

Testing Risk Information Seeking and Avoidance in the Context of HPV Vaccination: A Comparison of Disease Risks and Vaccine-Related Risks

SOO JUNG HONG

National University of Singapore, Singapore

YUNGWOOK KIM

Ewha Womans University, South Korea

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 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. nonextended). 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: HPV, vaccination, PRISM, information seeking, information avoidance

Human papillomavirus (HPV), which is the most common sexually transmitted disease (STD), causes 99% of cervical and other cancers, such as penile, anal, oropharyngeal, vulvar, and vaginal cancers (Centers for Disease Control and Prevention [CDC], 2021). In South Korea, the onset rate of cervical cancer remains high among young women aged between 15 and 34 years, although it has decreased since the national cervical cancer screening was adopted in 1999 (National Cancer Information Center, 2015). Specifically, between 2015 and 2019, the proportion of cervical cancer patients increased by 65% among women in their 20s (Kim, 2019). The development of the HPV vaccine has led to promising advances in public health and cancer control (Ache & Wallace, 2008). Although the South Korean government has provided free HPV vaccines to 12-year-old females since 2016, young adult women past this age have fallen within a policy blind spot (Kim, 2019; Lee, 2021). Recent studies suggest that the HPV vaccine uptake rates of South Korean college women are much lower than those of women in other developed countries (Park et al., 2019; Seong & Kim, 2014).

Soo Jung Hong: cnmhsj@nus.edu.sg

Yungwook Kim: kimyw@ewha.ac.kr

Date submitted: 2021-10-17

Copyright © 2022 (Soo Jung Hong and Yungwook Kim). Licensed under the Creative Commons Attribution Non-commercial No Derivatives (by-nc-nd). Available at <http://ijoc.org>.

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 risk information processing, seeking, and avoidance hypotheses 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; Kahlor, 2010) as the main study model and extended it by including information avoidance as a dependent variable. This study aims to test the relationships within PRISM using a survey on South Korean college women's risk information seeking and avoidance regarding the HPV and HPV vaccine to identify the factors that may contribute to women's uptake rate of the HPV vaccine.

Literature Review

Public Perceptions of HPV Vaccine Safety in the Context of South Korea

Public risk perceptions and distrust of vaccines have progressively troubled immunization programs throughout the world. The literature emphasizes that public perceptions of vaccine risks are affected by exposure to negative online information regarding vaccines (Nan & Madden, 2012). In particular, content about vaccines' side effects has been published in several media outlets, including social media platforms, in many countries (Intlekofer, Cunningham, & Caplan, 2012). Although several studies have confirmed that adverse cases related to the HPV vaccine are minor or unrelated, skepticism exists among the public. Previous works have shown that exposure to unfavorable content and comments on social media influences attitudes toward vaccination, vaccine-related risk perceptions, and intention to vaccinate (Kim, Han, & Seo, 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 2016 (Park, Jang, Lee, & Kim, 2020). After widespread coverage of the side effect in the first half of 2016, negative effects from other countries were frequently reported later that year without mention of the vaccine's safety (Lee & Hong, 2018). Although the Japanese researchers have withdrawn their results from the journal in which their article was published, many people still trust the inaccurate information that the HPV vaccine may cause brain damage (Park et al., 2020). In the medical community, this situation has generated concerns that vaccine uptake rates among South Korean women might decline for several years (Park et al., 2019; Seong & Kim, 2014). The Korean Centers for Disease Control and Prevention have also recognized distorted media reporting and rumors as the cause of low vaccination rates (Lee & Hong, 2018).

The importance of consumers' perceptions of vaccine safety is becoming increasingly important in the contemporary media environment. Negative and inaccurate sources of information regarding the HPV vaccine are pervasive and negatively influence individuals' vaccine uptake (Ortiz, Smith, & Coyne-Beasley, 2019). In this study, the separate models regarding HPV risks and vaccine risks are compared, 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 Seeking and Avoidance in the Context of HPV Vaccination

Information management includes communicative and cognitive activities, such as seeking, avoiding, providing, appraising, and interpreting the stimuli that individuals receive (Brashers, Goldsmith, & Hsieh, 2002). Health information seeking is generally defined as purposeful and volitional behaviors to search for health information or ask health-related questions using either online or offline sources (Lambert & Loisel, 2007). Health information seeking is influenced by various factors, such as instrumental, psychological, and sociocultural factors (Leckie, Given, & Buschman, 2010), and previous literature has investigated these factors to understand individuals' information-related decision making and behaviors (e.g., Griffin, Dunwoody, & Neuwirth, 1999; Kahlor, 2010).

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, Melnyk, Miller, & Shepperd, 2010). In fact, risk information avoidance is a widely occurring communication phenomenon (Brashers et al., 2002). According to previous literature, risk information avoidance refers to the common behavior of actively avoiding risk information; this can apply 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, Rintamaki, Ramsey, & Brashers, 2012; Narayan, Case, & Edwards, 2011). There is a wide variety of situations in which people prefer ignorance over knowledge seeking (Sweeny et al., 2010). Uncertainty, by avoiding information, allows for hope or optimism (Brashers et al., 2000). Therefore, maintaining hope is one of the major self-reported motives for risk information avoidance in the face of a potential disease (Barbour et al., 2012). Brashers and colleagues (2002) noted that in high-stakes situations, "information seeking and avoiding may be a balancing act for individuals who need to achieve multiple goals" (p. 261).

In addition, HPV-related content on the Internet varies in terms of what message it conveys (Basch & MacLean, 2019). When risk information is ambiguous, individuals may regard their risks as pessimistic or avoid health information and decision making (Brashers et al., 2002; Politi, Han, & Col, 2007). Furthermore, risk information regarding the HPV vaccine may cause information avoidance among the South Korean public because the risks in media reports often include uncertain and inaccurate information (Lee & Hong, 2018). Although risk information avoidance can have serious consequences for individuals and the public's health and risk management, the topic has been relatively understudied compared to risk information seeking (Deline & Kahlor, 2019). For this reason, it is necessary to investigate information seeking and avoidance from diverse perspectives, reflecting both disease and vaccine risks.

The PRISM

In this study, we explore factors that predict individuals' information seeking and avoidance regarding HPV risks and HPV vaccine-related risks by employing PRISM (Kahlor, 2010). As an augmented version of the risk information seeking and processing (RISP) model (Griffin et al., 1999), PRISM views risk information seeking as a planned behavior and provides a map of relationships that should be explored regarding risk information-seeking behaviors (Kahlor, 2010). Like other models of information seeking, however, PRISM regards individual behaviors as cognitively determined, reasoned, but not necessarily

rationalized (Kahlor, 2010). To map predictors of information-seeking intentions, PRISM integrates diverse prior theoretical models of communication, such as the theory of planned behavior (TPB; Ajzen, 1991), the extended parallel processing model (EPPM; Witte, 1992), and the theory of motivated information management (Afifi & Weiner, 2004). Since it was first introduced, the PRISM model has explained approximately 60% of the variances in intentions to seek risk information (Kahlor, 2010). Although 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).

