**Testing Risk Information Seeking and Avoidance in the Context of HPV Vaccination:**

**A Comparison of Disease Risks and Vaccine-Related Risks**

This study investigates the procedures for risk information seeking and avoidance among South Korean female college students in the context of human papillomavirus (HPV) vaccination by adopting the Planned Risk Information Seeking Model (PRISM). Structural equation modeling and a percentile bootstrap method were employed to analyze the data. Several relationships hypothesized in the PRISM were significant in the contexts of both HPV risk and vaccine-related risk. The extended PRISM with the outcome of avoidance intentions yielded results that were similar to the original PRISM regarding both HPV risk and vaccine risk. However, a few differences were found across contexts (i.e., HPV risk vs. vaccine risk) and model types (i.e., extended vs. non-extended), including differences in indirect effects and model fits. The findings have theoretical and practical implications for future research on the (extended) PRISM, which predicts both seeking intent and avoidance intentions in the context of vaccination.

*Keywords: human papillomavirus, vaccination, Planned Risk Information Seeking Model, information seeking, information avoidance*

Annually, between half and 80% of people search for health information online in many countries, while relatively few people share their findings with healthcare professionals (Betsch et al., 2012; Kwon et al., 2015; Lee et al., 2015; Orr et al., 2016; Smith, 2017). Content opposing vaccination is prevalent on the Internet, with the emergence of a new paradigm of healthcare that emphasizes patients’ power and questions the legitimacy of science and medical professionals’ expertise (Kata, 2012). This has created an environment where anti-vaccine activists are able to spread their messages effectively (Kata, 2012). The impact of anti-vaccine messages and vaccination refusal on public health is particularly challenging when misinformation and disinformation are disseminated through social media (Scherer et al., 2016).

The human papillomavirus (HPV), which is the most common sexually transmitted disease, is also the cause of 99% of cervical cancer cases, as well as other cancers, such as penile, anal, oropharyngeal, vulvar, and vaginal cancers (CDC, 2019). The development of the HPV vaccine has led to a promising advance in public health, as well as cancer control (Ache & Wallace, 2008). However, the content on the HPV vaccine also includes a wide variety of misinformation, irrelevant rumors, and conspiracy theories, which negatively influence individuals’ HPV vaccine uptake (Ortiz et al., 2019). In South Korea, the onset rate of cervical cancer remains very high among young women between 15 and 34 years of age, although it has decreased since the adoption of the national cervical cancer screening in 1999 (National Cancer Information Center, 2015). Moreover, in South Korea, female young adults’ uptake rates for the HPV vaccine are much lower than those of other developed countries (Seung & Kim, 2014).

To address these concerns, this study focuses on HPV vaccine risks and HPV risks by employing cross-sectional data from multiple universities across the country. More specifically, this study tests the hypotheses related to risk information processing, seeking, and avoidance regarding HPV risk and vaccine risk. To investigate the procedures for risk information seeking and avoidance, we adopted the planned risk information seeking model (PRISM) as the main study model and extended it by including information avoidance as a dependent variable. The aim of this study is to test the relationships within PRISM using a survey on South Korean college women’s risk information seeking and avoidance about the HPV and HPV vaccine to finally identify the factors that may contribute to women’s uptake rate of the HPV vaccine.

## Information Seeking Regarding HPV Risks and Vaccine Risks

Content about the vaccine’s side effects has been published in several media outlets, including social media platforms (Davies et al., 2002; Intlekofer et al., 2012). Some media messages have suggested that vaccines are dangerous, not effective, or that there might be unethical relationships between the government and pharmaceutical companies despite evidence of vaccine efficacy (Briones et al., 2012; Intlekofer et al., 2012). Although several studies have confirmed that adverse cases related to the HPV vaccine are either minor or unrelated, skepticism exists among the public, especially given the amplification of misinformation on social media. Previous works have shown that exposure to unfavorable content and comments on social media influences attitudes toward vaccination, vaccine-related risk perceptions, and the intention to vaccinate (Kim et al., 2020; Nan & Madden, 2012). In South Korea, a side effect of the HPV vaccine (i.e., brain damage) discovered by Japanese medical researchers was popular health news in 2013. Among the medical community, this news generated concerns that there would be a potential decrease in vaccine uptake rates among South Korean women (Seung & Kim, 2014).

For all these reasons, it is important to investigate the public’s risk perception and information seeking for both HPV risk and vaccine risk. In terms of the two types of risks, individuals’ risk information seeking can be understood as planned behavior based on their risk perception, negative emotions, perceived knowledge insufficiency, and other social-cognitive and contextual variables. As an augmented version of the risk information seeking and processing (RISP) model (Griffin et al., 1999), the PRISM views risk information seeking as a planned behavior and provides a map of relationships that should be explored with regard to risk information-seeking behaviors (Kahlor, 2010). Like other models of information seeking, however, the PRISM regards individual behaviors as cognitively determined, reasoned, but not necessarily rational processes (Hornik, 1990; Kahlor, 2010).

The PRISM integrates diverse prior models of health and risk communication to map predictors of information-seeking intentions. More specifically, the PRISM poses novel relationships that are derived from the Theory of Planned Behavior (TPB; Ajzen, 1991), the Extended Parallel Processing Model (EPPM; Witte 1992), the Health Information Acquisition Model (HIAM; Freimuth et al., 1989), the Comprehensive Model of Information Seeking (CMIS; Johnson & Meischke, 1993), and the Theory of Motivated Information Management (TMIM; Afifi & Weiner, 2004). Variables derived from the TPB are attitudes toward behavior, subjective norms, perceived behavioral control, and behavioral intentions. Variables borrowed from the RISP model include risk judgments, perceived insufficiency, and affective responses (Kahlor 2010).

