An Application of the Risk Information Seeking and Processing Model in Understanding College Students’ COVID-19 Vaccination Information Seeking and Behavior

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Abstract
This study tested the utility of risk information seeking and processing (RISP) model in understanding college students’ information seeking about COVID-19 vaccines and their vaccination behavior. Participants (N = 158) completed a survey measuring the RISP constructs at Time 1 and their COVID-19 vaccination behavior at Time 2. The RISP model explained 71.1% of the variance in COVID-19 vaccine information seeking. Risk information seeking and attitude toward the COVID-19 vaccine positively influenced college students’ intentions to get the vaccine, which positively predicted their vaccination behavior. Overall, these variables explained 33.4% of the variance in COVID-19 vaccine intention, and 37.2% of the variance in COVID-19 vaccination behavior.

Keywords
risk information seeking and processing (RISP) model, COVID-19 vaccine, future behavior

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Since the first outbreak of the COVID-19 in December 2019, the world has been facing a life-threatening pandemic that has not only taken the life of more than 5 million people (Johns Hopkins University, 2021), but also caused devastating social and economic disruptions. Originally, the best COVID-19 preventative measures included wearing face masks and social distancing. More recently, several COVID-19 vaccines have been developed and authorized for use. As of December 2021, 1 year since the first vaccines were authorized in December 2020, only about 56% of the population in the United States have been fully vaccinated (Centers for Disease Control and Prevention, 2021b). Among different age groups, young adults aged between 18 and 29 years have reported the lowest COVID-19 vaccination rates (38.3%) as compared with other age groups (Diesel et al., 2021). In a national survey in March 2021 of 5,082 young adults (ages 18–25 years), 10% of them reported that they definitely will not get the vaccine and 14% reported that they probably will not (Adams et al., 2021). While this age group has been found to be less likely to die of COVID-19, relative to older adults, they have the highest cumulative COVID-19 infection incidence (Centers for Disease Control and Prevention, 2022). This age group has also been found to be driving the surges of COVID-19 in 2020 in the United States (Monod et al., 2021). Low vaccination rate among young adults has become particularly concerning in college campuses due to its closed nature and sharing of living spaces. As new variants such as Delta and Omicron increase their rate of transmission, higher educational institutions must take effective measures to encourage vaccination to ensure students’ health and well-being.

Due to limited experience and lack of knowledge about the new virus, and the quickly developed vaccine with new technology, people may perceive the need for more information to determine their prevention behavior. There are many theories and models that examine informational behavior, such as the comprehensive model of information seeking (CMIS; Johnson & Meischke, 1993), the RISP model (Griffin et al., 1999), and theory of motivated information management (TMIM; Afifi & Weiner, 2004). There are also many theories examining people’s health and risk prevention behavior, such as social cognitive theory (Bandura, 1986), the extended parallel processing model (EPPM; Witte, 1992), and the reasoned action approach (RAA; Fishbein & Ajzen, 2010). Very little research has examined the link between risk information seeking and the risk preventative behavior. Guided by the RISP model (Griffin et al., 1999) and the RAA (Fishbein & Ajzen, 2010), this article aims to understand how college students’ information seeking about the COVID-19 vaccines influences their COVID-19 vaccination behavior.

Many past risk communication literatures focus on only informational behavior. But one important aspect of risk communication is to influence risk
prevention behavior (Yang, 2012). Since the COVID-19 vaccination program hit a peak of administering 4.6 million vaccine doses on April 10, 2021, vaccination has dramatically slowed down in the United States, with a vaccination rate remaining in the 50% range for months (Centers for Disease Control and Prevention, 2021a). We hope that our findings can help policymakers and organizations develop effective campaigns to encourage people who are still hesitant about the COVID-19 vaccines to seek more information and change their vaccination attitude and behavior.

The RISP Model

Generally speaking, the RISP model was developed to help predict and explain (a) how people seek and process risk information, and (b) how RISP affects risk-prevention behaviors (Griffin et al., 1999). Generally speaking, the informational portion of the RISP model was guided by Eagly and Chaiken’s (1993) heuristic-systematic model (HSM) and posits that people’s risk informational behaviors (i.e., seeking and processing) are under influence of the following factors: (a) information insufficiency, (b) risk perception, (c) affective responses, (d) informational subjective norm; (e) relevant channel beliefs (RCB), and (f) perceived information gathering capacity (PIGC). Furthermore, the risk-prevention portion of the RISP model was guided by Fishbein and Ajzen’s (2010) RAA and posits that risk-prevention behavior is under the direct and indirect influence of (a) RISP, (b) attitude, (c) norms, (d) perceived control, and (e) intention. In this research, we are particularly interested in examining the relationship between risk information seeking and risk prevention behaviors.

The risk information seeking portion of the RISP model has undergone extensive testing and is generally supported (e.g., see Yang et al., 2014 for a review; more recent examples include Brinker et al., 2020; Lu, 2015; Pokrywczynski et al., 2019; Zhou et al., 2021). However, more than two decades after the RISP model was originally proposed, the relationship between risk information seeking and risk-prevention behavior remains understudied. In fact, while a few RISP model studies have examined the relationship between risk information seeking and risk-prevention intentions (e.g., Li & Zheng, 2020; Yang, 2012), to our knowledge no other RISP model study has tested the relationship between risk information seeking and risk-prevention behavior (this is perhaps best illustrated by the fact that none of the RISP model studies cited in this article included risk-prevention behavior). Thus, the main purpose of this study is to help fill this gap in the literature, using a longitudinal research design with COVID-19 vaccination as the risk-preventive behavior.
Toward this end, this article will begin by defining and discussing the relationship between RISP model components and both risk information seeking and risk-prevention behavior. Next, we will outline the procedures of our longitudinal study where most RISP model constructs were measured at Time 1 and risk-prevention behavior (i.e., COVID-19 vaccination) was measured at Time 2. This will be followed by a presentation of our results, and a discussion of the theoretical and practical implications of our findings.

