they may be excluding people who most need health interventions. The authors note also that people who don’t know their risk may randomly select an option, leading to error and lower predictive validity of risk perceptions.

Of multiple innovative approaches to improving risk perception measurement, considering don’t know responses seems to be the most similar to our risk conviction approach. Certainly, people who answer “don’t know” should have less conviction. However, we are suggesting a continuous measure of risk conviction to be used as a moderator or an alternative to perceived risk. In contrast, don’t know responses dichotomize presence versus absence of uncertainty. In addition, we expect that people who don’t know their risk are lower in risk clarity than in risk correctness. Clarity refers to whether people have a sense of their own risk beliefs (similar to “don’t know” responding) whereas correctness assesses whether people think their risk beliefs are objectively accurate. Don’t know responses are likely to better capture this former component of risk conviction. Thus, we believe the approaches are complementary and both hold substantial promise for improving risk perception measurement.

Conclusion

By taking a theoretical approach to understanding and promoting engagement in health behaviors, we hope to accelerate knowledge and reduce duplicity. The goal of this paper is to draw connections between the literatures on attitudes and risk perceptions toward the end of promoting our understanding of risk perceptions. Importantly, insights from research on attitude strength might also extend to other health cognitions such as perceived subjective norms and beliefs about how one will feel upon getting a disease (affective forecasting). The specific application to perceived risk has important conceptual, methodological, and applied implications. Conceptually, it is crucial to understand how people think about risk to develop the best models to predict behavior and other outcomes that should be related to risk perceptions. If it conviction is as or even more important than magnitude of risk perception in predicting some types of behaviors, that would cause a notable change in the way researchers conceptualize risk perception.

A substantial literature reveals only modest correlations between risk perceptions and intentions/behavior, indicating that we may not be measuring risk perception in the most effective manner. Alternatives to conventional subjective probability measures (e.g., comparative and experiential risk assessments) have been developed and show promise, but nevertheless still predict a modest amount of variance in behavior. Well-developed measures of risk conviction might address this gap. In addition, applied work often attempts to increase risk perception in order to motivate behavior change; however, these attempts are often ineffective when the people receiving risk estimates cling to their original risk perceptions. Researchers designing interventions may need to pay further heed to the conviction with which people hold their risk perceptions in order to maximize effects on behavior change. We hope the field will consider applying attitude measurement principles to that of risk perception to be a fruitful endeavor.

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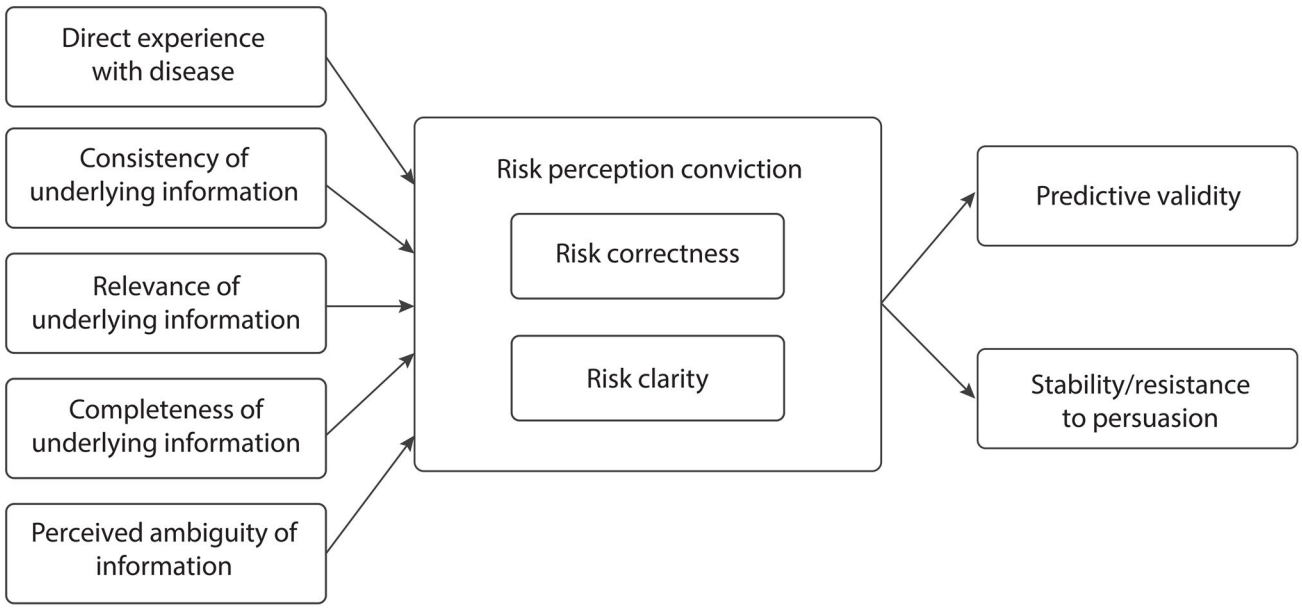