More specifically, the RISP model (Griffin et al., 1999) was designed to explain the variance in information seeking and processing in the context of risk communication (Kahlor, 2010). In this model, one of the most notable concepts, rooted in Chaiken’s (1980) sufficiency threshold, is information insufficiency, which serves as a decision point for risk information seeking. Information insufficiency is defined as the difference between the perceived current knowledge and the knowledge needed to deal adequately with the risk or as the perceived need for additional information (Griffin et al., 1999; Kahlor, 2007, 2010). According to the RISP framework and the other models mentioned above, information insufficiency is influenced by several factors, such as perceived seeking control, seeking-related subjective norms, and affective risk response. However, among the TPB variables, attitude toward seeking was not included in the original RISP model, while subjective norms and perceived seeking control were covered (Kahlor, 2010). Therefore, Kahlor (2010) adopted Kahlor’s (2007) augmented RISP model by integrating all the TPB concepts (i.e., attitude, norms, control, and intention) to develop the PRISM. According to Kahlor (2010), the PRISM outperformed the RISP model and TPB in the context of general health.

Although the PRISM has rarely been tested in the vaccination context, the relationships explored within the model are consistent with the findings based on theoretical and empirical models that have predicted information seeking about vaccination (e.g., Clarke & McComas, 2012; Wang & Ahern, 2015; Yang, 2012). Although previous literature has examined information seeking about vaccination, in this study, we explore factors that predict individuals’ information seeking about HPV risks and HPV-vaccine-related risks separately so that we can better understand how information seeking on each type of risk is predicted based on the PRISM. The importance of consumers’ perceptions of vaccine safety is becoming more important in the contemporary media environment. The negative and inaccurate sources of information regarding the HPV vaccine are pervasive and negatively influence individuals’ vaccine uptake (Ortiz et al., 2019). In this study, the separate models regarding HPV risks and vaccine risks are compared with each other, and the differences and similarities between the models are interpreted to better understand South Korean college women’s information seeking and decision making about HPV vaccination.

## Information Avoidance and Vaccination

Information management includes communicative and cognitive activities, such as seeking,avoiding, providing, appraising, and interpreting the stimuli that individuals receive (Brashers et al., 2002).Although knowledge is considered important and valuable in managing risks, people do not always seek information and sometimes even take great pains to avoid it (Sweeny et al., 2010). In fact, risk information avoidance is a widely occurring communication phenomenon (Brashers et al., 2002).There are a wide variety of situations in which people prefer ignorance over knowledge seeking (Sweeny et al., 2010). According to previous literature, risk information avoidance refers to the common behavior of actively avoiding risk information; this can be applied to media use (e.g., shutting off a television to avoid hearing about a risk-related topic) and interpersonal communication (e.g., changing the topic in conversation to avoid being exposed to risk information) (Barbour et al., 2012; Narayan et al., 2011).

Although information can be used to decrease distressing uncertainty, it is also possible for people to increase uncertainty, which allows for hope or optimism by avoiding information (Brashers et al., 2000). For example, according to Barbour et al. (2012), maintaining hope was one of the major self-reported motives for risk information avoidance in the face of potential disease. Since information can increase stress-producing certainty or uncertainty, information avoidance may help individuals maintain their current beliefs or knowledge (Brashers et al., 2000). More specifically, uncertainty in some situations leads to a negative relationship between affect (e.g., worry and fear) and information seeking, particularly in the case of high-level risks or affect (Brashers et al., 2002). Previous studies have examined this linkage empirically and have found that positive affect is positively related to avoidance, whereas negative affect is negatively associated with avoidance (Yang & Kahlor, 2013). The more one felt positive affect, such as happiness about a risk, the more one avoided risk information, while the more one felt negative affect, such as worry about a risk, the less one avoided risk information (Yang & Kahlor, 2013). Brashers, Goldsmith, and Hsieh (2002) insisted that in high-stakes situations, “information seeking and avoiding may be a balancing act for individuals who need to achieve multiple goals” (p. 261). The RISP relationships between perceived risk, perceived seeking control, and intention to seek risk information are derived from the EPPM (Witte, 1992). As the EPPM suggests, both risk judgment and perceived seeking control may affect information avoidance and information seeking at the same time. Therefore, it is meaningful to investigate the factors that predict both information seeking and avoidance in the context of HPV vaccination, factors such as conflicting stakes based on individuals’ perception of disease risks and vaccine-related risks.

HPV-related content on the internet varies greatly in the messages conveyed (Basch & MacLean, 2019). Moreover, as discussed previously, conspiratorial thinking is endemic among anti-vaccination groups, who often regard advocating scientific and medical consensus as concealing “the truth” (Grimes, 2016). Not surprisingly, proponents of the theory show conspiratorial traits and reasoning flaws, because they often depend on anecdotes over data and display low cognitive complexity in thinking patterns (Jacobson et al., 2007). Therefore, anti-vaccine messages are often uncertain and ambiguous. When risk information is ambiguous due to a lack of accuracy or uncertainty in probability assessments, individuals may regard their risks as pessimistic or avoid health information and decision making (Brashers et al., 2002; Camerer & Weber, 1992; Han et al., 2011; Politi et al., 2007). The risk information regarding the HPV vaccine may result in information avoidance because the risks included in the anti-vaccine messages often include uncertain information, as vaccine literature suggests. Moreover, risk information avoidance can have serious consequences for individuals and the public’s health and risk management (Deline & Kahlor, 2019). For this reason, it is necessary to investigate information seeking and avoidance from diverse perspectives, reflecting both disease and vaccine risks. Although risk information avoidance may result in serious consequences, the topic has been relatively understudied compared to risk information seeking (Deline & Kahlor, 2019).

