

## *Associations between COVID-19 risk perceptions, behavior intentions and worry*

### BACKGROUND

Risk perceptions are central to health behavior, but some types of risk perceptions may be more strongly connected to behavior than others. This research examined different risk perceptions of COVID-19 and their respective associations with behavior intentions and worry.

### PARTICIPANTS AND PROCEDURE

U.S. college students ( $N = 248$ ) and general adults ( $N = 300$ ) reported their risk perceptions of COVID-19 – including absolute numerical, verbal, comparative, and feelings of risk – as well as their worry and intentions to do things such as get vaccinated.

### RESULTS

Although most risk perceptions related to intentions and worry, feelings of risk were the most strongly and consistently related. The associations showed that the higher people's feelings of risk were, the greater were their intentions and worry.

### CONCLUSIONS

Assessing feelings of risk of COVID-19 may provide the best insight into people's perceived threat of this virus.

### KEY WORDS

risk perceptions; COVID-19; behavior intentions; worry

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AUTHORS' CONTRIBUTIONS – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection

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## BACKGROUND

As of November 2021, COVID-19 has infected over forty-six million Americans and has been deemed a causal factor in the death of nearly 750,000 of them (Centers for Disease Control, 2020). While this significant morbidity and mortality may have increased the threat of the virus for some individuals, others may continue to see themselves as having little to no risk. Risk perceptions of COVID-19 are important because they are likely to motivate individuals' preventive behaviors such as getting the vaccine (Cori et al., 2020; Dryhurst et al., 2020). Although research suggests that risk perceptions will be important for preventive behaviors in this context, some risk perceptions may be more strongly related to these behaviors than others. In two studies, we examined different types of risk perceptions of COVID-19 and their respective associations with behavior intentions such as talking to a doctor about the virus and getting the vaccine.

### THE IMPORTANCE OF RISK PERCEPTIONS

Many theories of health behavior include the construct of risk perception, which is defined as one's beliefs about personal susceptibility to a negative event (e.g., Champion & Skinner, 2008; Janz & Becker, 1984; Prentice-Dunn & Rogers, 1986; Weinstein, 1988). People's risk perceptions are likely to correlate with, influence, or motivate their health behaviors (Ferrer & Klein, 2015; Gaube et al., 2019), and to date, much research has demonstrated this to be true (e.g., Atkinson et al., 2015; Brewer et al., 2004, 2007; Evangeli et al., 2015; Grimley et al., 2020; Katapodi et al., 2004; McCaul et al., 1996). Indeed, Ferrer and Klein (2015) argued that risk perceptions are essential to processes of health behavior change, whether that be stopping risky behaviors or starting healthy ones. Although research has only begun to examine COVID-19 risk perceptions, experts argue they will be highly important for preventive behaviors and reducing the burden of this virus in the future (Betsch et al., 2020). While this may be true, people conceptualize their risk in different ways. To best understand how threatened people feel by COVID-19 and how that relates to their behavior intentions, we need to examine multiple measures of risk perceptions.

Risk perceptions may be assessed in different ways, but historically, researchers have used one type of measure (Gurmankin Levy et al., 2006; Klein & Stefanek, 2007). Absolute-numerical risk perception and absolute-verbal risk perception ask people to estimate their probability of risk – a number (e.g., percent) or a chance (scale from *low* to *high* or *no chance* to *guaranteed to happen*), respectively. While both measures have correlated with health behav-

ior and intentions, the correlations are often smaller than expected (e.g., for a recent overview, see Champion & Skinner, 2008). Researchers argue this is because probability-based risk perceptions do not capture emotions associated with health threats such as worry (e.g., Loewenstein et al., 2001; Slovic et al., 2005).

Over the years, researchers have included additional measures of risk perception, including those that conceptually differ from probabilities. Two in particular have been highlighted: comparative risk perception and feelings of risk. Comparative risk perception questions ask people to rate their risk of a health event on a scale from *much lower than a similar other* to *much higher* with a mid-point of *about the same*. Compared to traditional absolute measures, researchers have found that comparative risk measures can have stronger associations with health behavior and intentions (Blalock et al., 1990; Dillard et al., 2011; Klein, 1997, 2002). Feelings of risk, also called “perceived vulnerability” and “affective risk perceptions” (Dillard et al., 2012; Ferrer & Klein, 2015; Slovic et al., 2005; Weinstein et al., 2007), ask individuals to rate how vulnerable they feel to health threats. Compared to the absolute measures and (sometimes) the comparative measures, feelings of risk have been more likely to predict preventive behavior intentions and actual behavior for several health threats (e.g., Dillard et al., 2012; Janssen et al., 2011, 2014; Weinstein et al., 2007).