The RISP Model and Information Seeking

According to the RISP model (Griffin et al., 1999), risk information seeking is a planned behavior under the direct and indirect influence of various factors: (a) information insufficiency, (b) risk perception, (c) affective responses, (d) informational subjective norm; (e) relevant channel beliefs, and (f) perceived information gathering capacity.

Information insufficiency. Information insufficiency refers to one’s motivation to fill the gap between what one currently knows about a risk and what one hopes to know, so that one can respond to the risk adequately. It is a central motivator in the RISP model, which was built on the sufficiency principle from the HSM (Chaiken et al., 1989). HSM asserts that people are motivated to seek information in order to reach a sufficient level of judgmental confidence. Judgmental confidence is the degree of confidence to which an individual aspires in a judgmental situation (Chaiken et al., 1989). The bigger the discrepancy between one’s actual level of confidence and one’s desired level of confidence, the more motivated one is to seek additional information (Chaiken et al., 1989). Similarly, in the context of risk information seeking, the RISP model proposes that in order to effectively manage the risk and reduce uncertainties, people may engage in information seeking when they perceive the need to close the gap between their current knowledge (i.e., what people already know about COVID-19) and sufficiency threshold (i.e., what people think they should know for their own purposes). Being the central part of the model, the relationship between information insufficiency and information seeking has been widely tested, but results are inconsistent. While many studies found a positive relation between insufficiency and seeking behavior (e.g., Griffin et al., 2008; Li & Zheng, 2020; Yang, 2012), some also found no relationship (Brinker et al., 2020; Yang et al., 2014). Yang et al. (2014) suggested in their meta-analysis that information insufficiency might work particularly well for risks that people are familiar with, based on their finding that people’s current knowledge about the risk consistently predicted seeking behavior. With almost 2
years into the COVID-19 pandemic, we expect that people would become more familiar with the risk of COVID-19 and that the relationship between information insufficiency and information seeking should hold. Indeed, Li and Zheng (2020) and Zhou et al. (2021) found a positive relationship between people’s perceived information insufficiency about COVID-19 and their online information seeking.

Centered around information insufficiency, the RISP model also describes a number of other factors that can influence information seeking either directly or indirectly through information insufficiency.

Perceived hazard characteristics and affective response. According to the RISP model, perceived information insufficiency is driven in part by a person’s cognitive and affective response to the risk (Griffin et al., 1999). The cognitive response is perceived hazard characteristics, which include multiple dimensions such as perceived likelihood of harm from exposure to a risk, perceived personal control over the risk, and trust in risk management institutions (Griffin et al., 2004). Similar to the majority of the RISP studies, we focus on one perceived hazard characteristic, which is risk perception which includes two components: perceived severity and perceived susceptibility (Griffin et al., 1999; Sheeran et al., 2014; Witte, 1992). Perceived severity refers to beliefs about the significance or magnitude of the threat, while perceived susceptibility refers to one’s subjective perceptions of the probability that the risk will cause harm to oneself. Risk perception is often accompanied by how we feel about the risk emotionally. In other words, individuals who perceive COVID-19 as a serious disease (i.e., high severity) that is likely to happen to them (i.e., high susceptibility) should subsequently experience greater negative affect. Substantial evidence in the risk communication literature has shown the connection between risk perception and negative affect (Lu, 2015; Roberto et al., 2021; Yang, 2012; Yang & Kahlor, 2013; Zhou et al., 2021). In the original model, Griffin et al. (1999) proposed that affective responses induced by the perception of risk will increase the need for more information and therefore lead to active seeking of information. The latest iteration of the RISP model indicates that affective responses should have both a direct and indirect (i.e., through information insufficiency) influence on information seeking (Li & Zheng, 2020; Pokrywcynski et al., 2019; Yang & Kahlor, 2013). This makes sense because people may use information seeking as a coping strategy to deal with their negative affect (Neuwirth et al., 2000). Therefore, this study expects an indirect relationship through information insufficiency, as well as a direct relationship between negative affect and information seeking (Kahlor et al., 2020; Yang, 2012; Yang et al., 2014; Yang & Kahlor, 2013).
**Informational subjective norm.** Informed by the subjective norm concept from the RAA (Fishbein & Ajzen, 2010), another central variable in the RISP model is informational subjective norm. Informational subjective norm describes an individual’s inclination to conform to social pressures or expectations that they should acquire sufficient information to deal with the risk (Fishbein & Ajzen, 2010; Griffin et al., 1999). Unlike other components in the RISP model, which focus on an individual’s evaluation and beliefs about the risk or the information, informational subjective norm considers potential influence from sociocultural factors in the communication environment (Yang et al., 2014). The original RISP model positions informational subjective norm as an indirect predictor of information seeking through information insufficiency (Griffin et al., 1999, 2004; Kahlor et al., 2006). Recent developments of the RISP model have found evidence for both a direct and an indirect effect on information seeking (Brinker et al., 2020; Lu, 2015; Yang, 2012; Zhou et al., 2021). In other words, it is possible that people may seek information simply because others expect them to, with or without perceiving the need for more information. This study therefore expects both a direct and an indirect relationship between informational subjective norm and information seeking through information insufficiency.

**Relevant channel beliefs (RCB).** Initially, this construct focuses on beliefs about specific channels where information sources reach the audiences. These beliefs, according to Dunwoody and Griffin (2014), “may move a person to look for information in some types of channels rather than others” (p. 222). This original conceptualization and operationalization of channel beliefs distinguish information channels from information sources. Essentially, the original RISP model proposes that whether an individual seeks information from a specific channel (e.g., radio vs. TV) may depend on the degree to which this individual believes that this specific medium may (a) distort reality and (b) provide useful cues for risk information processing (Griffin et al., 2004, 2008). However, the relation between channel beliefs and risk information seeking has been found to be weak and inconsistent in earlier RISP research (Yang et al., 2014). Griffin et al. (2013) proposed that this could be because the operationalization of channel beliefs focuses on individuals’ beliefs on news media rather than information sources. This became particularly problematic in today’s world where information channels have grown exponentially and people can instantly reach information from various channels with minimum cost. Imagine when an individual searches for information about COVID-19 vaccines on Google.com, it is unlikely that this individual would click on only one link when Google.com presents millions of search results. Furthermore, algorithms detect people’s interests and feed people with information from
various channels and sources through email, news feeds, social media, and more. In an era of information explosion, while it would be ideal to examine how individuals seek information from certain channels but not others, it is perhaps impossible for information seekers to make such distinctions. Therefore, instead of examining beliefs about specific channels, we approach information seeking in a general manner and focus on the general attitude toward the behavior of information seeking. Some recent RISP research has indeed found this approach effective in understanding risk information seeking. Kahlor (2007, 2010) found that incorporating one’s salient behavioral beliefs related to information seeking can significantly enhance the explanatory power of the model. Furthermore, Yang (2012) found that when college students hold a favorable belief toward existing information about H1N1 vaccine, they are more likely to search for more information about the vaccine. We expect to find that when people have a favorable belief toward the information about COVID-19 vaccines in general, that is, when they believe that more information will effectively close their gap of knowledge about COVID-19 vaccines, they are more likely to seek information.

