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Elaboration, Cancer Worry, and Risk Perception Mediate the Association Between News Attention on the Internet and Intention to Uptake HPV Vaccination: Extending the Cognitive Mediation Model

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This study tests an extended cognitive mediation model (CMM) by adding cancer worry and risk perceptions as outcomes of elaboration and predictors of intention to uptake human papilloma virus (HPV) vaccination among young Chinese women. It also investigates if news attention on newspaper, television, and the Internet are indirectly associated with the intention to uptake HPV vaccination through these mediators. Results of structural equation modeling based on survey data with 399 female university students indicate partial support to the extended CMM. Results show that news attention on the Internet is positively associated with elaboration, while news attention on newspaper and television had no association with it. Moreover, elaboration is positively associated with cancer worry but not with risk perception. Next, cancer worry and risk perception were associated with intention to uptake HPV vaccination. Finally, mediation analysis results showed that news attention on the Internet is indirectly associated with intention to uptake HPV vaccination through elaboration and cancer worry. Theoretical and practical implications of the study are discussed.

Keywords: cancer worry, elaboration, HPV vaccination, news attention, risk perception

The human papillomavirus (HPV) is the most common sexually transmitted infection worldwide and is a key risk factor for cervical cancer (Scherer et al., 2018). Nonetheless, it is a highly preventable infection because of the availability of HPV vaccines (Zhu et al., 2014). Since 2006, national immunization policies for HPV have been adopted in many countries (Brotherton & Bloem, 2015). However, compared with other

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countries, routine HPV vaccination in China is implemented relatively late (Colombara & Wang, 2013). It was not until July 31, 2017, that GlaxoSmithKline's Cervarix HPV vaccine was formally made available for use in mainland China (Li, Nowak, Jin, & Cacciatore, 2018). The reason for the late implementation of HPV vaccination in China is complex, including seven-year phase III clinical trials of the vaccine; severe shortage of HPV vaccine supply because of high demand; undesirable events associated with vaccination that jeopardize the general public's confidence in the HPV vaccine; the high cost of HPV vaccines; and cultural, social, and religious sensitivity to accepting a vaccine for a sexually transmitted infection (Wong et al., 2019). The delay in HPV vaccination implementation in China is believed to have led to a serious cancer-related health burden (Colombara & Wang, 2013).

Although the HPV vaccine was proved to be effective and safe in the Chinese population, the awareness, knowledge, and acceptance of the vaccine among young Chinese women remain quite low in China. Studies show that only 20–30% of Chinese women have heard of HPV and only half of them intend to uptake HPV vaccination (He & He, 2018; Wang & Wu, 2018). Considering that promoting HPV vaccination in various media channels is a vital step to reduce cervical cancer rates in China (Li et al., 2009; Wen & Shen, 2016), there is an urgent need to understand the process of how media-related factors affecting young Chinese women's intention to uptake HPV vaccination.

Previous research shows that the successful uptake of HPV vaccine relies on personal (e.g., awareness and knowledge of HPV disease, and vaccination intention) and sociodemographic factors (Hong, Zhang, Li, Lin, & Liu, 2013; Xue et al., 2018). However, only a few studies theoretically explain the association of HPV vaccine-related news on women's intention to uptake HPV vaccination, particularly in China (e.g., Yang & Myrick, 2020; Zhang & Wang, 2019). Based on this research gap, we propose and test an extension of the CMM (Eveland, 2001) to unravel the process by which news attention on newspaper, television, and the Internet relate to intention to uptake HPV vaccination through potential mediators (i.e., elaboration, cancer worry, and risk perception). We test the model using a sample of young Chinese women who are university students in Kunming, China. Aside from theoretical contributions, our findings can be used by Chinese health agencies to guide efforts in improving the delivery of HPV vaccine-related news to promote the uptake of HPV vaccination.