To date, there have been studies highlighting the importance of COVID-19 risk perceptions (e.g., Cori et al., 2020; Dryhurst et al., 2020). However, none have examined the associations between different measures of risk perception, worry and intentions. Exploring the various ways in which people perceive their risk of COVID-19 and whether they have different associations with behavior will provide insight into how best to measure risk perceptions for this virus and who may feel most at risk. Ultimately, this type of research can inform interventions into best practices for encouraging preventive behaviors related to COVID-19.

### OVERVIEW AND HYPOTHESES

Participants completed an online survey that assessed their COVID-19 risk perceptions including their absolute numerical risk, absolute verbal risk, comparative risk, and feelings of risk. They then reported their behavior intentions and their worry about the virus. In line with research described above, all measures of risk perception were expected to correlate with behavior intentions, but we hypothesized that of the four measures, feelings of risk would have the strongest associations. In other words, the more vulnerable people feel to COVID-19, the greater are

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their intentions to plan to talk to a doctor about the virus, look for more information, and eventually get the vaccine. In both studies, we also examined associations between risk perceptions and worry about COVID-19. Consistent with the research described above, we similarly hypothesized that feelings of risk would have stronger associations with worry relative to the other risk perception measures.

## PARTICIPANTS AND PROCEDURE

This paper presents two studies that surveyed American individuals near the beginning of the COVID-19 pandemic. Study 1 included college students who were recruited via their psychology course, and Study 2 included general adults who were recruited via a survey company (Prolific). Both studies used the online platform Qualtrics to present the survey and record data. Both studies included measures that assessed risk perceptions of COVID-19, behavior intentions, and worry about the virus. Other than an additional intention measure in Study 2, the measures for the two studies were identical. All measures were adapted from previous research that has assessed these constructs for other health threats.

### PARTICIPANTS

Participants in Study 1 included 251 students from a large university in the Midwest. The majority (68%) of participants were female and the average age was 19 ( $SD = 1.56$ ). Most were also freshmen (67%) with some sophomores (15%), juniors (12%) and seniors (4%). Most participants reported their race as White (89%; 3% of whom were of Hispanic ethnicity) with some African American (4%) and Asian American (3%) participants (4% other races or not reported). Three participants were dropped from the analysis because they reported having been previously diagnosed with COVID-19.

Participants in Study 2 included 300 adults, of whom 42% were female and the average age was 36 ( $SD = 10.00$ ). The majority were White (80%; 7% of whom were of Hispanic ethnicity) with some African American (7%) and Asian American (9%) participants (4% other races). Only those who reported no previous diagnoses of COVID-19 could enroll in the study.

### PROCEDURE

Data collection for Study 1 occurred over a two-week period, beginning March 30, 2020 and ending April 15. College students enrolled in introductory psychology courses were invited to enroll in a study on “Beliefs and expectations about the novel coro-

navirus” which they could link to via a study website maintained by the university. After self-selecting into the study, participants completed a consent form, and then responded to the survey. In exchange for participating, students received a partial credit in their course.

Data collection for Study 2 occurred on May 12, 2020. Adults were recruited through Prolific, an international survey data company that specializes in recruiting participants for behavioral research. Prolific maintains a pool of approximately 70,000 respondents who have completed demographic information. Any participant who matches study criteria will see the study on their dashboard and can choose to opt in. The eligibility criteria for the current study included being a U.S. citizen, being at least 25 years of age, and having no diagnosed disease (heart disease, diabetes or other). Participants were compensated \$10.48 per hour.

The research was approved by Grand Valley State University IRB (no. 20-272-H).

### MEASURES

*Risk perception.* In both studies, four measures were used to assess risk perceptions, all which were adapted from previous research (Klein, 2002; Weinstein et al., 2007; Windschitl, 2003). Absolute numerical risk perception was assessed with the question, “What do you think is the objective likelihood that you will get the coronavirus?”. Participants could select a number on a line from 0 to 100%. Absolute verbal risk perception was assessed with the question, “How likely is it that you will get the coronavirus at some point in the future?”. Participants indicated their response on a 7-point scale ranging from *no chance* to *certain to happen*. Comparative risk perception was assessed with the question, “In your opinion, how do you think your chance of getting the coronavirus in the future compares to the average person your age, and race?”. Participants indicated their response on a 7-point scale ranging from *much lower* to *much higher* with a midpoint of *about the same*. For the feelings of risk perception, participants were asked to indicate their agreement with the statement, “I feel very vulnerable to getting the coronavirus” on a 7-point scale ranging from *strongly disagree* to *strongly agree*.