**Perceived information gathering capacity (PIGC).** This RISP model also proposes that, in addition to motivation, an individual must believe that he or she has the ability to gather the information needed (Griffin et al., 1999). This construct overlaps with the RAA’s perceived behavioral control (Fishbein & Ajzen, 2010) and Bandura’s (1986) self-efficacy. The more an individual feels capable of performing a behavior, the more likely it is that he or she will engage in that behavior. However, empirical studies have yielded inconsistent results regarding the relation between perceived information gathering capacity and information seeking. For example, while Griffin et al. (2008), Kahlor (2010), and Lu (2015) found a positive relation, Yang (2012) and Brinker et al., (2020) found a negative relation, and Hubner and Hovick (2020), Kahlor (2007), and Kahlor et al. (2006) found no significant relationship. Dunwoody and Griffin (2015) suggested that the inconsistent findings could be due to inconsistent operationalizations of perceived information gathering capacity. While some measures focus on very specific aspects of information seeking, such as knowing which channel sources to go to, and assessing the amount of time and effort to exert in information seeking (e.g., Griffin et al., 2008; Lu, 2015), others focus on the perceived ease or difficulty in getting useful information in general (e.g., Kahlor et al., 2006; Yang, 2012). Yang et al. (2014) also suggested in their meta-analysis that the inconsistent results could be because of the different media and information sources examined in the earlier RISP studies and more recent ones. Earlier RISP literature examined information seeking in an era of traditional media dominated by TV, radio, or newspaper, and
many people may have to rely on interpersonal sources for risk information. The cost of information seeking might be higher in those information environments. However, since the development of internet and social media, we now live in an information-loaded society with information at our fingertips. It is possible that the effect of one’s information gathering capacity has also evolved and therefore influences people information seeking behavior differently. In this article, given the amount of information overload during the COVID-19 pandemic, and to be consistent with our conceptualization of a general relevant channel belief, we think it is more appropriate to focus on people’s general perceived information gathering capacity rather than specific aspects of the information seeking process.

Based on the previous theories and empirical findings reviewed above, the following hypotheses and research question are advanced (see left-hand portion of Figure 1 up to and including information seeking):

\textit{Hypothesis 1 (H1)}: (a) Perceived severity, and (b) perceived susceptibility will be positively related to negative affect.

\textit{Hypothesis 2 (H2)}: Negative affect will be positively related to (a) information insufficiency, and (b) information seeking.

\textit{Hypothesis 3 (H3)}: Informational subjective norm will be positively related to (a) information insufficiency, and (b) information seeking.

\textit{Hypothesis 4 (H4)}: Information insufficiency will be positively related to information seeking.

\textit{Hypothesis 5 (H5)}: Relevant channel beliefs will be positively related to information seeking.

\textit{Research Question 1 (RQ1)}: What is the relationship between perceived information gathering capacity and information seeking?
The RISP Model and Risk Prevention Behavior

While the RISP model has been tested many times, little research has investigated the connection between risk information seeking and risk prevention intention and behaviors (Li & Zheng, 2020; Yang et al., 2014). This connection is predicated on the assumption that information seeking can affect the underlying cognitive structures that shape, change, or reinforce an individual’s intentions and behavior (Griffin et al., 1999). A decade ago, and in an effort to empirically link the RISP model and the RAA, Yang (2012) asked, “how does information seeking relate to behavioral intention” (p. 1706). Her study, which focused on the H1N1 vaccine, found that (a) there was a significant relationship between information seeking and behavioral intention, and that (b) information seeking accounted for additional variance in intention even when other TPB variables were present. More recently, and for similar reasons, Li and Zheng (2020) predicted that risk information seeking would be positively related to COVID-19 prevention intentions. They found that risk information seeking was positively and directly associated with COVID-19 prevention intentions (i.e., wearing masks, washing hands, and avoiding crowds). To provide one non-RISP model example that supports the theoretical and empirical relationships behind the seeking–intention link, Dutta-Bergman (2004) found that people who searched health information on the internet were more health conscious, held stronger health beliefs, and reported higher levels of healthy activities.

In our study, we use a longitudinal research design to (a) assess the relation between risk information seeking and COVID-19 vaccination intention, and (b) determine whether risk information seeking indirectly affects people’s COVID-19 vaccination behavior. According to the RAA (Fishbein & Ajzen, 2010), attitude and perceived behavioral control are two key predictors of intention, and intention and perceived behavioral control are two key predictors of behavior. Based on the aforementioned findings from Yang (2012) and Li and Zheng (2020), we expect information seeking, attitudes, and perceived behavioral control regarding the COVID-19 vaccine to accurately predict COVID-19 vaccination intentions, and that COVID-19 vaccination intentions will predict future COVID-19 vaccination behavior. Therefore, we propose the following hypotheses (see right-hand portion of Figure 1):

**Hypothesis 6 (H6):** (a) Information seeking, (b) vaccination attitude, and (c) perceived behavioral control will be positively related to vaccination intent.