News Attention and Intention to Uptake HPV Vaccination

Mass media are crucial channels of communication for health promotion and disease prevention campaigns (Payne & Schulte, 2003). Scholars (Eveland, 2001; McGuire, 2001) argue that behavior can be modified by giving attention to news-related media messages. Specifically, a change or reinforcement of perception and behavior can occur when individuals are more attentive to messages generated by media outlets (DeFleur & Ball-Rokeach, 1989; Lin & Lagoe, 2013). After HPV vaccination was officially licensed for use in mainland China, HPV vaccination-related information provided by the media increased sharply (Li et al., 2018). Since scholars have long argued that media coverage influences public attitudes and perceptions of health issues effectively (Li et al., 2009; Saguy, Frederick, & Gruys, 2014; Wen & Shen, 2016), it is critical to deeply understand the relationship between media attention and intention to uptake HPV vaccination. In this study, news attention refers to individuals' level of conscious attention dedicated to receiving cervical cancer and HPV vaccination on several news outlets (Li & Bautista, 2020; Li & Li, 2020; Slater, Goodall, & Hayes,

2009). To date, several studies show that news attention and behavioral intention on specific health issues are related (Lin, Li, & Bautista, 2017). For instance, Lee, Ho, Chow, Wu, and Yang (2013) found that breast cancer media attention was positively correlated with intention to perform cancer-related precautions. Lovejoy, Riffe, and Lovejoy (2015) found that those who pay more attention to health information in television, magazines, and newspapers had a higher intention to avoid unprotected sun exposure.

The abovementioned studies have mostly examined the direct association between news attention and behavioral intention of various health issues. However, according to the CMM (Eveland, 2001), the relationship between media attention and behavior change is not as straightforward as it seems. People are motivated to pay attention to news content, which leads to elaborative processing, and this processing, ultimately, contributes to knowledge gain and behavior change. Therefore, the central purpose of the current study is to use the CMM as a framework to unravel potential factors that could mediate the association between news attention and intention to uptake of HPV vaccination among young Chinese women.

Notably, while newspaper and television continue to play their roles as traditional channels for disseminating news, the growing adoption of the Internet and Internet-related media outlets (e.g., social media, blogs, and more) have changed people's media habits over the past decades in China (Hao, 2015). Market reports forecast that between 2016 and 2021, time spent on digital media will increase from 2.97 to 4.58 hours while time spent on traditional media (i.e., TV, newspapers, magazines, and radio) will decrease from 3 to 2.62 hours (Cheung, 2019). It is also important to note that although media outlets are highly regulated in China (Kennedy, 2009; Zeng, Dai, & Jiang, 2019), the Internet serves as an online space where its citizens can conveniently search for both formal (i.e., government-made) and informal (i.e., user-generated) information on various health issues (Hao, 2015). Xiao and Su (2020) examined online Chinese news content 12 months before and after the approval of the HPV vaccine in China and found that most online news reports mentioned the efficacy of the vaccine, and the number of articles highlighting the effectiveness of the vaccine significantly increased after the approval. Li et al. (2018) found that news stories that appear in newspapers in China were a mix of positive and problematic content. On the positive side, almost all the articles mentioned HPV's relation to cervical cancer, which could better improve public understanding of HPV vaccination. However, on the problematic side, Chinese newspapers' coverage of HPV disease and vaccine has been inadequate and incomplete as the epidemiological information related to HPV was often missing critical elements. Following previous work (Lee et al., 2013; Lin et al., 2017, Lovejoy et al., 2015), we conceptualize that young Chinese women are likely to obtain news about cervical cancer and HPV vaccination from a combination of traditional (i.e., newspaper and television) and new (i.e., the Internet) media. Therefore, this study aims to use the CMM as a framework to deeply investigate how attention to HPV-related news on traditional (i.e., newspaper and television) and new (i.e., the Internet) media platforms affect intention to uptake of HPV vaccination among young Chinese women. Thus, the following research question was proposed:

RQ1: Does news attention on either newspaper, television, or the Internet have an indirect effect on intention to uptake HPV vaccination?

Cognitive Mediation Model

The CMM, conceptualized by Eveland (2002), is a useful theoretical framework for explaining how people learn from the news. It argues that individuals are motivated to pay attention to news content, which leads to elaborative processing, and this processing, ultimately, contributes to knowledge gain and behavior change (Eveland, 2001). That is, the relationship between media attention and behavior change is not as straightforward as it seems but is mediated by the process of elaboration. Elaboration refers to individuals' cognitive activities of linking past knowledge, experiences, and beliefs with new information (Eveland, 2001; Eveland & Dunwoody, 2002). According to the CMM, news attention serves as a direct antecedent of elaboration in the information processing course (Eveland, 2001). Without such attention, the information cannot be part of an individual's consciousness (Eveland, 2001). Since empirical studies within (e.g., Lee, Shin, Kawaja, & Ho, 2016; Lo, Wei, & Su, 2013) and outside (e.g., Eveland, 2001, 2002) health communication support this claim by finding that news attention is positively related to elaboration, we posit that news attention to HPV vaccination and cervical cancer in newspaper, and on television and the Internet should encourage young Chinese women to elaborate more on HPV vaccination. Thus, the following hypotheses were proposed:

H1a: News attention on newspaper is positively associated with elaboration.