In developing their Planned Risk Information Avoidance (PRIA) model, Deline and Kahlor (2019) conceptualized information avoidance as deliberate behavior and a risk-related phenomenon (Barbour et al., 2012; Case et al., 2005; Griffin et al., 1999; Narayan et al., 2011; Slovic et al. 2004). To build the PRIA model, Deline and Kahlor (2019) sought guidance from existing information management models such as the TMIM (Afifi & Weiner, 2004), the CMIS (Johnson & Meischke, 1993), the HIAM (Freimuth et al., 1989), the EPPM (Witte, 1992), the RISP (Griffin et al., 1999), and the PRISM (Kahlor, 2010). Among these frameworks, however, Deline and Kahlor (2019) focused mostly on the PRISM because it describes most relationships derived from the other aforementioned models (Kahlor, 2010). These linkages include a range of cognitive, emotional, and sociocultural factors, which indicate that risk information seeking is deliberately planned (Kahlor, 2010). Therefore, in this study, by adopting Deline and Kahlor’s (2019) rationale, we test the same variables on risk information avoidance as in the PRISM, which predicts seeking intents with regard to HPV risks and HPV-vaccine-related risks.

## Hypotheses and Research Questions

The first aim of this study is to test the PRISM in the context of HPV vaccination with regard to both HPV risks and HPV-vaccine-related risks. Predictions (Hypotheses 1–13) are presented in Figure 1. Each hypothesis will be tested separately for HPV risks and HPV-vaccine-related risks. The following hypotheses, all of which were suggested by the literature above, present the relationships described in Figure 1. In the result section, Hypotheses 1-1 to 13-1 will be about HPV risks, and Hypotheses 1-2 to 13-2 will be about HPV-vaccine-related risks.

H1: Attitude toward seeking is positively related to information-seeking intent.

H2: Seeking-related subjective norms relate positively to information-seeking intent.

H3: Perceived seeking control is positively related to information-seeking intent.

H4: Risk judgments are positively related to affective risk responses.

H5: Affective risk responses relate positively to perceived knowledge insufficiency.

H6: Seeking-related subjective norms relate positively to perceived knowledge insufficiency.

H7: Perceived knowledge insufficiency relates positively to information-seeking intent.

H8: Affective risk responses are positively related to information-seeking intent.

H9: Attitude toward seeking relates positively to perceived knowledge insufficiency.

H10: Perceived seeking control is negatively related to perceived knowledge insufficiency.

H11: Attitude toward seeking is positively related to perceived knowledge.

H12: Perceived seeking control is positively related to perceived knowledge.

H13: Seeking-related subjective norms are positively related to perceived knowledge.

The following research question was investigated by testing the same model (Figure 1) with a different outcome (i.e., risk information avoidance) in both contexts (i.e., HPV and HPV vaccine risk information).

RQ1: What variables from the PRISM model are associated with risk information avoidance intentions?

To investigate RQ1, the hypotheses 1-1 to 1-13 and 2-1 to 2-13 that were developed for the model with the outcome of information-seeking intent was retested with the outcome of information avoidance. These hypotheses include “a” after each original hypothesis number (e.g., H1-1a) in the Results section. Hypotheses 1, 2, 3, 7, and 8 include reverse directions of those predicting information-seeking intent when predicting information avoidance.

Perceived seeking control

Seeking-related subjective norms

Perceived knowledge

Perceived knowledge insufficiency

Risk judgment

Affective risk response

Seeking intent

H4

H8

H7

H5

H10

H6

(A)

H9

H13

H12

Attitude toward seeking

H11

H1

H2

H3

***Figure 1.* Planned Risk Information Seeking Model (Kahlor, 2010).**

*Note.* (A) This link shows that perceived knowledge insufficiency is measured by perceived knowledge threshold controlled for perceived knowledge (Griffin et al., 2004).

Finally, since we tested both models (predicting seeking intent and avoidance intentions) in the two different risk contexts (i.e., HPV risk and HPV-vaccine-related risk), we explored the following research questions to compare and interpret the results in the two contexts:

RQ2: How do the extended PRISM predictions of risk information avoidance intentions differ from the model’s predictions of seeking intent when tested in the two different risk contexts (i.e., HPV risk and HPV-vaccine-related risk)?

# Methods

## Participants and Procedures

After the Institutional Review Board approved this research project, 500 female South Korean college students were recruited in 2020 through an online research company based in Seoul, South Korea. This study recruited only participants who had not received the HPV vaccine. After reading the information sheet, the individuals were asked to indicate whether they consented to take part in the study. Quota sampling was used for this study. The research company sent e-mail invitations to 8,376 female college students registered for the company’s online survey panel, and 1,424 participated in this study. Finally, 500 people’s data completed on time were used in this study. The participants used, on average, 9 min to complete the survey, and received one dollar each for their participation. The mean age of the participants was 22.55 years (*SD* = 1.62).

## Measures

### **Risk Judgment**

Risk judgment was measured by two self-report scales: perceived risk seriousness and perceived risk probability (adapted from Kahlor, 2010). Perceived risk seriousness for HPV risks and vaccine-related risks were separately measured by asking the participants how serious they thought it could be 1) if they were infected with HPV (i.e., seriousness of HPV risks) and 2) if they experienced any vaccine-related problems after vaccination (i.e., seriousness of vaccine risks). The perceived risk probability for HPV risks and vaccine-related risks were separately measured by asking the participants how likely they thought they could become infected with HPV (i.e., probability of HPV risks) and how likely they thought they would experience any vaccine-related problem after vaccination (i.e., seriousness of vaccine risk). The subjects reported their responses on a 5-point scale ranging from 1 (*not at all*) to 5 (*very serious* for seriousness and *very likely* for probability). The variable “risk judgment” was derived by multiplying together the measures of perceived probability and perceived seriousness (Griffin et al., 2008). Therefore, we obtained *M*= 11.80, *SD*= 4.45 for the judgment for HPV risks and *M*= 12.43, *SD*= 4.61 for the judgment for vaccine-related risks.