**Hypothesis 7 (H7):** (a) Vaccination intent, and (b) perceived behavioral control will be positively related to vaccination behavior.
Method

Participants and Procedures

Participants were recruited from a nonrandom convenience sample of two undergraduate communication classes (N = 477 students total) at a large southwestern University. Students were told that the purpose of the study was to better understand how people gather, process, and feel about information and risk about the COVID-19 vaccine. Students self-selected to participate in the study. Data were collected at 2 points in time using Qualtrics Survey Software. All procedures were approved by the sponsoring university’s institutional review board.

Time 1 data were collected in January 2021. This was 1 month after U.S. Food and Drug Administration (2021) approved the first COVID-19 vaccine for emergency use on December 11, 2020. Two hundred and seventy-one individuals completed the Time 1 survey (after excluding one individual who indicated that they had already received both doses of the COVID-19 vaccine; 56.8% of the full potential sample). Participants received a small amount of extra credit for completing the Time 1 survey.

Time 2 data were collected in April 2021, approximately 1 month after the state where data collection took place opened up the COVID-19 vaccine to anyone aged 16 years and older on March 23, 2021 (Innes & Steinbach, 2021). One hundred and fifty-eight (58.3%) of the eligible individuals who participated in Time 1 survey also completed the Time 2 survey. Participants received a small amount of extra credit or a US$5 gift card for completing the Time 2 survey.

The final sample consisted of 158 participants. These participants were 37.3% male, and 62.7% female, with a mean age of 19.04 years (SD = 1.10). The sample was 65.8% White, 24.1% Asian, 3.2% Black or African American, and 5.1% Other. Finally, 26.6% of the sample identified as Hispanic or Latino/a, and 84.8% of participants were U.S. citizens.

Nonresponse analysis was conducted to see whether there were any differences between those who did and did not respond to the Time 2 survey for any of the variables under investigation using the Time 1 data. Independent sample t tests revealed just one difference: those who responded at both points in time tended to have more negative affect toward the COVID-19 than participants who only responded at Time 1 (t = 2.11, df = 267; p = .036).

Instrumentation

A detailed discussion of each measure follows, and survey items, means, standard deviations, and Cronbach’s alphas for all variables are presented in Table 1. All variables were measured at Time 1, except for COVID-19 vaccination behavior that was measured 3 months later at Time 2.
Table 1. Descriptive Statistics and Scale Items for All RISP Model Constructs.

| Variable          | Scale M (SD) | Scale α  | Scale items                                                                                                           |
|-------------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------|
| Severity          | 4.09 (0.86)  | .89      | • COVID-19 is a severe health issue.                                                                                   |
|                   |              |          | • COVID-19 is a dangerous illness.                                                                                     |
|                   |              |          | • COVID-19 can lead to harmful health problems.                                                                         |
|                   |              |          | • COVID-19 has serious health consequences.                                                                            |
| Susceptibility    | 3.84 (0.82)  | .82      | • It is possible that I will get the COVID-19.                                                                          |
|                   |              |          | • Getting the COVID-19 is something that could happen to me.                                                             |
|                   |              |          | • I am at risk of getting the COVID-19.                                                                                 |
|                   |              |          | • I am susceptible to getting COVID-19.                                                                                 |
| Negative affect   | 2.91 (1.24)  | .91      | Overall, the information about the COVID-19 makes me feel                                                               |
|                   |              |          | • Anxious                                                                                                              |
|                   |              |          | • Scared                                                                                                                |
|                   |              |          | • Fearful                                                                                                               |
| Current knowledge | 50.96 (22.99)| NA       | Now, we would like you to rate your knowledge about the COVID-19 vaccine.                                                 |
|                   |              |          | Please use a scale of 0 to 100, where 0 means knowing nothing and 100 means knowing everything you could possibly know about this topic. |
|                   |              |          | Using this scale, how much do you think you currently know about the COVID-19 vaccine?                                 |

(continued)
Think of that same scale again. This time, we would like you to estimate how much knowledge you would need to achieve an understanding of the COVID-19 vaccine that is good enough for your purposes? Of course, you might feel you need the same, more, or possibly even less, information about this topic.

Using a scale of 0 to 100, how much information about the COVID-19 vaccine would be sufficient for you, that is, good enough for your purposes?

| Variable                        | Scale $M$ (SD) | Scale $\alpha$ | Scale items                                                                                     |
|---------------------------------|----------------|----------------|-----------------------------------------------------------------------------------------------|
| Perceived information threshold | 73.41 (21.51)  | NA             | Think of that same scale again. This time, we would like you to estimate how much knowledge you would need to achieve an understanding of the COVID-19 vaccine that is good enough for your purposes? Of course, you might feel you need the same, more, or possibly even less, information about this topic. Using a scale of 0 to 100, how much information about the COVID-19 vaccine would be sufficient for you, that is, good enough for your purposes? |
| Information subjective norm     | 3.54 (0.78)    | .85            | • Most people who are important to me think I should stay on top of information about the COVID-19 vaccine.  
• I am expected to be knowledgeable about the COVID-19 vaccine.  
• My friends and family would want me to know about the COVID-19 vaccine.  
• Most people whose opinions I value want me to stay informed about the COVID-19 vaccine.  
• Most people who are important to me believe I should seek information about the COVID-19 vaccine. |
| Relevant channel beliefs        | 3.19 (0.71)    | .71            | I find that most information about the COVID-19 vaccine is  
• Useful  
• Believable  
• Exaggerated  
• Biased |
| Variable                        | Scale M (SD) | Scale α | Scale items                                                                                          |
|--------------------------------|--------------|---------|------------------------------------------------------------------------------------------------------|
| Perceived information gathering capacity | 3.54 (0.76)  | .87     | - It is easy for me to get useful information about the COVID-19 vaccine.                             |
|                                |              |         | - I feel quite capable of finding the information I need about the COVID-19 vaccine.                |
|                                |              |         | - I know how to get good information about the COVID-19 vaccine.                                     |
|                                |              |         | - It is difficult for me to find information about the COVID-19 vaccine. (reversed)                  |
|                                |              |         | - I DO NOT know where to find information about the COVID-19 vaccine. (reversed)                      |
| Information seeking            | 3.69 (0.90)  | .92     | - I plan to seek information about the COVID-19 vaccine in the next 3 months.                         |
|                                |              |         | - I will seek information about the COVID-19 vaccine in the next 3 months.                           |
|                                |              |         | - I intend to find more information about COVID-19 in the next 3 months.                             |
|                                |              |         | - I am likely to look for more information about COVID-19 in the next 3 months.                      |
| Perceived behavioral control   | 3.13 (0.88)  | .78     | - I would know how to get the COVID-19 vaccine if I wanted to.                                       |
|                                |              |         | - It would be easy for me to get the COVID-19 vaccine if I wanted to.                                |
|                                |              |         | - I would be able to get the COVID-19 vaccine if I wanted to.                                       |
|                                |              |         | - I DO NOT know where to find information about the COVID-19 vaccine. (reversed)                      |
Table 1. (continued)