Extending PRISM to Different Risk Contexts

According to PRISM, individuals' risk information seeking can be understood as planned behavior based on their risk perceptions, negative emotions, perceived knowledge insufficiency, and other social-cognitive and contextual variables. We apply this theoretical perspective to two different risk contexts (i.e., HPV risk and HPV vaccine-related risk). That is, we explore factors that predict individuals' information seeking on each type of risk based on PRISM. Moreover, since information can increase stress-producing certainty or uncertainty, information avoidance may help individuals maintain their current beliefs or knowledge (Brashers et al., 2000). Therefore, we investigated the factors that predict both information seeking and avoidance in the context of HPV vaccinations.

The first aim of this study was to test PRISM with regard to both HPV risks and HPV vaccine-related risks. Predictions (Hypotheses 1–13) based on PRISM are presented in Figure 1. The PRISM and RISP models focus on predicting risk-related information seeking and integrate plentiful evidence from existing theories, particularly the TPB (Ajzen, 1991; Albarracín & Shavitt, 2018). These models consider information seeking as a behavior and incorporate two TPB variables (i.e., subjective norms and perceived behavioral control) that predict behavioral intentions (Ajzen, 1991). Among the three TPB variables, attitude toward seeking was not included in the original RISP model, and Kahlor (2010) adopted Kahlor's (2007) augmented RISP model by integrating all TPB constructs to develop PRISM. Therefore, PRISM suggests that attitudes, perceived seeking control, and seeking-related subjective norms can predict information-seeking intentions (Kahlor, 2010).

According to Kahlor (2010), PRISM outperformed RISP and TPB in the context of health risks. In addition, the TPB variables were found to have significant relationships with information seeking in previous studies conducted in the context of vaccination (e.g., Clarke & McComas, 2012; Wang & Ahern, 2015). Therefore, in this study, we adopt the rationale of PRISM and develop the following hypotheses to test them in the two types of risk contexts.

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.

Risk perceptions reflect individuals' subjective judgments about whether a risk is fatal and uncontrollable (Slovic, 2000). Risk perception is a central factor that predicts individuals' responses to risk-related events (Lindell & Perry, 2012). Negative emotions are experienced when people recognize an impending threat to their well-being. That is, people experience negative emotions when the environment is appraised as containing a stimulus that is relevant to the individual, incongruent with maintaining well-being, and close in time (Lazarus, 1991; Scherer, 2001). In the same vein, PRISM suggests that risk perception can affect relevant affective responses (Kahlor, 2010).

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

In both RISP and PRISM, 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 refers to the difference between the perceived current knowledge and the knowledge needed to deal adequately with the risk or the perceived need for additional information (Griffin et al., 1999; Kahlor, 2007, 2010). That is, when the desired level of knowledge about the risk topic is higher than the current knowledge level, information insufficiency exists. As discussed above, risk perceptions reflect individuals' overall judgments of the risk's fatal characteristics. Because people tend to protect themselves from severe risks, negative affective responses triggered by high levels of risk perceptions can prompt greater information needs, predisposing individuals to obtain additional risk information (Afifi & Weiner, 2004; Kahlor, 2010).

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

Previous literature has consistently found that seeking-related subjective norms are not only the direct antecedent of information seeking but also an indirect antecedent through information insufficiency (Hovick, Kahlor, & Liang, 2014; Yang, Aloe, & Feeley, 2014; Yang & Kahlor, 2013). In the same vein, according to PRISM, seeking-related subjective norms predict individuals' perceived knowledge insufficiency (Kahlor, 2010). Therefore, we expect that individuals who perceive information seeking about the risks of HPV and HPV vaccines as a normative behavior will need more information than they currently have (Kahlor, 2010).

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

Emotional feelings and emotion-related processes often serve as effective feedback that guides subsequent cognition, decision making, and behavior (Clore, Gasper, & Garvin, 2001). Emotion-related cognition interferes with existing cognitive processes and affects individuals' judgments (Lazarus, 1991). As discussed above, PRISM suggests that risk perceptions, which reflect individuals' overall judgments of the risk's characteristics, prompt greater information need for self-protection and increase the motivation for information seeking (Kahlor, 2010).

Individuals believe that this information-seeking process will reduce the gap between what they know about a risk and what they would like to know (Lewis, 2017; Niederdeppe et al., 2007). According to RISP, people attempt to acquire sufficient information that can serve as the basis for their beliefs, attitudes,

and behaviors (Griffin et al., 1999). Therefore, it is natural that perceived information insufficiency increases the intention to seek more information on a risk topic (Griffin et al., 1999). PRISM suggests that risk perception can influence relevant affective responses, which in turn influence information-seeking intention (Kahlor, 2010). Several studies support the notion that negative affective responses cause information seeking (Dillard, Li, & Yang, 2021). In this spirit, we explore the following hypotheses.

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

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

According to the RISP framework, information insufficiency is influenced by several factors, such as perceived seeking control, seeking-related subjective norms, and affective risk response (Griffin et al., 1999). However, among the TPB variables, attitude toward seeking was not included in the original RISP model (Kahlor, 2010). Kahlor's PRISM (2010) includes attitudes toward seeking by reflecting the rationale of the TPB in the model more thoroughly. In addition, several communication theories (e.g., TMIM; Afifi & Weiner, 2004; PRISM; Kahlor, 2010) have highlighted the importance of perceived efficacy (or perceived behavioral control) as a significant predictor of information-seeking behavior, and research conducted in a wide variety of health domains (i.e., breast cancer, HPV vaccination, smoking) provides evidence for this (e.g., Pask & Rawlins, 2016; Rimal & Juon, 2010). According to PRISM, not only seeking-related subjective norms but also perceived seeking control and attitudes toward seeking predict individuals' seeking intentions through the mediation of information insufficiency (Kahlor, 2010). However, unlike the other two predictors, PRISM suggests that perceived seeking control is negatively related to information insufficiency because perceived insufficiency may reflect an individual's negative perception toward seeking (i.e., regarding it as useless or inefficacious; Kahlor, 2010). Therefore, the following hypotheses were formulated.

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

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

Beyond information-seeking intention and perceived knowledge insufficiency, PRISM proposes that the three constructs of the TPB predict one's perceived knowledge (Kahlor, 2010). The most essential prediction within PRISM is that perceived current knowledge increases seeking intentions by predicting perceived knowledge insufficiency. Previous studies have regarded the sufficiency threshold controlled for current knowledge as information insufficiency (Griffin, Neuwirth, Dunwoody, & Giese, 2004). Therefore, given that perceived knowledge has a significant influence on perceived insufficiency, PRISM theorizes that attitudes toward information seeking, perceived seeking control, and seeking-related subjective norms are also positively associated with perceived knowledge. Therefore, the following hypotheses were posited.