### **Attitude Toward Seeking**

The attitude toward seeking was measured separately for HPV risks and vaccine-related risks. To assess each variable, four 7-point semantic differential adjective pairs were employed: 1) nothelpful/helpful, 2) harmful/beneficial, 3) bad/good, and 4) worthless/valuable. The items were summed to create a scale, which demonstrated good internal consistency (adapted from Kahlor, 2010): *α*= .73; *M*= 5.47, *SD*= 1.17 for HPV risks and *α*= .79; *M*= 5.47, *SD*= 1.22 for vaccine-related risks.

### Seeking-Related Subjective Norms

Seeking-related subjective norms were also measured separately for HPV risks and vaccine-related risks. To assess this variable, the participants were asked six questions about their perception of the knowledge of HPV and vaccine-related risks among other South Korean college women and about the expectations of their significant others (e.g., “Most South Korean college students stay informed about the HPV/vaccine-related risks”) (adapted from Kahlor, 2010). The participants reported their responses on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The items were summed to create a scale, which demonstrated good internal consistency: *α*= .89; *M*= 2.83, *SD*= .84 for HPV risks and *α*= .90; *M*= 2.82, *SD*= .84 for vaccine-related risks.

### **Perceived Seeking Control**

Perceived seeking control was measured separately for HPV risks and vaccine-related risks. To assess this variable, the participants were asked to indicate how well they could gather information about HPV and vaccine-related risks by answering four questions (e.g., “I know where to go for information I could rely on”) (adapted from Griffin, Dunwoody, & Neuwirth, 1999; Griffin et al., 2004). The subjects reported their responses on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The items were summed to create a scale, which demonstrated good internal consistency: *α*= .76; *M*= 2.90, *SD*= .75 for HPV risks and *α*= .72; *M*= 3.03, *SD*= .69 for vaccine-related risks.

### **Information Insufficiency**

To assess information insufficiency about HPV risks and HPV vaccine risks, two self‐report scales were used: (1) current knowledge about HPV vaccine risks and HPV risks and (2) the information sufficiency threshold (Griffin et al., 2004). The amount of information an individual perceives to still be necessary, or their level of information insufficiency, is the regressed difference between the threshold and the individual’s current knowledge (Griffin et al., 2004). Instead of using this difference between the information-sufficiency threshold and current knowledge, we entered current knowledge into the proposed model as a predictor of the sufficiency threshold. This allowed for the operationalization of information insufficiency as a dependent variable while also accounting for systematic variance in the threshold, which cannot be predicted by current knowledge or any information-sufficiency gap (Griffin et al., 2004). The details regarding each measure are described below.

***Current knowledge about HPV vaccine risks and HPV risks.*** Theparticipants provided their current level of knowledge about the HPV vaccine risks on a 100‐point scale. They were asked to choose a value from 0 to 100 indicating the knowledge they thought they currently had, with 0 meaning knowing absolutely nothing and 100 meaning knowing everything a person could possibly know about the HPV. The exact wording of the question was “Please estimate the amount of knowledge you currently have about the possible risks to you from the HPV vaccine.” During the analysis, the participants’ answers were divided by 10. The mean value for current knowledge was as follows: *M*= 3.61, *SD*= 2.79 for HPV risks and *M*= 3.12, *SD*= 2.62 for vaccine-related risks.

***Sufficiency threshold for HPV and vaccine information.***After the participants answered the current knowledge question about HPV vaccine risks, they were asked to use the same scale to indicate how much information they thought they needed in order to confidently address the risk associated with the HPV vaccine. The exact wording of the question was, “Please estimate the ideal amount of knowledge you would like to have to deal adequately with the HPV vaccine risk in your life.” During the analysis, the participants’ answers were divided by 10. The mean value for the sufficiency threshold was as follows: *M*= 7.06, *SD*= 2.38 for HPV risks, and *M*= 7.18, *SD*= 2.35 for vaccine-related risks.

### **Affective Risk Response**

Affective responses to HPV risks and vaccine-related risks were assessed separately by measuring the levels of anger and worry. The participants were asked to indicate on a scale from 0 to 10 how much anger and worry they would feel 1) if they got infected with the HPV (i.e., HPV risks) and 2) if they experienced any vaccine-related problem after vaccination (i.e., vaccine-related risks). The affective response scale was obtained as the sum of anger and worry: *M*= 11.19, *SD*= 4.36 for HPV risks and *M*= 9.67, *SD*= 4.21 for vaccine-related risks.

### **Seeking Intent**

Seeking intent for HPV risks and vaccine-related risks were assessed separately. To this end, the participants were asked three questions about their intentions to seek knowledge of HPV risks and vaccine-related risks (e.g., “I intend to seek more information about HPV risks”) (adapted from Griffin, Dunwoody, & Neuwirth, 1999). The subjects reported their responses on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). For vaccine-related risks, only two items were used to compute the scale to improve its reliability. The items were summed to create a scale, which demonstrated good internal consistency: *α*= .93; *M*= 3.87, *SD*= .74 for HPV risks and *α*= .92; *M*= 3.80, *SD*= .73 for vaccine-related risks.

### **Intention to Avoid Seeking Information**

Intention to avoid seeking information about HPV risks and vaccine-related risks were assessed separately. To this end, the participants were asked three questions about their intentions to seek knowledge of HPV risks and vaccine-related risks (e.g., “When the topic of HPV comes up, I’m likely to tune it out”) (adapted from Griffin et al., 1999). The subjects reported their responses on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The items were summed to create a scale, which demonstrated good internal consistency: *α*= .86; *M*= 1.83, *SD*= .66 for HPV risks and *α*= .90; *M*= 1.90, *SD*= .69 for vaccine-related risks.