| Variable               | Scale M (SD) | Scale α | Scale items                                                                                                                                 |
|------------------------|--------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Vaccination attitude   | 3.70 (0.95)  | .84     | Generally speaking, I think getting the COVID-19 vaccine is                                                                                  |
|                        |              |         | • Bad–good                                                                                                                                   |
|                        |              |         | • Useless–useful                                                                                                                             |
|                        |              |         | • Risky–safe                                                                                                                                  |
|                        |              |         | • Foolish–wise                                                                                                                                 |
| Vaccination intention  | 3.19 (1.26)  | .96     | I plan to get the COVID-19 vaccine in the NEXT 3 months (i.e., during the Spring 2021 semester).                                           |
|                        |              |         | I will try to get the COVID-19 vaccine in the NEXT 3 months (i.e., during the Spring 2021 semester).                                         |
|                        |              |         | I intend to get the COVID-19 vaccine in the NEXT 3 months (i.e., during the Spring 2021 semester).                                            |
|                        |              |         | I am likely to get the COVID-19 vaccine in the NEXT 3 months (i.e., during the Spring 2021 semester).                                         |

*Note.* RISP = risk information seeking and processing.
RISP model constructs

**Risk perception.** Previous RISP literature has operationalized risk perception differently. Some studies treated perceived severity and perceived susceptibility as two separate variables representing risk perception (e.g., Griffin et al., 2004; Hubner & Hovick, 2020): some studies treated risk perception as one latent construct measured by adding items about perceived severity and perceived susceptibility (e.g., Yang, 2012; Yang & Kahlor, 2013), and some studies treated risk perception as one latent construct represented by the product of perceived severity and perceived susceptibility (e.g., Brinker et al., 2020; Griffin et al., 2008; Lu, 2015). In our study, perceived severity (e.g., “COVID-19 can lead to harmful health problems”) and perceived susceptibility (e.g., “it is possible that I will get the COVID-19”) were each assessed with four items, using 5-point scales (1 = **strongly disagree** to 5 = **strongly agree**). Due to the inconsistency in the operationalization of risk perception, we ran a confirmatory factor analysis (CFA) and found that the two-factor model had good model fit ($\chi^2/df = 3.99$, root mean square error of approximation [RMSEA] = .14, comparative fit index [CFI] = .91, and standardized root mean square residual [SRMR] = .08), whereas the single-factor model had poor model fit ($\chi^2/df = 14.25$, RMSEA = .29, CFI = .59, SRMR = .22). Therefore, perceived severity and perceived susceptibility were entered separately in the model with four items loading on each factor.

**Affective response: negative affect.** In this study, we focus on negative affect toward COVID-19. Participants rated how information about the COVID-19 made them feel (“fearful,” “scared,” and “anxious”) on a 5-point Likert-type scale (1 = **none of this feeling** to 5 = **a great deal of this feeling**). These items were adapted from Witte (1994), Yang (2012), and Roberto (2022).

**Information insufficiency.** Information insufficiency was calculated using two items adapted from Brinker et al. (2020), Griffin et al. (2004, 2008), Lu (2015), and Yang (2012). The current knowledge item asked participants to rate their knowledge about the COVID-19 vaccine on a scale ranging from 0 (i.e., *knows nothing about the COVID-19 vaccine*) to 100 (i.e., *knowing everything about the COVID-19 vaccine*). The sufficiency threshold item asked participants to estimate how much knowledge of the COVID-19 vaccine would be good enough for their purposes using the same 0 to 100 scale. Rather than using the difference score to represent information sufficiency, we followed Brinker et al. (2020), Dunwoody and Griffin (2015), and Griffin et al. (2004, 2008) and used a regression approach. By regressing the sufficiency threshold on current knowledge, we can remove variances in sufficiency thresholds that are accounted for by current knowledge. Thus,
the residual variance in sufficiency threshold represents information insufficiency.

**Informational subjective norm.** Informational subjective norm was measured using five items (e.g., “Most people who are important to me think I should stay on top of information about the COVID-19 vaccine”) on 5-point Likert-type scales (1 = *strongly disagree* to 5 = *strongly agree*). These items were adapted from Fishbein and Ajzen (2010) and Yang (2012).

**Relevant channel beliefs.** This study operationalizes relevant channel beliefs as a general belief toward information about COVID-19 vaccines. Following Yang (2012), participants rated their attitude toward most information about COVID-19 vaccines on 5-point scales (1 = *strongly disagree* to 5 = *strongly agree*) using four items (i.e., “useful,” “believable,” “exaggerated,” and “biased”).

**Perceived information gathering capacity.** This study measures perceived information gathering capacity using 5-point scales (1 = *strongly disagree* to 5 = *strongly agree*) and four items (e.g., “I feel quite capable of finding the information I need about the COVID-19 vaccine”), adapted from Yang (2012) and Yang and Kahlor (2013).

**Information seeking.** Information seeking (e.g., “I plan to seek information about the COVID-19 vaccine in the next 3 months”) was measured with four items on 5-point Likert-type scales (1 = *strongly disagree* to 5 = *strongly agree*). These items were adapted from Brinker et al. (2020), (Lu, 2015), and Yang (2012).

**RAA constructs.** In addition to measuring the RISP model constructs, we also measured participants’ attitude toward the COVID-19 vaccine, their perceived behavioral control regarding the COVID-19 vaccine, and their intention to get COVID-19 vaccine at Time 1, as well as their COVID-19 vaccination behavior at Time 2.