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.

This study investigates how the variables from PRISM predict individuals' information avoidance within the model. In both PRISM and RISP, the theoretical relationships between perceived risk, perceived seeking control, and intention to seek risk information are derived from the EPPM (Witte, 1992). According to the EPPM, both perceived risk and perceived seeking control affect individuals' information avoidance and information seeking simultaneously, depending on the level of perceived threat and efficacy (Witte, 1992). Although the relationships between PRISM and RISP have often been used to predict information-seeking behaviors across different domains in health communication, the relationships between some variables and information seeking have proved inconsistent (Yang et al., 2014). Some studies have found that some of these constructs serve as significant predictors of information avoidance rather than information seeking (e.g., Yang & Kahlor, 2013). However, while some studies have found that negative affect is negatively associated with information avoidance (Yang & Kahlor, 2013), uncertainty may lead to a positive relationship between negative affect (e.g., worry and fear) and avoidance, particularly with high-level risks or affect (Brashers et al., 2002). Given the EPPM's rationale and the findings, explained above, of other previous studies, we expect that the variables that predict information seeking in PRISM might be significantly associated with risk information avoidance intentions in the extended model. However, given the different levels of uncertainty embedded in different risks (i.e., in this case, HPV risk and HPV vaccine-related risk), we expect that there might be differences in the predictions across risk conditions. In this spirit, we explored the following hypothesis and research question to compare and interpret the results in the two contexts:

H14: Variables from PRISM (i.e., attitudes, subjective norms, perceived seeking control, affective risk responses, and perceived knowledge insufficiency) are significantly associated with risk information avoidance intentions in the extended models in both risk contexts.

RQ1: 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)?

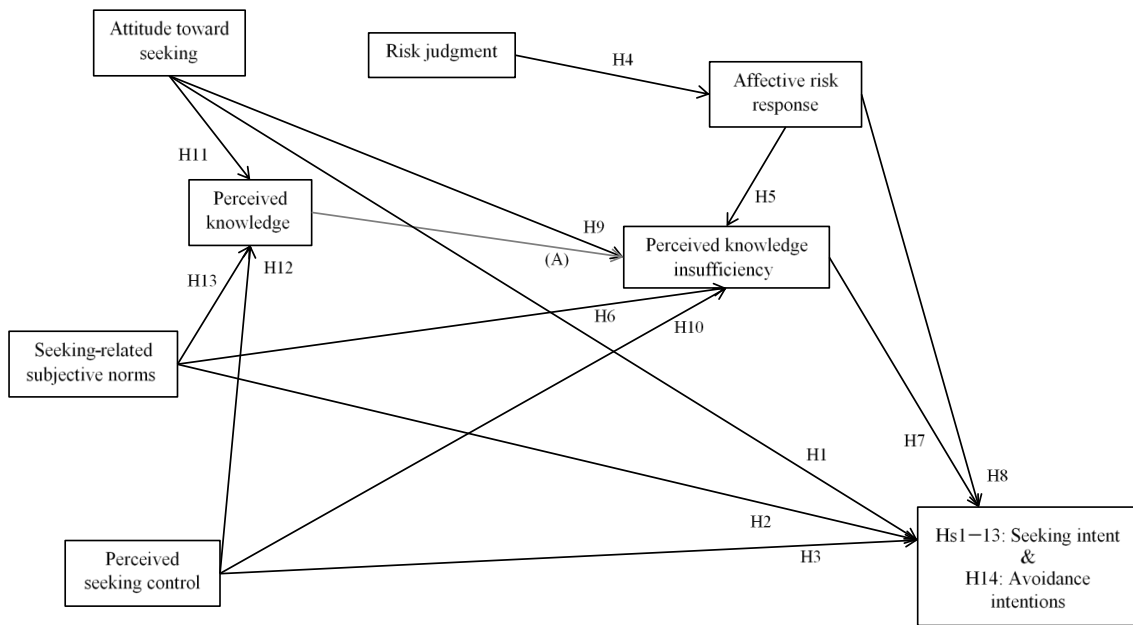


Figure 1. PRISM (Kahlor, 2010) and its extended model.

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

Methods

Participants and Procedures

After the Institutional Review Board approved this research project, 500 female South Korean college students were recruited in September 2020 through an online research company based in Seoul, South Korea. A professional research company recruited participants using its research panel, which contains more than 7 million global research panelists. We requested that the company collect 500 participants' data. We requested that participants be South Korean female college students who have never been vaccinated. Approximately 1,400 people applied to participate in the survey, and the 500 participants who met the conditions and finished the survey on time (i.e., in order but within a reasonable time) were included in the data set. The participants took, on average, 9 minutes to complete the survey, and they received one dollar each for their participation. The mean age of the participants was 22.55 years ($SD = 1.62$).

Measures

All variables were assessed using multiple-item scales adapted from prevalidated measures.

Risk Judgment

Risk judgment was measured using two self-report scales: perceived risk seriousness and perceived risk probability (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 and (2) if they experienced any vaccine-related problems after vaccination. The perceived risk probability for HPV risks and vaccine-related risks were separately measured by asking the participants (1) how likely they thought they could become infected with HPV, and (2) how likely they thought they would experience any vaccine-related problems after vaccination. The participants reported their responses on a 5-point Likert scale. The variable "risk judgment" was derived by multiplying the measures of perceived probability and perceived seriousness (Griffin et al., 2008). We obtained $M = 11.80$, $SD = 4.45$ for the judgment of HPV risks; and $M = 12.43$, $SD = 4.61$ for the judgment of 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) not helpful/helpful, (2) harmful/beneficial, (3) bad/good, and (4) worthless/valuable (Kahlor, 2010). The items were summed to create a scale that demonstrated good internal consistency: $a = .73$; $M = 5.47$, $SD = 1.17$ for HPV risks; and $a = .79$; $M = 5.47$, $SD = 1.22$ 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 seven questions about their perceptions 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"; Kahlor, 2010). The participants reported their responses on a 5-point Likert scale. The items were summed to create a scale: $a = .89$; $M = 2.83$, $SD = .84$ for HPV risks; and $a = .90$; $M = 2.82$, $SD = .84$ 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"; Griffin et al., 2004). The participants reported their responses on a 5-point Likert scale. The items were summed to create a scale: $a = .76$; $M = 2.90$, $SD = .75$ for HPV risks; and $a = .72$; $M = 3.03$, $SD = .69$ 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 be necessary (i.e., information insufficiency) is the regressed difference between the threshold and the individual's current knowledge (Griffin et al., 2004). Therefore, 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).