*Behavior intentions.* We developed two questions to assess behavior intentions in Study 1 and an additional question in Study 2. All three questions were based on intention measures used in other research (e.g., Dillard et al., 2012). Participants were asked, “How likely is it that you will talk to your doctor in the near future to get advice on ways to reduce your risk of the coronavirus?”, “If a vaccine that protects from the coronavirus became available would you

want to get vaccinated, or not?”, and “How likely is it that you will look for information about the coronavirus (for example, by using the internet or talking to others)?” (this question was added in Study 2). Participants responded to each question on 7-point scales ranging from *not at all likely* to *extremely likely*. Because the three questions asked about different behaviors, including a behavior that was not yet possible, we analyzed them separately.

**Worry.** Three questions assessed worry about getting COVID-19 (adapted from similar items used in previous research; Hay et al., 2006). Participants were asked, “How worried are you about getting coronavirus?”, “When you think about coronavirus, to what extent do you feel fearful?”, and “To what extent are you concerned about getting coronavirus?”. Participants responded to the questions on 7-point scales, from *not at all* to *extremely*. We averaged the three items ( $\alpha = .91$ ).

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## DESCRIPTIVES

The means and SDs for primary measures in both studies are presented in Table 1. For correlational analyses, we first examined correlations among risk perceptions. In both studies, the four risk perception measures were positively (significantly) correlated with one another, ranging from  $r_s = .28$  to  $.63$  in Study 1, and  $r_s = .48$  to  $.80$  in Study 2. Table 2 presents risk perceptions' correlations with intentions and worry for both studies. In Study 1, only two risk perceptions, absolute-verbal and feelings of risk, were positively correlated with intention to get vaccinated, and only feelings of risk related to intention to talk to one's doctor. In Study 2, all risk perceptions were positively correlated with intention to get vaccinated, but feelings of risk were the only risk perception to relate to all intentions. In both studies, all risk perceptions were positively associated with worry about the virus.

## RESULTS

### DATA ANALYSIS

Data were analyzed using the SPSS, version 26. In both studies, after examining means and SDs of primary variables, we conducted correlational analyses to examine bivariate associations between the different risk perceptions, intentions and worry. Hierarchical regressions were then conducted to examine independent associations with the different risk perceptions. In each study, the four risk perceptions were entered as independent variables with intentions as a dependent variable, and then again with worry as a dependent variable.

### PRIMARY ANALYSES

Regression was used to test independent associations between the different risk perceptions, intentions, and worry. Table 3 presents the coefficients for both studies. In Study 1, except for vaccine intention, feelings of risk was the only risk perception to significantly relate to all variables. The associations suggested that as feelings of risk of the virus were higher, people had higher intentions to talk with their doctor and they were more worried about the virus. Similarly, in Study 2, feelings of risk was the only measure significantly associated with all variables (note that comparative risk perception was also significant for intention to look for information).

**Table 1**

*Means and SDs for Study 1 and Study 2*

Variable	Study 1 ( <i>N</i> = 248)		Study 2 ( <i>N</i> = 300)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Absolute numerical risk perception	39.28	23.07	37.42	24.84
Comparative risk perception	3.65	1.11	3.57	1.13
Absolute verbal risk perception	3.49	1.34	3.76	1.44
Feelings of risk	3.46	1.59	3.42	1.58
Intention to talk to doctor	2.26	1.47	2.41	1.74
Intention to get vaccinated	5.73	1.77	5.51	1.90
Worry	3.62	1.64	3.92	1.76
Intention to look for information			5.02	1.76

**Table 2***Correlations for Study 1 and Study 2*

Study 1 (N = 248)				
	Intention to talk to doctor	Intention to get vaccinated	Worry	
Absolute numerical risk perception	.05	.10	.33**	
Comparative risk perception	-.02	.08	.16*	
Absolute verbal risk perception	.10	.17**	.41**	
Feelings of risk	.16*	.14*	.56**	
Study 2 (N = 300)				
	Intention to talk to doctor	Intention to get vaccinated	Worry	Intention to look for information
Absolute numerical risk perception	.07	.29**	.47**	.24**
Comparative risk perception	.15**	.16**	.32**	.08
Absolute verbal risk perception	.09	.30**	.47**	.23**
Feelings of risk	.28**	.38**	.68**	.32**

Note. \* $p < .05$ , \*\* $p < .01$ .