**Attitude.** Attitude was assessed by asking, “Generally speaking, I think getting the COVID-19 vaccine is” followed by four 5-point semantic differential items (i.e., “Bad–Good,” “Harmful–Helpful,” and “Useless–Useful”; Fishbein & Ajzen, 2010; Yang, 2012).

**Perceived behavioral control.** Perceived behavioral control was assessed using three 5-point Likert-type items (e.g., “It would be easy for me to get
the COVID-19 vaccine if I wanted to”). Response categories for these items arranged from 1 = *strongly disagree* to 5 = *strongly agree*.

**Intention.** Intention was measured using four 5-point Likert-type items (i.e., “I intend to get the COVID-19 vaccine in the next 3 months [i.e., during the Spring 2021 semester]”). Response categories for these items ranged from 1 = *strongly disagree* to 5 = *strongly agree*.

**Behavior.** Behavior was measured at Time 2 by asking, “How many doses of the COVID-19 vaccine have you received in the past 3 months (i.e., during the Spring 2021 semester)?” The response categories for this behavior item were “I received zero/no doses of the COVID-19 vaccine in the past 3 months,” “I received one of the two doses of the COVID-19 vaccine in the past 3 months,” and “I received both doses of the COVID-19 vaccine in the past 3 months.” Results indicate that 46.8% of participants received zero/no doses of the COVID-19 vaccine in the past 3 months, 24.1% received one dose of the COVID-19 vaccine in the past 3 months, and 29.1% received both doses of the COVID-19 vaccine in the past 3 months.

**Linking questions.** The linking of the Time 1 and Time 2 responses was accomplished using a self-generated identification code (Schnell et al., 2010) based on responses to the following questions: (a) “On what day of the month were you born,” (b) “What are the last two numbers of your phone number,” and (c) “What is the last digit of your student ID?” Participants’ gender, age, ethnicity, and citizenship were used to match responses in the few cases where the generated codes were identical among multiple participants.

**Data Analytic Plan**

Structural equation modeling (SEM) was used to assess how well the data fit to the proposed theoretical model using the “lavaan” package (Rosseel, 2012) in R (RStudio Team, 2020). We followed a two-step procedure by first specifying the measurement models through CFA and then completing the estimation of structural models (Kline, 2016). Full information maximum likelihood (FIML) was used to address missing data (Enders, 2010). The following fit indices were used to evaluate model fit: the $\chi^2/df$ ratio, the CFIIs, RMSEA, and SRMR. An acceptably fit model must meet the following criteria: the $\chi^2/df$ ratio $\leq$ 5, CFI $\geq$ .90, RMSEA $\leq$ .08, and SRMR $\leq$ .08 (Hu & Bentler, 1999; Kline, 2016). Fit indices of the measurement models and final structural models are reported in Figure 2.
Results

The CFA showed that the measurement model fit the data well ($\chi^2/df = 1.75$, CFI = .88, RMSEA = .07, and SRMR = .07). The final structural model also demonstrated an acceptable fit to the data ($\chi^2/df = 1.69$, CFI = .87, RMSEA = .07, and SRMR = .08). Path coefficients of the structural model are reported in Figure 2. Overall, the RISP constructs explained 71.9% of the variance in information seeking. Furthermore, information seeking and the RAA constructs explained 33.4% of the variance in COVID-19 vaccination intentions and 37.2% of the variance in COVID-19 vaccination behavior.

The RISP Model

The first hypothesis predicted that (H1a) perceived severity and (H1b) perceived susceptibility would be positively related to affective responses, specifically negative affect. As a reminder, CFA results showed that perceived susceptibility and perceived severity were two separate factors and thus were entered into the model separately. Perceived severity was significantly and positively related to negative affect ($\beta = .50$, $p < .001$). However, perceived susceptibility was not associated with negative affect ($\beta = .15$, $p = ns$). Therefore, H1a was supported, but H1b was rejected.

Then, affective responses were predicted to have a positive relation with (H2a) information insufficiency and (H2b) information seeking. Results showed that affective response (i.e., negative affect) was not related to information insufficiency ($\beta = 2.87$, $p = ns$) or information seeking ($\beta = .07$, $p = ns$). Therefore, H2a and H2b were both rejected.
Hypothesis 3 predicted that informational subjective norm would be positively related to (a) information insufficiency, and (b) information seeking. Results indicated that informational subjective norm was not related to information insufficiency ($\beta = 4.00, p = ns$), but was directly and positively related to information seeking ($\beta = .46, p < .001$). Therefore, H3a was rejected but H3b was supported.

The fourth hypothesis predicted that information insufficiency would have a positive relation with information seeking. Controlling for the current knowledge participants held about COVID-19 vaccines (Griffin et al., 2004), participants’ information insufficiency had a weak but significant positive relation with information seeking ($\beta = .01, p < .05$). Therefore, H4 was supported.

Hypothesis 5 predicted that relevant channel beliefs would be positively related to information seeking. As predicted, relevant channel beliefs were significantly and positively related to information seeking ($\beta = .85, p < .001$). Thus, H5 was supported.

Finally, we posed a research question regarding the relationship between perceived information gathering capacity and information seeking. Results indicated that perceived information gathering capacity was significantly and negatively related to information seeking ($\beta = -.24, p < .05$).

The RISP Model and Vaccination Behavior

In addition to testing the utility of the RISP model in explaining college students’ information seeking regarding the COVID-19 vaccine, we also predicted a relation between information seeking and college students’ vaccination intention and behavior. Hypothesis 6 predicted that information seeking, vaccination attitude, and perceived behavioral control would be positively related to vaccination intent. Results showed that information seeking ($\beta = .53, p < .001$) and vaccination attitude ($\beta = .62, p < .001$) were significantly and positively related to vaccination intent. However, perceived behavioral control was not related to vaccination intent ($\beta = .12, p = ns$). Therefore, H6a and H6b were supported, but H6c was rejected.