Current Knowledge About HPV Vaccine Risks and HPV Risks

The participants provided their current level of knowledge about HPV vaccine risks on a 100-point scale. 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 to confidently address the risk associated with the HPV (vaccine). 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 of 0 to 10 how much anger and worry they would feel if (1) they were infected with HPV (i.e., HPV risks) and (2) they experienced any vaccine-related problems 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"; Griffin et al., 1999). The participants reported their responses on a 5-point Likert scale. The items were summed to create a scale: $\alpha = .93$; $M = 3.87$, $SD = .74$ for HPV risks; and $\alpha = .92$; $M = 3.80$, $SD = .73$ 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 avoid seeking information about HPV risks and vaccine-related risks (e.g., "When the topic of HPV comes up, I'm likely to tune it out"; Griffin et al., 1999). The participants reported their responses on a 5-point Likert scale. The items were summed to create a scale: $\alpha = .86$; $M = 1.83$, $SD = .66$ for HPV risks; and $\alpha = .90$; $M = 1.90$, $SD = .69$ for vaccine-related risks.

Data Analysis

To test the hypotheses and research question of this study, SPSS Version 22 and AMOS 22 were used. Specifically, the proposed model (Figure 1) was examined via structural equation modeling (SEM). The most common forms of SEM include measured confirmatory factors, latent variable paths, and variable path analysis models (Mueller & Hancock, 2019). We used a measured variable path analysis model in this study. Path analysis is an extension of multiple regression analysis and assumes that each variable is reasonably free of measurement errors (Lleras, 2005). Since there is no latent variable in the path models, the fit indices are not meaningful.

We adopted the maximum likelihood (ML) estimation to test the extent to which the observed data fit the hypothesized model and to estimate the model's parameters. While AMOS assumes that in SEM, using ML estimations, data are drawn from a multivariate normal population (Arbuckle, 2013), in practice, researchers use relatively small samples that are clearly from non-normal populations (Nevitt & Hancock, 2001). Normally, 200 participants are considered large enough for an ML estimation, although the data distribution might be slightly non-normal. AMOS includes a built-in normality test; however, the information is not useful because the test is almost always guaranteed to be significant in SEM (Stevens, 2009). In SEM, kurtosis is more relevant to the normality test than skewness because kurtosis affects variances and covariances (Bryne, 2013). Thus, using kurtosis values for individual variables is recommended (Stevens, 2009). Our data showed no violation of normality because there was no kurtosis value greater than 3.00 (see Westfall & Henning, 2013).

A percentile bootstrap method with 5,000 resampling and bias-corrected 95% confidence intervals was used to investigate indirect effects in the multiple-mediator model. Finally, we checked and used modification indices during our analysis. Specifically, we tried the AMOS software's suggestions, which make sense from the theoretical perspective, and added two paths to each model. In Figures 2–5, path (A) indicates the perceived knowledge threshold controlled for perceived knowledge, and paths (B) and (C) were added according to the recommendations of the modification indices. Since we compared the original and extended PRISM models in different risk contexts, we thought that the recommendations would have some practical implications for each risk topic. The differences between the risk contexts will be further discussed in a later section.

Results

SEM was used to test PRISM in the context of HPV vaccination. Specifically, Hypotheses 1-1 through 13-1 were tested with PRISM in the context of HPV risks, and Hypotheses 1-2 through 13-2 were tested with PRISM regarding vaccine-related risks. To investigate H14, the extended PRISM, with the outcome of information avoidance, was run in the context of HPV risks and vaccine-related risks. Next, to investigate RQ1, the path coefficients from each figure were compared with those from the other figures.

Testing PRISM in the Context of HPV Vaccination

HPV Risks

To test Hypotheses 1-1 through 1-13, PRISM was run in the context of HPV risks (Figure 2). According to the results, attitude toward seeking (H1-1: $\beta = .22, p < .001$) and perceived seeking control (H3-1: $\beta = .17, p < .001$) were positively related to information-seeking intent. Risk judgment was positively related to affective risk response (H4-1: $\beta = .32, p < .001$), and affective risk response significantly increased perceived knowledge insufficiency (H5-1: $\beta = .13, p < .05$). Both perceived knowledge insufficiency (H7-1: $\beta = .24, p < .001$) and affective risk response (H8-1: $\beta = .14, p < .01$) were significantly and positively related to seeking intent. Attitude toward seeking was positively related to perceived knowledge insufficiency (H9-1: $\beta = .10, p < .05$). Attitude toward seeking significantly increased perceived knowledge (H11-1: $\beta = .09, p < .01$). Perceived seeking control (H12-1: $\beta = .36, p < .001$) and seeking-related subjective norms (H13-1: $\beta = .43, p < .001$) 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.

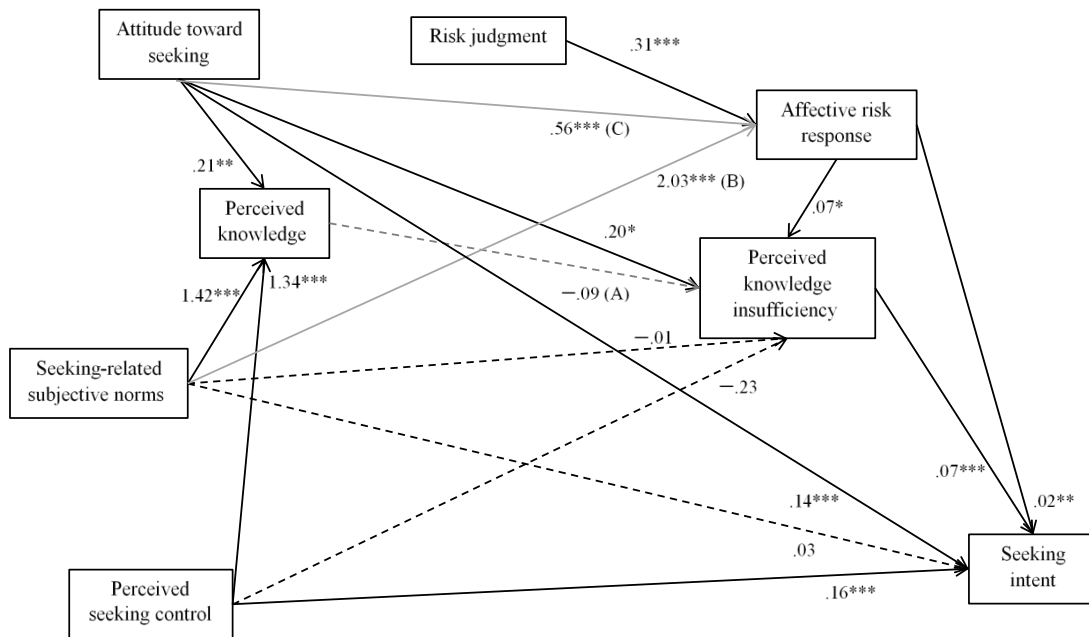


Figure 2. PRISM for HPV risk information seeking (unstandardized).