H1b: News attention on television is positively associated with elaboration.

H1c: News attention on the Internet is positively associated with elaboration.

Moreover, the CMM pointed out that by linking new information to current and previous knowledge and experiences, elaboration tends to facilitate greater media impact and can better inform decision making when performing actions (Eveland, 2001), such as intention to uptake HPV vaccination. Thus, the following hypothesis was posited:

H2: Elaboration is positively associated with intention to uptake HPV vaccination.

Although the CMM has been used to test knowledge and behavioral intentions for various health communication issues (e.g., Ho, Peh, & Soh, 2013; Lee et al., 2016; Zhang & Yang, forthcoming), there is still a need to further examine whether there are other mediators that influence the association between elaboration and behavioral intention. As noted by Eveland (2001), the CMM should benefit from additional variables related to information processing. Accordingly, it is interesting to examine whether such variables could both serve as consequences of elaboration and predictors of behavioral intention. Following the lines of several health communication studies, this study extends the CMM by investigating whether cancer worry (e.g., Klasko-Foster, Kiviniemi, Jandorf, & Erwin, 2020; Zhao & Nan, 2016) and risk perception (Consedine, Magai, Krivoshekova, Ryzewicz, & Neugut, 2004; Hay, Buckley, & Ostroff, 2005; Vrinten, van Jaarsveld, Waller, von Wagner, & Wardle, 2014), aside from elaboration, serve as additional mediators when predicting the association between young Chinese women's news attention and intention to uptake HPV vaccination. The following sections provide an overview of these mediators.

Risk Perception

Risk perception is one of the two additional mediators that we propose to be an outcome of elaboration and a predictor of young Chinese women's intention to uptake HPV vaccination. It is defined as individuals' subjective perception of their probability to develop cervical cancer (Consedine et al., 2004; Hay et al., 2005; Vrinten et al., 2014). In many of the influential health behavior models, such as the health belief model (e.g., Janz, & Becker, 1984) and theory of reasoned action (e.g., Fishbein, 1979; Fishbein & Ajzen, 1981), risk perception is posited as a central construct to understand individuals' behavior changes. These models suggest that people who recognize that they are at risk are more likely to embrace protective or less risky behaviors compared with their counterparts (Kowalewski, Henson, & Longshore, 1997).

In the domain of health communication, previous research has shown that risk perception positively influences people's intentions to adopt protective measures (Lin et al., 2017). For instance, women's perceived risk of breast cancer was found to be linked to their intent to take up mammography screening (e.g., Katapodi, Lee, Facione, & Dodd, 2004; Lee et al., 2013). Since risk perception was found to be a significant antecedent of individuals' behavioral intentions, this study expects that Chinese young women who perceive the risk of developing cervical cancer have a greater intention to uptake HPV vaccination.

Moreover, as cervical cancer is a highly relevant issue for women, elaborating more on news related to cervical cancer and HPV vaccination (especially negative ones) may result in higher stress, consequently heightening the perception of the risk. Nan and Madden's (2012) experiment somewhat supports this idea since spending time reading a negative information blog about HPV (i.e., HPV is ineffective against cervical cancer and can lead to blindness) resulted in a higher perceived risk of HPV vaccination and lower intention to uptake HPV vaccination. Besides, Shen and Seung (2018) found that elaboration from viewing a sexual health video is associated with a higher perceived risk for sexually transmitted diseases. Therefore, we argue that elaboration is positively associated with risk perception. The following hypotheses are proposed:

H3: Elaboration is positively associated with risk perception.

H4: Risk perception is positively associated with intention to uptake HPV vaccination.