H7a and H7b predicted the relation between vaccination intent and perceived behavioral control and vaccination behavior. Results showed that vaccination intent ($\beta = .25, p < .001$) was significantly and positively related to vaccination behavior at Time 2. However, perceived behavioral control was not related to vaccination behavior ($\beta = -.01, p = ns$). Therefore, H7a was supported and H7b was rejected.
Discussion

According to the RISP model, information seeking is best predicted by information insufficiency that in turn is best predicted by risk perception, affective responses, and informational subjective norm, as well as relevant channel beliefs and perceived information gathering capacity. The first goal of this study was determining how well the RISP model predicted college student’s information seeking regarding the COVID-19 vaccine. According to the RAA, an individual’s behavior is best predicted by their intention and perceived behavioral control and their intentions are best predicted by both attitudes, perceived behavioral control, and subjective norms. The second goal of this study was to determine how well information seeking, attitudes, and perceived behavioral control predicted COVID-19 vaccination intentions and behavior. As will be discussed in the following, results were largely, but not completely, consistent with both theories.

Information Seeking

The RISP model posits that information seeking is driven by the desire to close the information gap between the amount of knowledge an individual currently holds about the risk and the amount of knowledge that he or she desires to have. In this sample, on a scale from 0 to 100, participants estimated their mean level of current knowledge at 50.96 and their mean desired level of knowledge at 73.41, indicating that college students perceived insufficient information about the COVID-19 vaccine. However, the effect of such perceived information insufficiency on information seeking was only marginal (β = .01, p < .05). This is consistent with the findings from Yang and Kahlor (2013, β = .01, p < .001), Lu (2015, β = .02, p < .05), and Zhou et al. (2021, β = .01, p < .001). Especially, when compared with other predictors of information seeking, such as informational subjective norm, relevant channel beliefs, and perceived information gathering capacity, the extent to which perceived information insufficiency plays in motivating information seeking seem to deserve further examination.

While more work could be done to better operationalize information insufficiency, we propose that one possible reason for the weak relationship could be because of the operationalization of information seeking. Earlier in the article, we suggested that the beliefs about specific channels and the specific capacities to seek information may no longer be as predictive of information seeking in today’s information saturated environment as it used to be. Indeed, our general approach of conceptualization and operationalization of RCB and PIGC seemed to work well in predicting information compared with the
inconsistent findings in past RISP literature. Similarly, the construct of information seeking may also require some fine-tuning. Specifically, whether individuals are actively and purposefully seeking information or simply attending to information that they encounter casually may be influenced by different factors. Theoretically, information insufficiency in RISP represents the motivation to close the gap between current and ideal levels of knowledge to reach judgmental confidence. We propose that such motivation would drive active seeking more than passive seeking. While communication researchers and information researchers recognize the distinction between active versus passive seeking (e.g., Brashers et al., 2002; Griffin et al., 2013), very few risk information seeking research has teased them apart in empirical testing. Our study followed Yang et al.’s (2014) measurement of information seeking (i.e., I will try to seek information . . ., I intend to find more information . . ., I intend to look for information . . ., and I will look for information . . .). Many other RISP studies (e.g., Brinker et al.; Lu, 2015; Yang & Kahlor, 2013) used similar measures. Future research should consider measuring specifically active seeking, using items from earlier RISP studies such as “I’m likely to go out of my way to get more information” (Griffin et al., 2008) to better capture the relationship between information insufficiency and active information seeking.

In the RISP model, another driver of risk information seeking is affective response toward the risk. However, in this study, the negative affect toward COVID-19 (i.e., “fearful,” “scared,” and “anxious”) failed to predict information seeking about the COVID-19 vaccine. This is surprising because the relation between negative affect and information seeking has been reported consistently in past RISP studies (e.g., Brinker et al., 2020; Hubner & Hovick, 2020; Yang, 2012; Yang & Kahlor, 2013; Zhou et al., 2021). One possible reason could be that we measured affective response toward the risk (i.e., COVID-19), but we measured information seeking about the risk prevention (i.e., the COVID-19 vaccine). It is possible that people’s negative emotional response toward the risk does not translate to their response toward the risk prevention behavior. Future research should distinguish between information seeking about a risk and information seeking about risk preventions. Similarly, affective responses toward both the risk and the risk prevention should both be measured to better understand information seeking about risk prevention. Furthermore, in addition to negative affect, future research should also measure positive affect, especially emotions toward risk prevention. Only a few previous RISP studies examined positive affect toward a risk, such as flood (Griffin et al., 2008), zika virus (Hubner & Hovick, 2020), or sexual assault (Pokrywcynski et al., 2019). However, positive affect has only been found to predict people’s information seeking in more neutral contexts, such as health
risks of eating American-style food (Lu, 2015) or climate change (Yang & Kahlor, 2013). We propose that it may be particularly important to examine positive affect such as hope toward risk prevention information seeking. It is possible that the more hopeful an individual feels toward a preventative behavior, the more likely that this individual would engage in information seeking.

Vaccination Behavior

This study also investigated how information seeking behavior, along with attitude toward the COVID-19 vaccine and perceived behavioral control regarding the COVID-19 vaccine, affected COVID-19 vaccine intentions and behavior. Together, these variables explained 33.4% of the variance in intention and 37.2% of the variance in behavior. These results compare favorably with previous RAA research. To illustrate, results from previous meta-analyses indicate that the RAA typically explains between 33% and 44% of the variance in intention and between 19% and 32% of the variance in behavior (Armitage & Conner, 2001; Downs & Hausenblas, 2005; McEachan et al., 2011; Rich et al., 2015). For intention, including information seeking substantially increased the predictive power over the RAA variables alone (i.e., attitude and perceived behavioral control explained 22.6% of the variance in intention, while adding information seeking increased the amount of variance explained to 33.4% in intention).

Practically, these results provide some important and useful information for those interested in developing interventions for this topic and intended audience. Specifically, while it is promising that 53.2% of participants were at least partially vaccinated against COVID-19 during the short time the vaccine had become available to them, the fact that 46.8% of participants were unvaccinated at the time data collection took place indicates that additional efforts may be necessary to convince these students to get vaccinated against COVID-19. Furthermore, we provide some noteworthy insights for those wishing to influence college students’ COVID-19 vaccination. More specifically, these results suggest that intention, attitude, and information seeking represent ripe targets for those wishing to influence college students’ COVID-19 vaccination behavior. In this study, information seeking, attitudes, and intention all hovered around the middle (i.e., 3.19–3.70) of a 5-point scale, suggesting there is room for improvement on all three variables.