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Vaccine Risks

To test Hypotheses 1–2 through 13–2, PRISM was run in the context of vaccine-related risks (Figure 3). According to the results, attitude toward seeking (H1–2: $\beta = .31$, $p < .001$), seeking-related subjective norms (H2–2: $\beta = .09$, $p < .05$), and perceived seeking control (H3–2: $\beta = .14$, $p < .001$) were positively related to information-seeking intent. Risk judgment was positively related to affective risk response (H4–2: $\beta = .44$, $p < .001$). Perceived knowledge insufficiency was significantly and positively related to seeking intent (H7–2: $\beta = .21$, $p < .001$). Both attitude toward seeking (H9–2: $\beta = .16$, $p < .001$) and perceived seeking control (H10–2: $\beta = -.11$, $p < .05$) were significantly associated with perceived knowledge insufficiency. Perceived seeking control (H12–2: $\beta = .26$, $p < .001$) and seeking-related subjective norms (H13–2: $\beta = .47$, $p < .001$) 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.

Testing the Extended PRISM With the Outcome of Information Avoidance

To investigate H14, the PRISM model with the outcome of information avoidance was run in the context of HPV risks and vaccine-related risks (Figures 4 and 5). In the model tested in the context of HPV risks (Figure 4), attitude toward seeking ($\beta = -.24$, $p < .001$), perceived seeking control ($\beta = -.13$, $p < .01$), perceived knowledge insufficiency ($\beta = -.20$, $p < .001$), and affective risk response ($\beta = -.11$, $p < .05$) were significantly and negatively related to avoidance intentions. In the model tested in the context of

HPV risk information seeking and vaccine-related risk information seeking. The path coefficients from Hypotheses 2 and 10 were significant in the models predicting HPV risk information avoidance and vaccine-related risk information avoidance. In conclusion, the significances of path coefficients derived from Hypotheses 1, 3, 4, 7, 9, 12, and 13 were consistent across the four figures.

In terms of the mediation effect, as Figures 2–5 show, perceived knowledge insufficiency functioned as an important mediator between the social cognitive variables (i.e., attitude toward seeking and/or perceived seeking control) and seeking/avoidance intentions in all four models. In addition, as Figures 2, 4, and 5 show, affective risk response was also identified as a significant mediator within these models.

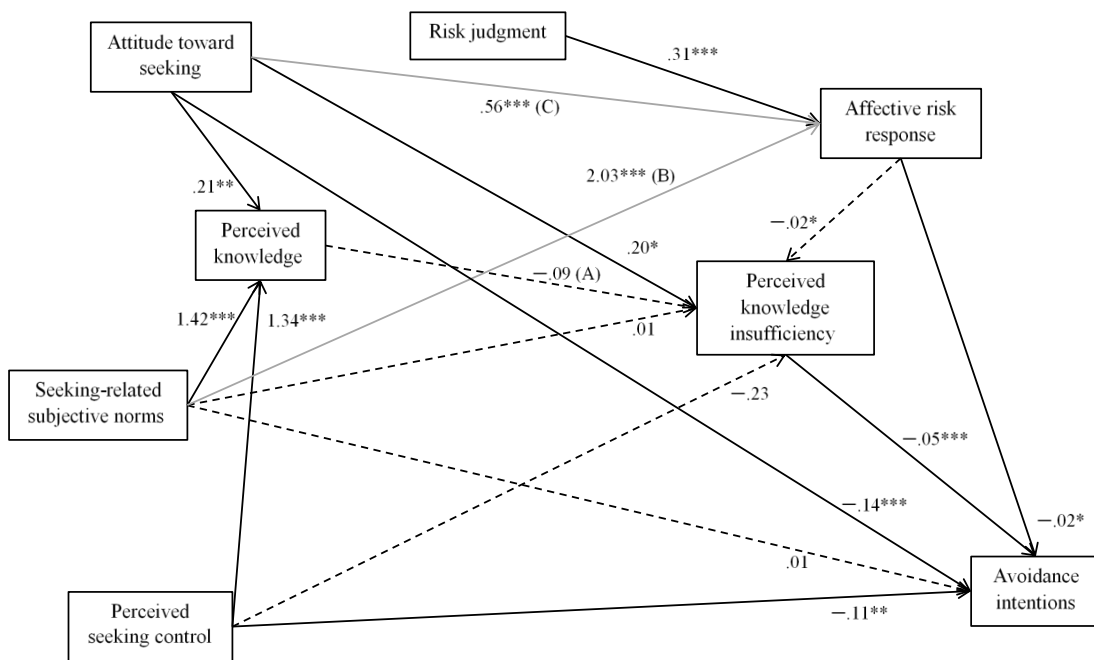


Figure 4. Extended PRISM for HPV risk information avoidance (unstandardized).
 Note. *p <.05; **p <.01; ***p <.001.

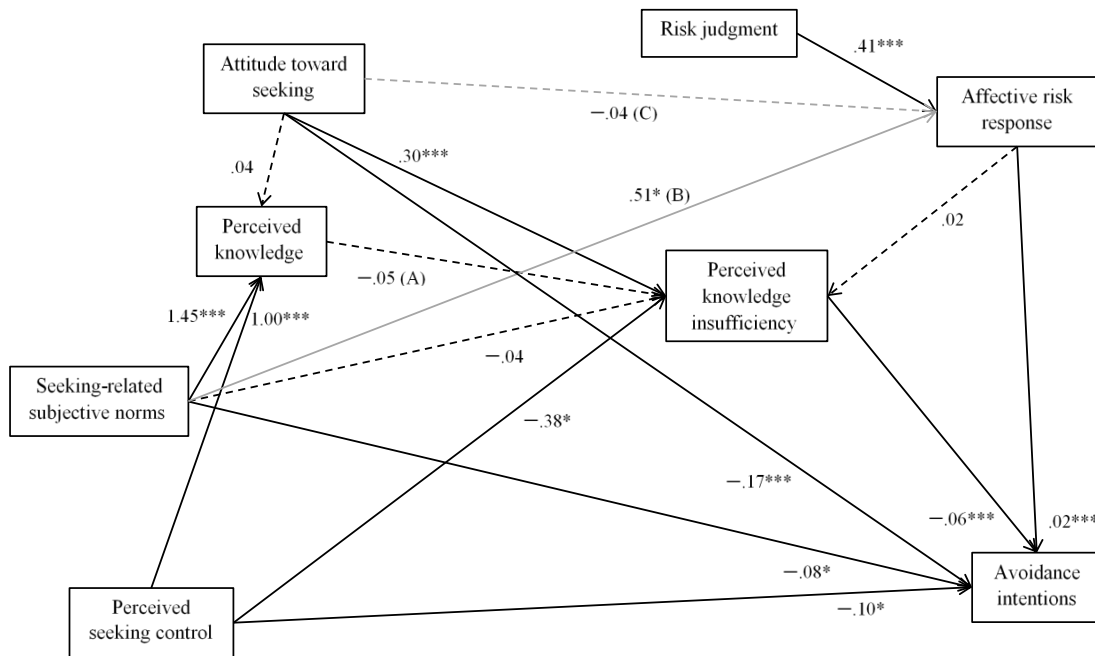


Figure 5. Extended PRISM for vaccine-related risk information avoidance (unstandardized).
 Note. *p <.05; **p <.01; ***p <.001.