## Data Analysis

To test the hypotheses and research questions for this study, SPSS Version 22 and AMOS 22 were used. Specifically, the proposed model (Figure 1) was examined via structural equation modeling (SEM). In particular, we used a measured variable path analysis model in this study. The path analysis is an extension of multiple regression analysis and assumes that each variable is reasonably free of measurement error (Lleras, 2005). We checked and utilized modification indices to improve model fits during our analysis. Specifically, we tried the Amos software’s suggestions that make sense from the theoretical perspective, and added two paths to each model. A percentile bootstrap method with 5000 samples and bias-corrected 95% confidence intervals was used to investigate indirect effects in the multiple mediator model (Preacher & Hayes, 2008).

# Results

Before conducting the main analysis, zero-order correlations among the variables were analyzed in each context of risk (Tables 1 and 2). To test Hypotheses 1–13, SEM was used to test the PRISM in the context of HPV vaccination. Specifically, Hypotheses 1-1 through 13-1 were tested with the PRISM in the context of HPV risks, and Hypotheses 1-2 through 13-2 were tested with the PRISM regarding the vaccine-related risks. To investigate RQ1, the PRISM with the outcome of information avoidance was run in the context of HPV risks and vaccine-related risks. Next, to investigate RQ2, the path coefficients from each figure were compared with those from other figures. As described below, the significances of path coefficients derived from Hypotheses 1, 3, 4, 7, 9, 12, and 13 were consistent across the four figures. Except for these paths, there were 1–3 additional path(s) that was/were significant in each model. Only the paths or hypotheses that are significant in each condition are *italicized* in the following sections.

**Table 1. *Zero-order Correlations between Variables in the Context of HPV Risk.***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. |
| 1. Attitude toward seeking
 | 1 |  |  |  |  |  |  |  |  |
| 1. Seeking-related subjective norms
 | .13\*\* | 1 |  |  |  |  |  |  |  |
| 1. Perceived seeking control
 | .15\*\* | .44\*\*\* | 1 |  |  |  |  |  |  |
| 1. Perceived knowledge
 | .20\*\*\* | .60\*\*\* | .57\*\*\* | 1 |  |  |  |  |  |
| 1. Sufficiency threshold
 | .10\* | -.01 | .08 | -.05 | 1 |  |  |  |  |
| 1. Risk judgment
 | .15\*\* | .27\*\*\* | .13\*\* | .29\*\*\* | .08 | 1 |  |  |  |
| 1. Affective risk response
 | .25\*\*\* | .49\*\*\* | .27\*\*\* | .53\*\*\* | .06 | .48\*\*\* | 1 |  |  |
| 1. Seeking intent
 | .30\*\*\* | .20\*\*\* | .23\*\*\* | .16\*\*\* | .26\*\*\* | .21\*\*\* | .27\*\*\* | 1 |  |
| 1. Avoidance intentions
 | -.30\*\*\* | -.13\*\* | -.17\*\*\* | -.16\*\*\* | -.22\*\*\* | -.12\*\* | -.22\*\*\* | -.51\*\*\* | 1 |

*Note:* \**p* < .05; \*\**p* < .01; *\*\*\*p < .*001

**Table 2. *Zero-order Correlations between Variables in the Context of Vaccine Risk.***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. |
| 1. Attitude toward seeking
 | 1 |  |  |  |  |  |  |  |  |
| 1. Seeking-related subjective norms
 | .12\*\* | 1 |  |  |  |  |  |  |  |
| 1. Perceived seeking control
 | .10\* | .34\*\*\* | 1 |  |  |  |  |  |  |
| 1. Perceived knowledge
 | .10\* | .56\*\*\* | .42\*\*\* | 1 |  |  |  |  |  |
| 1. Sufficiency threshold
 | .14\*\* | -.06 | -.13\*\* | -.09\* | 1 |  |  |  |  |
| 1. Risk judgment
 | .15\*\* | .14\*\* | -.05 | .08 | .09 | 1 |  |  |  |
| 1. Affective risk response
 | .07 | .16\*\*\* | -.05 | .10\* | .05 | .46\*\*\* | 1 |  |  |
| 1. Seeking intent
 | .38\*\*\* | .17\*\*\* | .17\*\*\* | .13\*\* | .24\*\*\* | .19\*\*\* | .07 | 1 |  |
| 1. Avoidance intentions
 | -.35\*\*\* | -.13\*\* | -.14\*\* | -.11\* | -.22\*\*\* | -.13\*\* | -.11\* | -.59\*\*\* | 1 |

*Note:* \**p* < .05; \*\**p* < .01; *\*\*\*p < .*001

## Testing the PRISM in the Context of HPV Vaccination

### **Hypotheses 1-1 through 13-1**

To test Hypotheses 1-1 through 1-13, the PRISM was run in the context of HPV risks, and the model fit indices are as follows: CMIN = 19.84, DF = 4, *p*< .01, RMSEA = .09, CFI = .98, SRMR = .03 (Figure 2). According to the results,attitude toward seeking (H1-1: *B*= .14, *p* < .001) and perceived seeking control (H3-1: *B*= .16, *p* < .001) were positively related to information-seeking intent. Risk judgment was positively related to affective risk response (H4-1: *B* = .31, *p* < .001), and affective risk response significantly increased perceived knowledge insufficiency (*H5-1*: *B*= .07, *p* < .05). Both perceived knowledge insufficiency (H7-1: *B*= .07, *p* < .001) and affective risk response (*H8-1*: *B*= .02, *p* < .01)

were significantly and positively related to seeking intent. Attitude toward seeking was positively related to perceived knowledge insufficiency (H9-1: B = .20, p < .05). Attitude toward seeking significantly increased perceived knowledge (H11-1: B = .21, p < .01). Perceived seeking control (H12-1: B = 1.34, p < .001) and seeking-related subjective norms (H13-1: B = 1.42, p < .001) were positively related to perceived knowledge. Therefore, Hypotheses 1-1, 3-1, 4-1, 5-1, 7-1, 8-1, 9-1, 11-1, 12-1, and 13-1 were supported in the context of HPV risks.