Cancer Worry

Cancer worry is the other additional mediator that we propose to be an outcome of elaboration and a predictor of young Chinese women's intention to uptake HPV vaccination. It is defined as an emotion-based response to a perceived or real threat of developing cancer (Consedine et al., 2004; Hay et al., 2005; Vrinten et al., 2014). Scholars argue that cancer worry is unique from general dispositional worry since it involves engaging in cancer-related negative thoughts, regardless of any contexts (Andersen et al., 2007; Krakow et al., 2015). According to Jensen, Bernat, Davis, and Yale (2010), cancer worry tends to be operationalized as cancer worry frequency (i.e., how often one worries about cancer) and cancer worry severity (i.e., magnitude of such worries).

Past research shows that cancer worry tends to heighten individuals' risks perceptions of developing cancer (Krakow et al., 2015). That is, if young Chinese women worry about developing cancer, such worry will heighten their perceived risk of contracting cancer. Since risk perception is found to be positively associated with intention to take preventative measures (Becker, 1974; Janz & Becker, 1984), it is logistically to expect that cancer worry may also predict cancer-related behaviors, such as HPV vaccine. One empirical research supports this expectation where it found that cancer worry was positively related to HPV vaccination intention (Krakow et al., 2015). Therefore, we argue that cancer worry is positively associated with risk perception and intention to uptake HPV vaccination.

On the other hand, we argue that cancer worry is an outcome of elaboration considering that elaborating on news related to cervical cancer and HPV vaccination may reinforce cancer worry. Prior research provides clues on such a relationship. For example, researchers found that those who were frequently exposed to news messages about cervical cancer were worried about having a cervical cancer diagnosis (Lemal & Van den Bulck, 2011). Likewise, Chae (2015) found that online cancer information seeking (a means of exposing oneself to cancer-related news and giving attention to it) can increase cancer worry. Following the CMM, we argue that those who have given attention to such news had elaborated on that news, which then predisposed them to develop cancer worry. Therefore, the following hypotheses were posited:

H5: Elaboration is positively associated with cancer worry.

H6: Cancer worry is positively associated with risk perception.

H7: Cancer worry is positively associated with intention to uptake HPV vaccination.

Overall, we present our proposed extended CMM model based on the abovementioned hypotheses (Figure 1).

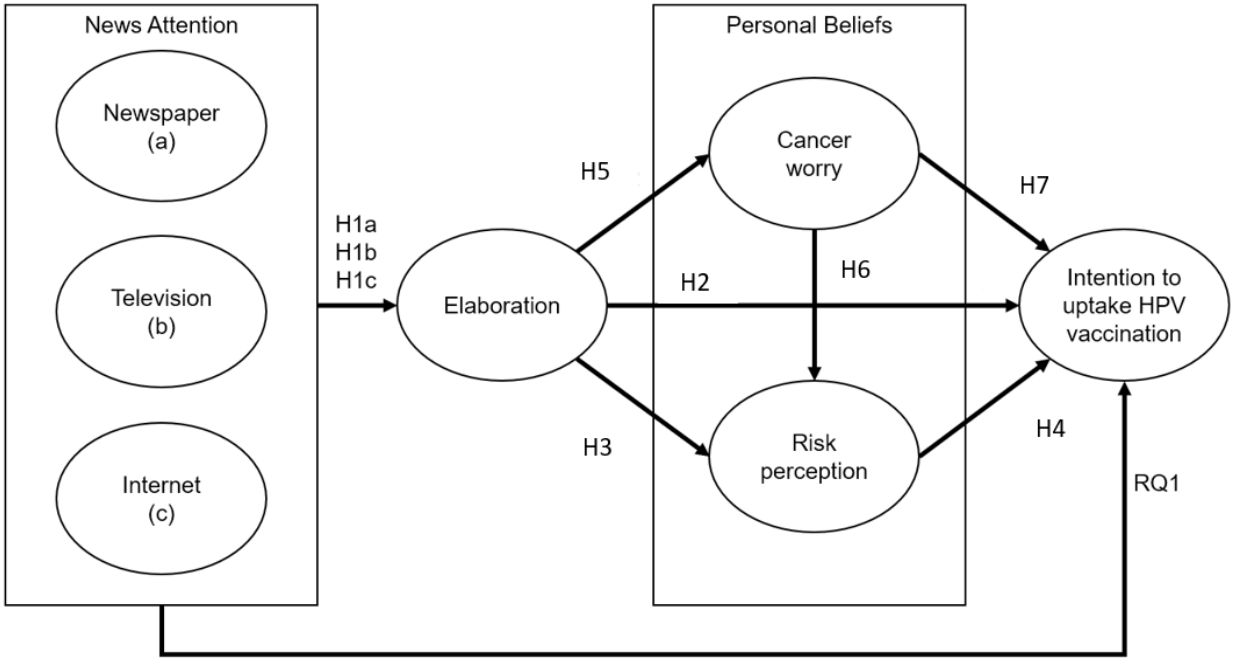

Figure 1. Proposed extended cognitive mediation model.