Discussion

This study investigates the procedures of risk information seeking and avoidance by adopting PRISM and employing cross-sectional data from female college students in South Korea. We compared and interpreted the results from 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 regarding vaccination and relevant risks.

First, while several paths hypothesized in PRISM were significant in models tested in the contexts of HPV risk and HPV vaccine-related risk, the results particularly highlight the significant roles of the three TPB variables in increasing seeking intent. 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 PRISMs with the outcome of seeking intent. In both PRISMs (Figures 2 and 3), attitude toward seeking was positively related to perceived knowledge insufficiency and information-seeking intent. In the extended PRISMs (Figures 4 and 5), attitude toward seeking was positively associated with perceived knowledge insufficiency and negatively related to information avoidance intentions. The results suggest that, compared with other variables, attitude toward seeking may have a more powerful impact on perceived knowledge insufficiency, thereby affecting seeking-related variables (i.e., seeking intent and avoidance intentions) directly and

indirectly. Given that both PRISM and RISP regard information insufficiency as one of the most remarkable factors predicting seeking intent, this attitude's role in increasing information insufficiency cannot be underestimated. In addition, perceived seeking control significantly affected seeking-related outcomes across the four models and significantly increased perceived insufficiency in the models tested in relation to vaccine-related risks. Finally, 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 has significant implications for studies conducted on infectious diseases because, as an altruistic behavior, vaccination that prevents infections may affect not only the person deciding, but also other individuals within the person's social environment (Shim, Chapman, Townsend, & Galvani, 2012). These results align with the previous literature on vaccination conducted in the Asian context in that social cognitive variables play significant roles in individuals' information seeking (e.g., Yang & Liu, 2021).

Second, the results suggest that although some 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 risk contexts (i.e., HPV vs. vaccine) and model types (i.e., extended vs. nonextended). First, in all four models, perceived knowledge insufficiency was identified as an important mediator between the social cognitive variables (i.e., attitude toward seeking and/or perceived seeking control) and seeking/avoidance intentions. The results suggest the theoretical robustness and consistency of PRISM and other models that highlight the importance of perceived knowledge insufficiency in individuals' decision making about information-seeking behaviors. However, differences were found across the models. For example, in the extended model with the outcome of information avoidance intentions (Figure 5), the affective response toward vaccine-related risk, which is considered a highly uncertain risk, significantly increased information avoidance intentions. This aligns with the previous literature: Uncertainty leads to a negative relationship between negative affect and seeking, particularly with 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. In contrast, when the model was tested in a less uncertain risk-related context (i.e., HPV), a reverse result was found (Figure 4). This result suggests that young college women may consider HPV-related risks less uncertain and/or dangerous than vaccine-related risks.

Third, the results suggest the limitations and potential of PRISM. First, the link between perceived knowledge and perceived knowledge insufficiency was not significant in any of the models tested in this study. This insignificant association has been found in previous studies conducted in several risk contexts (e.g., Huang & Ells, 2021). These results suggest that PRISM may have a limitation in terms of theoretical robustness. Due to this limitation, some previous studies (e.g., Hong, Biesecker, Ivanovich, Goodman, & Kaphingst, 2019) have replaced information insufficiency with other variables (e.g., information need). In addition, we have added significant paths that were not included in the original PRISM model, and these new paths suggest both the potential and limitations of PRISM. For example, a significant path between seeking-related subjective norms and affective risk response was added to both the original and extended PRISMs tested with regard to HPV risks and vaccine-related risks (Figures 2–5). Given that the link between subjective norms and affective risk response was not hypothesized in the original PRISM, the opinion of significant others might be important for young college women, particularly as it relates to STDs. In addition, a significant path between risk judgment and seeking intent was added only to the original model tested in

relation to vaccine risk (Figure 3). The result indicates that risk judgment may play a more significant role in increasing seeking intent regarding vaccine risks than disease risks. Moreover, the additional path between attitudes toward seeking and affective risk response was significant only in the models regarding disease risks (Figures 2 and 4). In particular, in PRISM for HPV risk information seeking (Figure 2), both attitudes toward seeking and subjective norms indirectly influenced seeking intent via affective responses. This reveals how social cognitions play an important role in affecting young college students' emotional responses and information-related behaviors toward disease risks. The additional paths found in this study suggest that PRISM has the flexibility and potential to be easily modified and applied to future research in different risk contexts while showing some theoretical limitations, in addition to the insignificant link between perceived knowledge and insufficiency.

Finally, the results provide important implications for the current media environment, where conspiratorial thinking is endemic among anti-vaccination groups, which often regard advocating scientific and medical consensus as concealing the truth (Grimes, 2016). 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 situation has created an environment in which anti-vaccine activists can spread their messages effectively (Kata, 2012). Some media messages have suggested that vaccines are dangerous or ineffective, 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). The impact of anti-vaccine messages and vaccination refusal on public health is particularly challenging in many countries (Scherer, Shaffer, Patel, & Zikmund-Fisher, 2016), and South Korea is no exception. Although we did not specifically measure variables related to misinformation, as discussed previously, rumors and misinformation caused by distorted media reporting have significantly affected South Koreans' low vaccination rates (Lee & Hong, 2018). The results of our study, which show differences in some associations across risk contexts, suggest that the ambiguity and uncertainty caused by rumors and misinformation may influence individuals' information-related behaviors as well as the effect of diverse cognitive and affective factors on these behaviors. Future studies will need to focus more on the influence of misinformation on the associations within PRISM and the differences across risk contexts.

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 a limitation. Further research using longitudinal panel data is needed to clarify the causal order. Second, our results show that HPV risk and HPV vaccine risk are similar across measures, which might result from a conflated assessment. If this is the case, this limitation could be removed in future research by randomly assigning participants to one of the two risk conditions. However, there is a possibility that the similarity across the two risk contexts suggests that, as discussed previously, South Korean people think the HPV vaccine can be dangerous while also acknowledging HPV risks. This may show the internal validity of this study in South Korea, which can explain why the HPV vaccine uptake rates of South Korean college women are much lower than those of women in other developed countries (Park et al., 2019; Seong & Kim, 2014). Finally, 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 regarding vaccinations. In conclusion, our findings provide meaningful theoretical and practical implications for future research investigating PRISM in the vaccination context. Specifically, the findings highlight the need to develop different models across risk contexts and cultures.