Perceived seeking control

Seeking-related subjective norms

Perceived knowledge

Perceived knowledge insufficiency

Risk judgment

Affective risk response

Seeking intent

.31\*\*\*

.02\*\*

.07\*\*\*

.07\*

-.23

-.01

-.09 (A)

.20\*

1.42\*\*\*

1.34\*\*\*

Attitude toward seeking

.21\*\*

.14\*\*\*

.03

.16\*\*\*

2.03\*\*\* (B)

.56\*\*\* (C)

***Figure 2.* PRISM for HPV Risk Information Seeking** (Unstandardized)

*Note:* \**p* < .05; \*\**p* < .01; \*\*\**p* < .001**.** Fit Indices: CMIN = 19.84, DF = 4, *p* < .01, RMSEA = .09, CFI = .98, AIC = 83.84, SRMR = .03.

(A): Perceived knowledge threshold controlled for perceived knowledge.

(B) and (C) were added according to the suggestion of the modification indices in the AMOS software.

### **Hypotheses 1-2 through 13-2**

To test Hypotheses 1-2 through 13-2, the PRISM was run in the context of vaccine-related risks, and the model fit indices were as follows: CMIN = 4.76, *p*= .45, DF = 5, RMSEA = .00, CFI = 1.00, AIC = 66.76, SRMR = .01, (Figure 3). According to the results,attitude toward seeking (H1-2: *B*= .19, *p* < .001), seeking-related subjective norms (*H2-2*: *B*= .07, *p* < .05), and perceived seeking control (H3-2: *B*= .15, *p* < .001) were positively related to information-seeking intent. Risk judgment was positively related to affective risk response (H4-2: *B* = .41, *p* < .001). Perceived knowledge insufficiency was significantly and positively related to seeking intent (H7-2: *B*= .06, *p* < .001). Both attitude toward seeking (H9-2: *B*= .33, *p* < .05) and perceived seeking control (*H10-2*: *B*= $-$.38, p < .05) were significantly associated with perceived knowledge insufficiency. Perceived seeking control (H12-2: *B*= 1.00, *p* < .001) and seeking-related subjective norms (H13-2: *B*= 1.45, *p* < .001) were positively related to perceived knowledge. Therefore, Hypotheses 1-2, *2-2,* 3-2, 4-2, 7-2, 9-2, *10-2*, 12-2, and 13-2 were supported in the context of vaccine-related risks.

Perceived seeking control

Seeking-related subjective norms

Perceived knowledge

Perceived knowledge insufficiency

Risk judgment

Affective risk response

Seeking intent

.41\*\*\*

-.01

.06\*\*\*

.02

-.38\*

-.04

-.05(A)

.33\*\*\*

1.45\*\*\*

1.00\*\*\*

Attitude toward seeking

.04

.19\*\*\*

.07\*

.15\*\*\*

.51\* (B)

.02\*\* (C)

***Figure 3.* PRISM for Vaccine-related Risk Information Seeking** (Unstandardized)

*Note:* \**p* < .05; \*\**p* < .01; \*\*\**p* < .001**.** Fit Indices: CMIN = 4.76, DF = 5, *p* = .45, RMSEA = .00, CFI = 1.00, AIC = 66.76, SRMR = .01.

(A): Perceived knowledge threshold controlled for perceived knowledge.

(B) and (C) were added according to the suggestions of the modification indices in the AMOS software.

## Testing the Extended PRISM with the Outcome of Information Avoidance

To investigate RQ1, the PRISM model with the outcome of information avoidance was run in the context of HPV risks and vaccine-related risks. The model fit indices are as follows: for the HPV risk model, CMIN = 15.54, DF = 5, *p*< .01, RMSEA = .08, CFI = .99, AIC = 79.54, SRMR = .02, (Figure 4) and for the vaccine-related model, CMIN = 16.82, DF = 4, RMSEA = .08, CFI = .98, AIC = 80.82, SRMR = .03, *p*< .01 (Figure 5). The hypotheses that were tested in the models with the outcome of information avoidance include “a” after each hypothesis number (e.g., H1-1a, H1-2a, etc.).

In the model tested in the context of HPV risks (Figure 4),attitude toward seeking (H1-1a: *B*= $-$.14, *p* < .001) and perceived seeking control (H3-1a: *B*= $-$.11, *p* < .01) were negatively related to avoidance intentions. Risk judgment was positively related to affective risk response (H4-1a: *B* = .31, *p* < .001). Perceived knowledge insufficiency was significantly and negatively related to avoidance intentions (H7-1a: *B*= $-$.06, *p* < .001). Attitude toward seeking (H9-1a: *B*= .20, *p* < .05) was significantly associated with perceived knowledge insufficiency. Attitude toward seeking (*H11-1a*: *B*= .21, *p* < .01), perceived seeking control (H12-1a: *B*= 1.34, *p* < .001), and seeking-related subjective norms (H13-1a: *B*= 1.42, *p*< .001) were positively related to perceived knowledge. Therefore, the path coefficients derived from Hypotheses 1-1a, 3-1a, 4-1a, 7-1a, 9-1a, *11-1a,* 12-1a, and 13-1a were significant within the model predicting avoidance intentions in the context of vaccine-related risks.