Method

Data Collection Procedure

A self-administered pen-and-paper survey was conducted in May 2018 among female university students enrolled in five universities located in Kunming, a medium-sized city in southwest China. Although men and women are eligible to take HPV vaccination, this study selected only female university students as target participants because media coverage of HPV vaccination in China at that time encouraged women to have it to prevent cervical cancer (Li et al., 2018; Xiao & Su, 2020). For instance, a recent study by Xiao and Su (2020) analyzed online Chinese news content related to HPV vaccine and found that over 80% of the headlines were female-centered and only 26.3% of the articles mentioned that males were also eligible for HPV vaccination. Considering the central purpose of the current study is to unravel the process by which news attention on newspaper, television, and the Internet relate to intention to uptake HPV vaccination through potential mediators, female university students were selected as target participants. Since this is a pilot study for a project on this topic, we used convenience and purposive sampling methods to recruit respondents. Specifically, the questionnaire was distributed in the libraries of Yunnan University, Kunming University of Science and Technology, Yunnan Normal University, and Yunnan Minzu University. During recruitment, potential respondents were informed of the study details.

Considering that HPV vaccination is recommended for women aged 25 and below in China (Li et al., 2018), only female students aged 18–25 who were familiar with HPV vaccine were invited to answer the

survey. We limited the survey only to those familiar with HPV vaccine since such familiarity is substantial when understanding the processing of HPV-related information into a health-related behavior, such as vaccination (i.e., those who do not know what an HPV vaccine is would not be able to accurately provide survey responses that reflect their information processing of HPV-related news). This was done through a screening questionnaire that asked about their familiarity with HPV vaccination (i.e., please tell me which number between 1 and 4 best represents how much you have heard, read, or seen about HPV vaccination? 1 = seldom; 4 = often.)

The Declaration of Helsinki was used as a basis for conducting ethical research on human subjects. Before starting the survey, all respondents provided written informed consent. They were also informed that their participation was voluntary and that they had the right and freedom to withdraw from the study at any time without prejudice. To protect the respondents' privacy, no personally identifiable information was collected. The questionnaire was initially prepared in English and later translated into Mandarin based on the World Health Organization's (n.d.) translation procedure (i.e., forward translation → back translation → pretesting → final version). It took around 10 minutes for the respondents to complete the survey.

Sample and Respondents' Profile

A total of 465 respondents took the survey. However, the final data set only includes data from 399 respondents who were 18–25 years old and those who responded other than seldom in the HPV familiarity question. In terms of respondents' demographic profiles, their average age is 21.40 years old (Mdn = 21, Min = 18, Max = 25, SD = 1.69) and most of them are undergraduate students (77.9%) enrolled in Yunnan Normal University (38.3%), Yunnan University (34.6%), Yunnan Minzu University (20.1%), and Kunming University of Science and Technology (7%).

Measurement

Intention to uptake HPV vaccination (M = 3.61, SD = .68, *McDonald's* ω = .89) was measured using three items adapted from Kim, Jang, and Kim (2014). These items are (a) "I intend to uptake HPV vaccination in the future," (b) "I will suggest that my family members uptake HPV vaccination," and (c) "I am very eager to uptake HPV vaccination." Respondents were asked to indicate their agreement on these items based on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

News attention on newspaper (M = 1.69, SD = .75, r = .67) was measured using two items. Respondents were asked to indicate how much attention they pay to the following on newspaper: (a) news stories related to cervical cancer and (b) news stories about HPV vaccination. Respondents were asked to indicate their attention on these items based on a 5-point Likert scale (1 = no attention at all, 5 = very close attention).