Figure 1.
Hypothesized antecedents and consequences of risk perception conviction

Table 1

Dimensions of attitude strength that may inform measurement of risk perceptions

Dimension of attitude strength	Definition in attitude literature	Application to risk perception measurement	Hypotheses concerning risk perceptions
Certainty	"The subjective sense of conviction one has about one's attitude, or the extent to which one is confident or sure of one's attitude" (Tormala & Rucker, 2007)	Conviction about one's personal risk for disease could be measured and treated as either a moderator of perceived risk or alternative to perceived risk items.	See Table 3
Accessibility	"The strength of the object-evaluation link" which is manifested as "the ease with which an attitude comes to mind" (Krosnick & Petty, 1995, p. 6)	Accessibility about perceived risk could be assessed by asking people how frequently they have thought about a particular disease or their likelihood of getting it (Windschitl, 2003), or by asking about "preoccupation with thoughts about risk" (Weinstein, 2003). The potential application of attitude accessibility to risk perception measurement has been previously identified (see Windschitl, 2003) but does not seem to have been extensively pursued.	Risk perceptions that are higher in accessibility should be more predictive of behavior.
Extremity	"The extent to which the attitude deviates from neutrality" (Krosnick & Petty, 1995, p. 6); in other words, the positivity or negativity of an attitude.	Extremity of risk perceptions could be determined by assessing the extent to which perceived risk deviates from the midpoint of the response scale. At their most extreme (e.g., 0% or 100%), risk perceptions should be held with substantial certainty. However, individuals who believe their risk to be intermediate may feel very confident that this is the case or they may pick an intermediate degree of risk because they are uncertain of their risk.	Risk perceptions that are more extreme may be more predictive of behavior, to the extent that extreme risk perceptions are also held with greater conviction. We expect that risk conviction should be more useful to measure than risk extremity.
Importance	"The degree of psychological significance people attach to an attitude" and a "manifestation of the degree of personal relevance of the attitude object" (Krosnick & Petty, 1995, p. 7).	A potentially related construct in the health domain is illness centrality, which has been measured as the extent to which people "define themselves in terms of their illness" (Helgeson & Novak, 2007, p. 260). This construct refers to people who have an illness. Future research on illness centrality may benefit from applying lessons learned from research on attitude importance.	Perceived risk may be more likely to predict behavior when a disease is more central to one's sense of self, for example when people have a family history of disease. For individuals who do not yet have a disease, risk importance or illness centrality (adapted for individuals without disease) could be measured for multiple diseases, which might indicate whether risk perceptions are likely to predict health behaviors for a particular individual.