Strengths and Limitations

In addition to using theory-guided measures and examining a practically important issue, this study has two important strengths that substantially contribute to the risk communication literature. First, it included and
successfully measured all seven RISP constructs for information seeking, which is often not the case in the RISP literature. For example, previous studies have omitted variables such as perceived susceptibility (Yang & Kahlor, 2013), informational subjective norms (Pokrywczyński et al., 2019; Zhou et al., 2021), relevant channel beliefs (Brinker et al., 2020; Griffin et al., 2004; Yang et al., 2014), perceived information gathering capacity (Griffin et al., 2004; Pokrywczyński et al., 2019), or affective response (Kahlor et al., 2006). By testing all seven predictors and their relations with information seeking in the structural model, it provides a fuller picture to understand risk information seeking.

Second, this study included a longitudinal measure of behavior, which is uncommon in general and, as far as we know, makes ours the first study to include future risk-prevention behavior in the RISP model. The link between risk information seeking and risk-prevention behavior is one important aspect of risk communication in general, and the RISP model in particular. However, and as noted previously, only two RISP model studies that we are aware of investigated this link (Li & Zheng, 2020; Yang, 2012). However, both of these studies were limited to intentions and did not include measures of actual behavior. In this article, we went beyond prevention intention and examined how information seeking affects the adoption of a prevention behavior.

As with any investigation, some potential limitations are also worth noting. One potential limitation relates to attrition (i.e., 158—or 58.3%—of 271 potential participants completed the survey at both points in time). While not ideal, we do not believe this represents a serious concern for at least three reasons. First, attrition is a common occurrence in longitudinal studies, and our retention rates are similar to other studies that focused on similar topics and intended audiences (e.g., Fruehwirth et al., 2021; Roberto et al., 2021; Ryerson et al., 2021 Zimmermann et al., 2021; Zhou et al., 2021). Second, and given we anticipated this might be an issue, we made sure to start with a sample that was large enough to lead to a meaningful conclusion once attrition was factored in (Schreiber et al., 2006). Third, in an abundance of caution, we also ran the main analyses using the 271 participants from Time 1 (i.e., sans Time 2 behavior). As you can see in Note 1, the measurement model, final structural model, and the percentage of variance explained compared favorably with those from the final sample who responded to the surveys at both points in time. Thus, although participants who dropped out of the study in Time 2 reported lower negative affect (see nonresponse analysis), we do not believe this substantially affected our results.

A second potential limitation concerns the exclusion of COVID-19 vaccination norms from the RAA portion of our model. This decision was made for two reasons. The first relates to the relatively poor performance of norms in previous RAA research. That is, numerous meta-analyses indicate that
norms are a weaker predictor of intention (i.e., Armitage & Conner, 2001; McEachan et al., 2011, 2016; Rich et al., 2015) or do not contribute to the prediction of intention (i.e., Downs & Hausenblas, 2005). The second concerned demand characteristics. Previous research indicates that several RISP model constructs can be difficult to successfully measure. Thus, we opted to add one or two items to several measures in our study as a precaution. On the plus side, this allowed us to secure high reliability for all variables (making this one of the few studies to successfully measure all RISP model constructs—see the foregoing discussion on “Strengths”). On the minus side, this resulted in a longer survey and increased demand characteristics for participants. Fortunately, the measured variables explained a substantial amount of the variance in COVID-19 vaccination intention and behavior. Nonetheless, we acknowledge that including COVID-19 vaccination norms may increase the predictive power of the model even further, something that can be tested in future research.

Third, we measured information insufficiency following established measure in RISP research by asking participants to estimate their current and ideal level of knowledge on COVID-19 vaccines that would be good enough for their purposes. We remained ambiguous about the goal of information seeking because we did not want to make any assumptions about people’s goals, especially when the vaccines were not even available to the general public at Time 1. Retrospectively, we think it might have been helpful to specify the purpose of information seeking, that is, the preventative behavior of getting the vaccines. According to the theorization of RISP that was built upon the HSM, risk information seeking is driven by the motivation to close the gap in judgmental confidence to be accurate in decision-making. With the ultimate goal of examining whether risk information seeking would lead to preventative behavior, we recommend future researchers to be as specific as possible regarding the purpose of information seeking when measuring information insufficiency. To state in a different way, instead of asking participants about their evaluations on how much information is good for their purposes, be specific and ask how much information is good for them to decide whether or not to adopt the preventative behavior (e.g., get vaccinated).

Finally, this study did not include information processing, another important outcome variable in the RISP model. This was due to our expectation of a small sample size as a result of the longitudinal design of the study. While this study allows us to understand how risk information seeking relates to risk preventative behavior, as far as we know, no research has examined the relationship between information processing and risk preventative behavior. However, according to the original theorization of RISP (Griffin et al., 1999),
deeper processing of risk information will likely bring more behavioral beliefs to their judgment about performing the behavior and lead to stable cognitive structures about the behavior. In other words, how people process risk information would affect people’s attitude toward risk prevention and their ultimate preventative behavior. Future research should consider the role that information processing plays when linking risk information behavior and risk prevention behavior.

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Note
1. To determine how attrition may have affected our results, we also tested the hypothesized model with the full sample \((N = 271)\) from Time 1 (i.e., without the Time 2 measure of behavior). The measurement model \(\chi^2/df = 1.91, \text{CFI} = .91, \text{RMSEA} = .06, \text{SRMR} = .07\), the final structural model \(\chi^2/df = 1.90, \text{CFI} = .90, \text{RMSEA} = .05, \text{SRMR} = .08\), and the percentage of variance explained for both information seeking (76.4%) and COVID-19 vaccination intention (47.3%) compared favorably with those from the final sample \((N = 158)\) who responded to the surveys at both points in time (see “Results” section).

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