References

- Ache, K. A., & Wallace, L. S. (2008). Human papillomavirus vaccination coverage on YouTube. *American Journal of Preventive Medicine, 35*(4), 389–392. doi:10.1016/j.amepre.2008.06.029
- Afifi, W. A., & Weiner, J. L. (2004). Toward a theory of motivated information management. *Communication Theory, 14*(2), 167–190. doi:10.1111/j.1468-2885.2004.tb00310.x
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T
- Albarracin, D., & Shavitt, S. (2018). Attitudes and attitude change. *Annual Review of Psychology, 69*(1), 299–327. doi:10.1146/annurev.ps.44.020193.001001
- Arbuckle, J. L. (2013). *Amos 22 user's guide*. Crawfordville, FL: Amos Development Corporation.
- Barbour, J. B., Rintamaki, L. S., Ramsey, J. A., & Brashers, D. E. (2012). Avoiding health information. *Journal of Health Communication, 17*(2), 212–229. doi:10.1080/10810730.2011.585691
- Basch, C. H., & MacLean, S. A. (2019). A content analysis of HPV related posts on Instagram. *Human Vaccines & Immunotherapeutics, 15*(7–8), 1476–1478. doi:10.1080/21645515.2018.1560774
- Brashers, D. E., Goldsmith, D. J., & Hsieh, E. (2002). Information seeking and avoiding in health contexts. *Human Communication Research, 28*(2), 258–271. doi:10.1111/j.1468-2958.2002.tb00807.x
- Brashers, D. E., Neidig, J. L., Haas, S. M., Dobbs, L. K., Cardillo, L. W., & Russell, J. A. (2000). Communication in the management of uncertainty: The case of persons living with HIV or AIDS. *Communication Monographs, 67*(1), 63–84. doi:10.1080/03637750009376495
- Briones, R., Nan, X., Madden, K., & Waks, L. (2012). When vaccines go viral: An analysis of HPV vaccine coverage on YouTube. *Health Communication, 27*(5), 478–485. doi:10.1080/10410236.2011.610258
- Centers for Disease Control and Prevention. (2021). *Human Papillomavirus (HPV)*. Retrieved from <https://www.cdc.gov/hpv/index.html>

- Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, 39(5), 752–756. doi:10.1037/0022-3514.39.5.752
- Clarke, C. E., & McComas, K. (2012). Seeking and processing influenza vaccine information: A study of health care workers at a large urban hospital. *Health Communication*, 27(3), 244–256. doi:10.1080/10410236.2011.578332
- Clore, G. L., Gasper, K., & Garvin, E. (2001). Affect as information. In J. P. Forgas (Ed.), *Handbook of affect and social cognition* (pp. 121–144). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Deline, M. B., & Kahlor, L. A. (2019). Planned risk information avoidance: A proposed theoretical model. *Communication Theory*, 29(3), 360–382. doi:10.1093/ct/qty035
- Dillard, J. P., Li, R., & Yang, C. (2021). Fear of Zika: Information seeking as cause and consequence. *Health Communication*, 36(13), 1785–1795. doi:10.1080/10410236.2020.1794554
- Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed model of the relationship of risk information seeking and processing to the development of preventive behaviors. *Environmental Research*, 80(2), S230–S245. doi:10.1006/enrs.1998.3940
- Griffin, R. J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information sufficiency and risk communication. *Media Psychology*, 6(1), 23–61. doi:10.1207/s1532785xmep0601_2
- Griffin, R., Yang, Z., Huurne, E., Boerner, F., Ortiz, S., & Dunwoody, S. (2008). After the flood: Anger, attribution, and the seeking of information. *Science Communication*, 29(3), 285–315. doi:10.1177/1075547007312309
- Hong, S. J., Biesecker, B. B., Ivanovich, J. L., Goodman, M. S., & Kaphingst, K. A. (2019). Factors affecting breast cancer patients' need for genetic risk information: From information insufficiency to information need. *Journal of Genetic Counseling*, 28(3), 543–557. doi:10.1002/jgc4.1087
- Hovick, S. R., Kahlor, L., & Liang, M. C. (2014). Personal cancer knowledge and information seeking through PRISM: The planned risk information seeking model. *Journal of Health Communication*, 19(4), 511–527. doi:10.1080/10810730.2013.821556
- Huang, J., & Ells, K. (2021). Risk here vs. risk there: Intention to seek information about gulf coastal erosion. *Environmental Communication*, 15(3), 386–400. doi:10.1080/17524032.2020.1853582
- Intlekofer, K. A., Cunningham, M. J., & Caplan, A. L. (2012). The HPV vaccine controversy. *AMA Journal of Ethics*, 14(1), 39–49. doi:10.1001/virtualmentor.2012.14.1.msoc1-1201

- Kahlor, L. (2007). An augmented risk information seeking model: The case of global warming. *Media Psychology, 10*(3), 414–435. doi:10.1080/15213260701532971
- Kahlor, L. (2010). PRISM: A planned risk information seeking model. *Health Communication, 25*(4), 345–356. doi:10.1080/10410231003775172
- Kata, A. (2012). Anti-vaccine activists, Web 2.0, and the postmodern paradigm—An overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine, 30*(25), 3778–3789. doi:10.1016/j.vaccine.2011.11.112
- Kim, S. (2019, October 11). Increasing cervical cancer incidence rates among young women in their 20s. *Health Chosun*. Retrieved from https://m.health.chosun.com/svc/news_view.html?contid=2019101100033
- Kim, H., Han, J. Y., & Seo, Y. (2020). Effects of Facebook comments on attitude toward vaccines: The roles of perceived distributions of public opinion and perceived vaccine efficacy. *Journal of Health Communication, 25*(2), 159–69. doi:10.1080/10810730.2020.1723039
- Lambert, S. D., & Loisele, C. G. (2007). Health information seeking behavior. *Qualitative Health Research, 17*(8), 1006–1019. doi:10.1177/1049732307305199
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.
- Leckie, G. J., Given, L.M., & Buschman, J. (2010). *Critical theory for library and information science: Exploring the social from across the disciplines*. Santa Barbara, CA: Libraries Unlimited.
- Lee, S. (2021, July 16). Lee Nak-yon, Offer the HPV vaccine to male and female adults for free. *Woman Times*. Retrieved from <http://www.womentimes.co.kr/news/articleView.html?idxno=53246>
- Lee, M., & Hong, J. (2018). Analysis of news articles regarding safety issue of HPV vaccine. *Journal of Internet Computing and Services, 19*(2), 77–88. doi:10.7472/jksii.2018.19.2.77
- Lewis, N. (2017). Information seeking and scanning. In P. Rossler (Ed.), *The international encyclopedia of media effects* (pp. 745–754). West Sussex, UK: John Wiley & Sons.
- Lindell, M. K., Mumpower, J. L., Huang, S. K., Wu, H. C., Samuelson, C. D., & Wei, H. L. (2016). Perceptions of protective actions for a water contamination emergency. *Journal of Risk Research, 20*(7), 887–908. doi:10.1080/13669877.2015.1121906
- Lindell, M. K., & Perry, R. W. (2012). The protective action decision model: Theoretical modifications and additional evidence. *Risk Analysis, 32*(4), 616–632. doi:10.1111/j.1539-6924.2011.01647.x