Table 2

Predicted associations of risk conviction with different types of health behaviors, if risk conviction were measured as an alternative to perceived risk

Type of health behavior	Examples of behavior	Predictions for people with low risk conviction	Predictions for people with high risk conviction	Caveats
Screening to determine disease risk	Predictive genetic testing, cholesterol screening, blood pressure screening	Those with low risk conviction will be *more* likely to obtain screening so they can learn additional risk information because they are uncertain about their degree of risk	Those with high risk conviction will be *less* likely to obtain screening to learn additional risk information. If they are certain their risk is either high or low, then there is no need to obtain screening to learn whether risk is high or low.	This association may depend on the reason for low risk conviction. If people have low risk conviction because they don't understand risk factors, they may not have the knowledge to understand what type of screening to seek.
Screening to determine presence or absence of disease	Mammography, colonoscopy, clinical or self-skin examination	Those with low risk conviction will be *less* likely to obtain screening, particularly if fearful of information that might be obtained.	Those with high risk conviction will be *more* likely to obtain screening. If they are certain their risk is low, then there is no need to be fearful of information that might be obtained. If they are certain their risk is high, then screening will be more likely to be useful.	This association may depend on the extent to which individuals express worry or fear about learning risk information, or they extent to which they typically avoid health information for these reasons.
Prevention	Sunscreen use, aspirin use, radon testing	Those with low risk conviction may be *less* likely to engage in prevention behaviors if the reason for the low risk conviction is lack of prior thought about the relevant disease.	People who are certain their risk is low may not engage in prevention behaviors if they think it is unnecessary, or they may be certain their risk is low precisely because they *already* engage in prevention behaviors. Conversely, people who are certain their risk is high may engage in more prevention behaviors because they think it is necessary, or they may be certain their risk is high precisely because they *do not* engage in prevention behaviors. As such, for prevention behaviors we do not think there would be a direct association between risk conviction and behavior, and risk perception itself would be more predictive.	The association of risk conviction with prevention behaviors may depend on whether the research conducted is cross-sectional (in which case risk perceptions may be a result of engagement in prevention behaviors) or prospective/longitudinal (in which risk conviction may predict behavior).

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Table 3

Strategies for measuring risk perceptions and dimensions of risk perceptions

Risk perception assessment	Sample item wording	Sample response scales	Differences from risk conviction
Absolute risk assessments with numeric scales	What do you think are the chances that you will develop cancer in your lifetime?	0% to 100%	This is a traditional, cognitive assessment of risk that does not account for the conviction with which perceived risk is held.
Absolute risk assessments with verbal scales	I think my chances of getting colon cancer sometime in my life are… (Dillard et al., 2012)	"Almost zero" to "Almost certain"	Although verbal scales may allow people to express greater uncertainty (Bruine de Bruin, 2000), this type of risk assessment does not capture the conviction of one's risk beliefs.
	How likely are you to get cancer in your lifetime? (Health Information National Trends Survey)	"Very unlikely" to "Very likely"	
Affective risk assessments	How worried are you about getting cancer? (Health Information National Trends Survey)	"Not at all" to "Extremely"	Although affective risk assessments may be systematically held with greater conviction, this is not yet known.
Experiential risk assessments	Select one answer that best represents your opinion about the statement: "I feel like I could easily get cancer in my lifetime." (Health Information National Trends Survey)	"I feel very strongly that this will NOT happen" to "I feel very strongly that this WILL happen."	Although experiential risk assessments may be systematically held with greater conviction, this is not yet known. It is likely that experiential risk assessments can also be guesses, particularly when people lack underlying knowledge about disease risk factors.
	I feel that my chances of getting skin cancer at some point in my life are small. (Janssen et al., 2011)	"Completely agree" to "Completely disagree"	
	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. (Windschitl, 2003)	Place a mark on a line that goes from 0 to 100	
Multi-level intuitive risk assessments	If I think too hard about the possibility of getting cancer, I could get it (Cognitive Causation); I get frightened when I think I could get cancer (Negative affect in risk); Anybody can get cancer, no matter what they do (Unpredictability of cancer) (Hay et al., 2014)	"Strongly disagree" to "Strongly agree"	This approach assesses dimensions of perceived risk. Conviction may be an additional dimension of perceived risk, and intuitive risk perceptions may contribute to whether people are certain of their perceived risk.
Don't know responses	Allowing respondents to select "don't know" risk versus treating "don't know" responses as missing data (Waters et al., 2013)	"Very unlikely" to "Very likely" with additional responses of "I don't know" or "No idea"	This strategy dichotomizes knowing vs. not knowing risk, and does not allow for varying degrees of uncertainty.

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