*COVID-19 risk perceptions, intentions, and worry*

## DISCUSSION

Research suggests that assessing risk perception in terms of one's feelings of risk may better predict health behaviors (e.g., Janssen et al., 2011; Weinstein et al., 2007). In two studies, we found support for this idea for the novel health threat of COVID-19. Relative to perceiving risk based on probabilities or comparisons to others, feeling "vulnerable" to this virus was more strongly and consistently associated with intentions to talk to one's doctor, look for information, and to get a vaccine when it becomes available. Of note, at the time of our data collection, getting a vaccine was only a possibility envisioned for the future. However, a recent study that included a representative sample of over 1,000 Americans also found that perceived vulnerability to COVID-19 had a stronger association with intentions to get the vaccine compared to probability-based risk perception (Meier et al., 2021). Together these findings suggest that feelings of risk of COVID-19 – though not necessarily perceiving a high numerical risk – may be particularly important to preventive behaviors related to this virus.

Along with behavior intent, our findings support the notion that feelings of risk may better capture health-related emotion than other ways of thinking about risk (e.g., Loewenstein et al., 2001; Slovic & Peters, 2006). In both studies, feelings of risk was more strongly associated with worry than other risk perceptions. Feelings of risk may be particularly meaningful because they rely on emotion, and not

probabilities. In fact, probability-based risk perception in the present studies had little to no associations with worry or intentions. This was true even though people in these studies estimated their average numerical risk of COVID-19 to be nearly 40%. Our findings agree with a recent study that found that COVID-19 absolute risk perception (i.e., one's chances from low to high) were not associated with social distancing, but worry was related to this behavior (Magnan et al., 2021). Given that much of the information that has been reported about COVID-19 has taken the form of probabilistic information, how people use this information deserves further study (Paulos, 2020).

Along with being some of the first empirical studies on risk perceptions of COVID-19, these studies contribute to a very small body of research on risk perceptions of emerging infectious diseases (de Zwart et al., 2009; Gidengil et al., 2012; Ibuka et al., 2010). However, the majority of these previous studies have included just one measure or assessed one type of risk perception (Dryhurst et al., 2020). Notably, in one study during the H1N1 pandemic, Renner and Reuter (2012) did find that absolute risk perceptions were only associated with vaccine intentions if they increased affective risk perception.

In the present research, we found that higher risk perceptions (of all types) were associated with higher worry. This is consistent with previous research that has connected risk perception and worry about various health threats (e.g., Mullens et al., 2004; Park et al., 2009; Shiloh et al., 2013) including recent research ex-

**Table 3**

*Regression coefficients for Study 1 and Study 2*

Variable	Study 1 (N = 248)											
	Intention to talk to doctor			Intention to get vaccinated			Worry					
	B	SE	t	B	SE	t	B	SE	t			
Absolute numerical risk perception	.00	.01	-0.67	.00	.01	-0.27	.00	.00	0.28			
Comparative risk perception	-.09	.08	-1.15	.05	.10	0.47	-.04	.07	-0.59			
Absolute verbal risk perception	.06	.10	0.65	.18	.12	1.50	.11	.08	1.40			
Feelings of risk	.16	.07	2.18*	.07	.09	0.80	.47	.06	7.80**			
	$\Delta R^2 = .03$			$\Delta R^2 = .03$			$\Delta R^2 = .34$					
	$\Delta F = 1.99$			$\Delta F = 1.97$			$\Delta F = 31.49**$					
Variable	Study 2 (N = 300)											
	Intention to talk to doctor			Intention to get vaccinated			Worry			Intention to look for information		
	B	SE	t	B	SE	t	B	SE	t	B	SE	t
Absolute numerical risk perception	-.01	.01	-1.83	.00	.01	0.10	.00	.01	0.27	.00	.01	0.40
Comparative risk perception	.13	.10	1.30	-.17	.10	-1.67	-.10	.07	-1.47	-.22	.10	-2.24*
Absolute verbal risk perception	-.05	.12	-0.46	.20	.12	1.58	.10	.09	1.09	.12	.12	1.01
Feelings of risk	.42	.08	5.09**	.41	.09	4.71**	.69	.06	11.40**	.35	.08	4.26**
	$\Delta R^2 = .11$			$\Delta R^2 = .16$			$\Delta R^2 = .47$			$\Delta R^2 = .12$		
	$\Delta F = 8.60**$			$\Delta F = 14.28**$			$\Delta F = 65.14**$			$\Delta F = 10.23**$		

Note. \* $p < .05$ , \*\* $p < .01$ .

aming related constructs (e.g., anxiety, belief about risk) for COVID-19 (Merlo et al., 2021). Some studies have found that increases in worry increase risk perception and vice versa (Lipkus et al., 2005). Although our studies suggest that risk perceptions and worry are related when it comes to the novel threat of COVID-19, experimental research is needed to determine whether one causes the other, or if they are both similarly influenced by a third factor.