- Lleras, C. (2005). Path analysis. *Encyclopedia of Social Measurement*, 3, 25–30. doi:10.1016/B0-12-369398-5/00483-7
- Mueller, R. O., & Hancock, G. R. (2019). Structural equation modeling. In G. R. Hancock, L. M. Stapleton, & R. O. Mueller (Eds.), *The reviewer's guide to quantitative methods in the social sciences* (pp. 445–456). New York, NY: Routledge.
- Nan, X., & Madden, K. (2012). HPV vaccine information in the blogosphere: How positive and negative blogs influence vaccine-related risk perceptions, attitudes, and behavioral intentions. *Health Communication*, 27(8), 829–836. doi:10.1080/10410236.2012.661348
- Narayan, B., Case, D. O., & Edwards, S. L. (2011). The role of information avoidance in everyday-life information behaviors. *Proceedings of the ASIST Annual Meeting*, 48, 1–7. doi:10.1002/meet.2011.14504801085
- National Cancer Information Center. (2015). *2015 cancer statistics*. Retrieved from <http://www.cancer.gov/mbs/>
- Nevitt, J., & Hancock, G. R. (2001). Performance of bootstrapping approaches to model test statistics and parameter standard error estimation in structural equation modeling. *Structural Equation Modeling*, 8(3), 353–377. doi:10.1207/S15328007SEM0803_2
- Niederdeppe, J., Hornik, R. C., Kelly, B. J., Frosch, D. L., Romantan, A., Stevens, R. S., . . . Schwartz, J. S. (2007). Examining the dimensions of cancer-related information seeking and scanning behaviors. *Health Communication*, 22(2), 155–167. doi:10.1080/10410230701454189
- Ortiz, R. R., Smith, A., & Coyne-Beasley, T. (2019). A systematic literature review to examine the potential for social media to impact HPV vaccine uptake and awareness, knowledge, and attitudes about HPV and HPV vaccination. *Human Vaccines & Immunotherapeutics*, 15(7–8), 1465–1475. doi:10.1080/21645515.2019.1581543
- Park, S., Jang, I., Lee, J. L., & Kim, Y. (2020). Factors affecting vaccination status of female adolescents subject to the Korean national HPV immunization program: Focusing on mothers' HPV knowledge and health beliefs of HPV vaccines. *Journal of the Korean Society of School Health*, 33(1), 58–66. doi:10.15434/kssh.2020.33.1.58
- Park, J.-Y., Kim, H.-R., Lee, S.-M., Lee, S.-Y., Lee, Y.-H., Lee, Y.-A., . . . Jeong, H.-C. (2019). Knowledge of cervical cancer, vaccination status of human papillomavirus in university students. *Asia-Pacific Journal of Multimedia Services Convergent With Art, Humanities, and Sociology*, 9, 479–490. doi:10.35873/ajmahs.2019.9.7.043

- Pask, E. B., & Rawlins, S. T. (2016). Men's intentions to engage in behaviors to protect against human papillomavirus (HPV): Testing the risk perception attitude framework. *Health Communication, 31*(2), 139–149. doi:10.1080/10410236.2014.940670
- Politi, M. C., Han, P. K., & Col, N. F. (2007). Communicating the uncertainty of harms and benefits of medical interventions. *Medical Decision Making, 27*(5), 681–695. doi:10.1177/0272989X07307270
- Rimal, R. N., & Juon, H. S. (2010). Use of the risk perception attitude framework for promoting breast cancer prevention. *Journal of Applied Social Psychology, 40*(2), 287–310. doi:10.1111/j.1559-1816.2009.00574.x
- Scherer, K. R. (2001). Appraisal considered as a process of multilevel sequential checking. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research* (pp. 92–120). New York, NY: Oxford University Press.
- Scherer, L. D., Shaffer, V. A., Patel, N., & Zikmund-Fisher, B. J. (2016). Can the vaccine adverse event reporting system be used to increase vaccine acceptance and trust? *Vaccine, 34*(21), 2424–2429. doi:10.1016/j.vaccine.2016.03.087
- Seong, D., & Kim, Y. H. (2014). Factors influencing the Human Papillomavirus (HPV) vaccination of females in their twenties in some Busan areas. *Journal of the Korea Academia-Industrial Cooperation Society, 15*(7), 4212–4219. doi:10.5762/KAIS.2014.15.7.4212
- Shim, E., Chapman, G. B., Townsend, J. P., & Galvani, A. P. (2012). The influence of altruism on influenza vaccination decisions. *Journal of The Royal Society Interface, 9*(74), 2234–2243. doi:10.1098/rsif.2012.0115
- Slovic, P. E. (2000). *The perception of risk* (1st ed.). New York, NY: Routledge. doi:10.4324/9781315661773
- Stevens, J. P. (2009). *Applied multivariate statistics for the social sciences* (5th ed.). New York, NY: Routledge.
- Sweeny, K., Melnyk, D., Miller, W., & Shepperd, J.A. (2010). Information avoidance: Who, what, when, and why. *Review of General Psychology, 14*(4), 340–353. doi:10.1037/a0021288
- Wang, W., & Ahern, L. (2015). Acting on surprise: Emotional response, multiple-channel information seeking and vaccination in the H1N1 flu epidemic. *Social Influence, 10*(3), 137–148. doi:10.1080/15534510.2015.1011227
- Westfall, P. H., & Henning, K. S. (2013). *Texts in statistical science: Understanding advanced statistical methods*. Boca Raton, FL: Taylor & Francis.

- Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs, 59*(4), 401–421. doi:10.1080/03637759209376276
- Yang, Z. J., Aloe, A. M., & Feeley, T. H. (2014). Risk information seeking and processing model: A meta-analysis. *Journal of Communication, 64*(1), 20–41. doi:10.1111/jcom.12071
- Yang, Z. J., & Kahlor, L. (2013). What, me worry? The role of affect in information seeking and avoidance. *Science Communication, 35*(2), 189–212. doi:10.1177/1075547012441873
- Yang, J. Z., & Liu, Z. (2021). Information seeking and processing in the context of vaccine scandals. *Science Communication, 43*(3), 279–306. doi:10.1177/10755470209835