Perceived seeking control

Seeking-related subjective norms

Perceived knowledge

Perceived knowledge insufficiency

Risk judgment

Affective risk response

Avoidance intentions

.31\*\*\*

-.02

-.05\*\*\*

-.02\*

-.23

.01

-.09 (A)

.20\*

1.42\*\*\*

1.34\*\*\*

Attitude toward seeking

.21\*\*

-.14\*\*\*

.01

-.11\*\*

2.03\*\*\* (B)

.56\*\*\* (C)

***Figure 4.* Extended PRISM for HPV Risk Information Avoidance** (Unstandardized)

*Note:* \**p* < .05; \*\**p* < .01; \*\*\**p* < .001**.** Fit Indices: CMIN = 15.54, DF = 4, *p* < .01, RMSEA = .08, CFI = .99, AIC = 79.54, SRMR = .02.

(A): Perceived knowledge threshold controlled for perceived knowledge.

(B) and (C) were added according to the suggestions of the modification indices in the AMOS software.

In the model tested in the context of vaccine-related risks (Figure 5),attitude toward seeking (H1-2a: *B*= $-$.17, *p* < .001), seeking-related subjective norms (*H2-2a*: *B*= $-$.08, *p*< .05), and perceived seeking control (H3-2a: *B*= $-$.10, *p* < .05) were negatively related to avoidance intentions. Risk judgment was positively related to affective risk response (H4-2a: *B* = .41, *p* < .001). Perceived knowledge insufficiency was significantly and negatively related to avoidance intentions (H7-2a: *B*= $-$.06, *p* < .001), while affective risk response significantly increased avoidance intentions (*H8-2a*: *B*= .02, *p* < .001). Both attitude toward seeking (H9-2a: *B*= .30, *p* < .001) and perceived seeking control (*H10-2a*: *B*= $-$.38, p < .05) were significantly associated with perceived knowledge insufficiency. Perceived seeking control (H12-2a: *B*= 1.00, *p* < .001) and seeking-related subjective norms (H13-2a: *B*= 1.45, *p* < .001) were positively related to perceived knowledge. Therefore, the path coefficients derived from Hypotheses 1-2a, *2-2a,* 3-2a, 4-2a, 7-2a, *8-2a,* 9-2a, *10-2a*, 12-2a, and 13-2a were significant within the model predicting avoidance intentions in the context of vaccine-related risks.

Perceived seeking control

Seeking-related subjective norms

Perceived knowledge

Perceived knowledge insufficiency

Risk judgment

Affective risk response

Avoidance intentions

.41\*\*\*

.02\*\*\*

-.06\*\*\*

 .02

-.38\*

-.04

-.05 (A)

.30\*\*\*

1.45\*\*\*

1.00\*\*\*

Attitude toward seeking

.04

-.17\*\*\*

-.08\*

-.10\*

.51\* (B)

-.04 (C)

***Figure 5.* Extended PRISM for Vaccine-related Risk Information Avoidance** (Unstandardized)

*Note:* \**p* < .05; \*\**p* < .01; \*\*\**p* < .001**.** Fit Indices: CMIN = 16.82, DF = 4, *p* < .01, RMSEA = .08, CFI = .98, AIC = 80.82, SRMR = .03.

(A): Perceived knowledge threshold controlled for perceived knowledge.

(B) and (C) were added according to the suggestions of the modification indices in the AMOS software.

## Comparing the Models Across the Types of Risk

To investigate RQ2, the path coefficients from each figure were compared with those from other figures. Hypotheses 1, 3, 4, 7, 9, 12, and 13 were significant in both models with two different outcomes (i.e., information seeking and information avoidance), regardless of the context of the risk information (i.e., disease risk and vaccine risk). However, H5 was significant only in the model predicting HPV risk information-seeking intent, while H8 was significant in the model predicting HPV risk information avoidance. While this path (i.e., H8) was significant in the model predicting vaccine-related risk information avoidance, the direction of the path coefficient was the same as that in the model predicting HPV risk information-seeking intent. H11 was significant in the models predicting HPV risk information seeking and vaccine-related risk information seeking. Hypotheses 2 and 10 were significant in the models predicting HPV risk information avoidance and vaccine-related risk information avoidance.

In addition, differences were also found in the model fits across risk conditions. The Akaike Information Criterion (AIC) value is a comparative measure of fit; therefore, it is meaningful only when two different models are evaluated. More specifically, lower AIC values indicate a better fit, which means the model with the lowest AIC is the best-fitting model (Kenny, 2020). According to the results of this study, the fit of the original PRISM predicting vaccine-related risk information seeking (Figure 3, AIC = 66.76) was better than those of the other three models: the PRISM for HPV risk information seeking (Figure 2, AIC = 83.84); the extended PRISM for HPV risk information avoidance (Figure 4, AIC = 79.54); and the extended PRISM for vaccine risk information avoidance (Figure 5, AIC = 80.82).

Finally, to investigate RQ2 further, we verified whether any indirect effects occurred in each model. As Figures 2–5 show, perceived knowledge insufficiency functioned as an important mediator between the social cognitive variables (i.e., attitude toward seeking and perceived seeking control) and seeking/avoidance intentions in all four models. In addition, as Figures 2 and 5 show, affective risk response was also identified as a significant mediator within these two models.

# Discussion

This study investigates the procedures of risk information seeking and avoidance by adopting the PRISM and employing cross-sectional data from female college students in South Korea. Additionally, we compared and interpreted the results from the PRISMs with two different outcomes (i.e., seeking intent and avoidance intentions) and for two different risk contexts (i.e., HPV risk and HPV-vaccine-related risk). The findings have theoretical and practical implications for future research on (extended) PRISMs that predict both seeking intent and avoidance intentions in the context of vaccination and relevant risks.