Although the findings were mostly consistent across the two studies, one difference was evident. The associations between risk perceptions, intentions and worry were noticeably smaller for the college students. Importantly, this difference cannot be attributed to the students reporting lower risk perceptions as the means for risk perceptions were similar across both samples. Instead, it may be that for younger people, their risk perceptions are just less

connected to their behavior. Others have revealed similar findings for viruses (Kanadiya & Sallar, 2011; Merrill et al., 2010). In one study, researchers found that although college students were knowledgeable about the harmfulness of H1N1, that knowledge did not motivate them to get the vaccine. These findings may suggest that researchers consider different approaches to motivate behavior for college students versus general adults.

#### IMPLICATIONS

In both studies, numerical risk perceptions had minimal associations with intentions. For example, whether people thought their risk of COVID-19 was 17% or 70%, it did not relate much to their plans to get vaccinated. This is in line with research which

suggests that providing people with numerical information will be ineffective in changing behavior (e.g., Brewer et al., 2007). Instead, one promising approach to increasing risk perceptions of COVID-19 and preventive behavior may be health narratives. Narratives are accounts of individuals' experiences conveyed in the first or third person (Winterbottom et al., 2008), and research shows they are particularly effective in increasing feelings of risk of health threats (Dillard et al., 2010).

There are many questions surrounding risk perceptions of COVID-19 that have yet to be explored. Our studies tested associations between risk perceptions and preventive intentions near the beginning of the pandemic (and one intention – vaccination – was not yet possible). But, how have risk perceptions, including feelings of risk, and their associations with behavior changed as the pandemic lingers? One recent study found that across time during the pandemic, negative emotions have lessened and the associations between risk perception and preventive behaviors have become weaker (Li et al., 2021). However, this study focused on traditional measures of risk perception (e.g., numerical) rather than feelings of risk. Other questions ask how the various types of COVID risk perceptions interact with factors such as perceived control, knowledge, and trust in health agencies (Cori et al., 2020). Risk perceptions of the virus may also relate to personality traits such as optimism (Schou-Bredal et al., 2021). In line with our findings, future studies should incorporate and test ideas from the tripartite model of risk perception, which is a contemporary model that includes affect or feelings as a dimension of risk perception (Ferrer et al., 2016).

Although COVID-19 is a novel health threat, the findings reported here suggest that researchers should assess risk perception of this virus with multiple measures. Assessing individuals' risk perceptions with only one measure may understate or overstate associations. Likewise, aggregating across multiple measures of risk perception could conceal meaningful differences such as whether one is more likely than another to relate to preventive behavior. Finally, the present study also suggests that individuals' intentions related to COVID-19 prevention may be better channeled with feelings of risk measures, and future studies should incorporate more affective measures to test these ideas further.

#### LIMITATIONS

One limitation of this research was the use of convenience samples. Study 1 surveyed college students and Study 2 included a non-nationally representative sample of Americans. Of note, a recent study using a representative sample of American adults did

replicate these results (Meier et al., 2021). A second limitation was the correlational and cross-sectional methods. While major models of health behavior (e.g., the Health Belief Model; Champion & Skinner, 2008) theorize that risk perceptions motivate health behavior, only experimental research can determine whether the different types of risk perception exert a causal influence on intentions or worry (Brewer et al., 2004). Our studies also examined behavior intentions rather than actual behavior. However, research has revealed that intentions are closely related to future behavior (Sheeran, 2002). Additionally, it was not possible to assess some of the behaviors (e.g., getting a vaccine) yet.

#### CONCLUSIONS

Researchers argue that COVID-19 risk perceptions will be important for enacting preventive health behaviors (Betsch et al., 2020; Cori et al., 2020; Dryhurst et al., 2020), but there are different types of risk perceptions. Across two studies, we found that feelings of risk of COVID-19 were more strongly associated with behavior intentions and worry about the virus than other types of risk perceptions. Future risk communication or behavioral intervention strategies that deal with COVID-19 should assess feelings of risk, in addition to traditional risk perception measures, as they may be particularly important for understanding behavior and worry about this virus.

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