First, in the contexts of HPV risk and HPV-vaccine-related risk, several paths hypothesized in the original PRISM were significant. Specifically, in both PRISMs (Figures 2 and 3), attitude toward seeking was positively related to perceived knowledge insufficiency, and both perceived seeking control and seeking-related subjective norms were positively related to perceived knowledge. Moreover, attitude toward seeking, perceived seeking control, and perceived knowledge insufficiency were positively related to information-seeking intent. Last, risk judgments were also positively associated with affective risk response within the two models. The results suggest that, compared to other two TPB variables, attitude toward seeking may have a more powerful impact on perceived knowledge insufficiency, thereby affecting seeking intent directly and indirectly. Given that both the PRISM and RISP models regard information insufficiency as one of the most remarkable factors predicting seeking intent, this attitude’s role in increasing information insufficiency and seeking intent cannot be underestimated. In addition, a significant path between seeking-related subjective norms and affective risk response was added to both PRISMs tested with regard to HPV risks and vaccine-related risks. Moreover, subjective norms indirectly affected the participants’ seeking intent within the PRISM for HPV risk information seeking (Figure 2). Given that the link between subjective norms and affective risk response was not hypothesized in the original PRISM, it is possible that the opinion of significant others might be important for young college women, particularly in the context of sexually transmitted diseases.

Second, taken overall, the extended PRISMs with the outcome of avoidance intentions showed results that were similar to the original PRISM for both HPV risks and vaccine risks, while the paths predicting avoidance intentions showed the reverse relationships of the links in the PRISMs with the outcome of seeking intent. Specifically, in both extended PRISMs (Figures 4 and 5), attitude toward seeking was positively associated with perceived knowledge insufficiency, and both seeking-related subjective norms and perceived seeking control were positively related to perceived knowledge. In addition, attitude toward seeking, perceived seeking control, and perceived knowledge insufficiency were negatively related to information avoidance intentions in both extended models. Risk judgment was positively related to affective risk response in both extended models as well. Finally, as in the original PRISMs, a significant path between seeking-related subjective norms and affective risk response was added to both extended PRISMs, thereby suggesting the perceived importance of significant others’ opinions in the context of sexually transmitted diseases. As discussed with regard to the results of the original models, the results of the extended models suggest the importance of attitude toward seeking in predicting seeking-related variables (i.e., seeking intent and avoidance intentions), as well as the role of subjective norms in the context of vaccination and/or infectious diseases. In the same vein, in the models regarding vaccine-related risks (Figures 3 and 5), the participants’ subjective norms significantly increased seeking intent and negatively affected information avoidance intentions. This also makes sense because, as an altruistic behavior, vaccination that prevents infectious diseases may affect not only the person making the decision but also other individuals within the person’s social environment (Shim et al., 2012). This result is well-aligned with the previous literature about vaccination conducted in the Asian context in that social cognitive variables play significant roles in individuals’ information seeking (e.g., Yang & Liu, 2021).

Third, the results of this study suggest that although the overall associations in both the original and extended PRISMs are consistent across contexts, reflecting both HPV risk and vaccine-related risk, there are a few differences across contexts and model types (i.e., extended vs. non-extended). First of all, in all four types of models, perceived knowledge insufficiency was identified as an important mediator between the social cognitive variables (i.e., attitude toward seeking and perceived seeking control) and seeking/avoidance intentions. The results suggest the theoretical robustness and consistency of the PRISM and other models that highlight the importance of perceived knowledge insufficiency in individuals’ decision-making about information-seeking behaviors. With regard to the models tested in the context of vaccine risks, a significant path between risk judgment and seeking intent was added only to the original model tested in the context of vaccine risk (Figure 3). The result indicates that risk judgment may play a more significant role in increasing seeking intent in the context of vaccine risks than in the context of disease risks. Moreover, in the same model, risk judgment has a significant effect on seeking intent even though affective risk response is significantly influenced by the judgment but fails to predict seeking intent. This result highlights the importance of cognitive judgment in the context of vaccine risk. However, in the extended model with the outcome of information avoidance intentions (Figure 5), the affective response toward vaccine-related risks, which was assessed by measuring the levels of anger and worry, significantly increased information avoidance intentions. This aligns with the previous literature: uncertainty leads to a negative relationship between negative affect and seeking, particularly in the case of high-level risks (Brashers et al., 2002). This also reveals that, for young college women, vaccine-related risk might be perceived as a high-level risk, which can lead to information avoidance, as the EPPM suggests. Finally, only in the models regarding disease risks (Figures 2 and 4) were the participants’ attitudes toward seeking significantly and positively related to their affective risk response. In particular, in the PRISM for HPV risk information seeking (Figure 2), both attitudes toward seeking and risk judgment indirectly influenced seeking intent via the affective responses. This reveals how social cognitions (i.e., attitudes) and cognitive risk judgments (i.e., disease-related risk judgments) together play an important role in affecting young college students’ emotional responses and information-related behaviors toward disease risks.

Last, differences were found with regard to the model fits across risk conditions. Specifically, according to the AIC values, the fit of the original PRISM predicting vaccine-related risk information seeking (Figure 3) was better than those of the other three models. The results suggest that the original PRISM is more suitable for testing information seeking for vaccine-related risks compared to the extended model, while there was no clear difference between the original and extended models in the context of disease risks. In addition, given that vaccine-related risks are more ambiguous than disease risks and often affected by misinformation and skepticism (Kim et al., 2020), these results make sense for the following reason: in the context of vaccine-related risks that involve uncertainty, young college students’ seeking intentions might be better predicted by PRISM variables, such as current knowledge and perceived knowledge insufficiency, which reflect the participants’ uncertainty perceptions.

## Limitations and Future Directions

Although this study provides several novel findings, it is important to acknowledge its limitations. First, the possibility of reverse causation in cross-sectional studies could be considered a limitation. Further research using longitudinal panel data is needed to clarify the causal order. Given that several routes were added to each model according to the suggestion of modification indices, future research should consider different links and/or variables that can extend the model and better explain the procedures of information seeking/avoidance in the context of vaccination. In conclusion, our findings provide meaningful theoretical and practical implications for future research investigating the PRISM in the vaccination context. Specifically, the findings highlight the need to develop different types of models across risk contexts and cultures.

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