News attention on television (M = 2.06, SD = .82, r = .66) was measured using two items. Respondents were asked to indicate how much attention they pay to the following on television: (a) news stories related to cervical cancer and (b) news stories about HPV vaccination. Respondents were asked to

indicate their attention on these items based on a 5-point Likert scale (1 = no attention at all, 5 = very close attention).

News attention on the Internet (*M* = 2.91, *SD* = .93, *r* = .71) was measured using two items. Respondents were asked to indicate how much attention they pay to the following on the Internet: (a) news stories related to cervical cancer and (b) news stories about HPV vaccination. Respondents were asked to indicate their attention on these items based on a 5-point Likert scale (1 = no attention at all, 5 = very close attention).

Elaboration (*M* = 3.32, *SD* = .70, *McDonald's ω* = .76) was measured using three items from Lin et al. (2017). These items include (a) "When I am reading or watching the news, I carefully analyze the information given about HPV vaccination in the news," (b) "After I encounter news on HPV vaccination, I am likely to stop and think about it," and (c) "I often relate what I learned from the news on HPV vaccination to other things I know." Respondents were asked to indicate their agreement on these items based on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Cancer worry (*M* = 3.57, *SD* = .76, *McDonald's ω* = .74) was measured using three items adopted from Jensen et al. (2010). These items include (a) "I brood about the physical consequences of getting cancer," (b) "I feel anxiety when I think of the possible consequences of getting cancer," and (c) "I worry about my health because of my chances of getting cancer." Although HPV is known for causing cervical cancer, it also can cause cancers of the vulva, vagina, anus, and oropharynx (United States Centers for Disease Control and Prevention, 2016). Thus, the items are not specific to cervical cancer. Respondents were asked to indicate their agreement on these items based on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Risk perception (M = 2.61, *SD* = .73, *r* = .59) was measured using two items. These items include (a) "How likely do you think it is that you will develop cervical cancer in the future?" and (b) How likely do you think it is that you will develop cervical cancer, as compared with the average woman of your age?" Respondents were asked to indicate their agreement on these items based on a 5-point Likert scale (1 = very unlikely, 5 = very likely).

Data Analysis

IBM SPSS Statistics version 26 was used to generate descriptive data and Mplus 7 to perform SEM. SEM is a robust multivariate statistical method commonly used to test research models in communication and other social science studies (e.g., Bautista, Rosenthal, Lin, & Theng, 2018; Degarege et al., 2019). Parameters for a good model fit were based on Bentler (1990): χ^2/df = < 3, CFI = > .90, TLI = > .90, RMSEA < .06, SRMR < .08. Unstandardized direct and indirect effects based on 10,000 bootstrap samples are reported. Indirect effect results are deemed statistically significant if the 95% confidence intervals (95% CI) do not cross zero. Age (M = 21.40, SD = 1.69) and grade (1 = undergraduate year one, 9.8%; 2 = undergraduate year two, 24.3%; 3 = undergraduate year three, 21.3%; 4 = undergraduate year four, 24.8%; undergraduate year five, 1.3%, 6 = master's student, 18.5%) were controlled in the analysis. A bivariate correlation analysis was also performed before running SEM (see Table 1).

Table 1. Bivariate Correlation Analysis Results.

	1	2	3	4	5	6	7	8	9
1. Age	1.00								
2. Educational level	.84**	1.00							
3. Newspaper	.05	-.03	1.00						
4. Television	.10*	.05	.60**	1.00					
5. Internet	.12*	.19**	.33**	.44**	1.00				
6. Elaboration	-.01	-.01	.20**	.15**	.38**	1.00			
7. Cancer worry	-.02	-.03	.05	.02	.16**	.29**	1.00		
8. Risk perception	.01	-.01	.12*	.07	.15**	.14**	.19**	1.00	
9. Intention	.08	.13*	.12*	.08	.42**	.38**	.40**	.29**	1.00

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

Results

Model Fit Assessment

Figure 2 shows the SEM results. Overall, the model achieved a good model fit: χ^2 (130) = 304.29, X2/df = 2.34, CFI = .94, TLI = .92, RMSEA (90% CI) = .058 (.050–.066), SRMR = .050 (Bentler, 1990). This suggests that the resulting paths in the model can be used for hypothesis testing. Results show that five of the nine hypotheses were supported. Factors predicting elaboration, cancer worry, risk perception, and intention to uptake HPV vaccination accounted for 29%, 15%, 8%, and 44% of the variance, respectively.

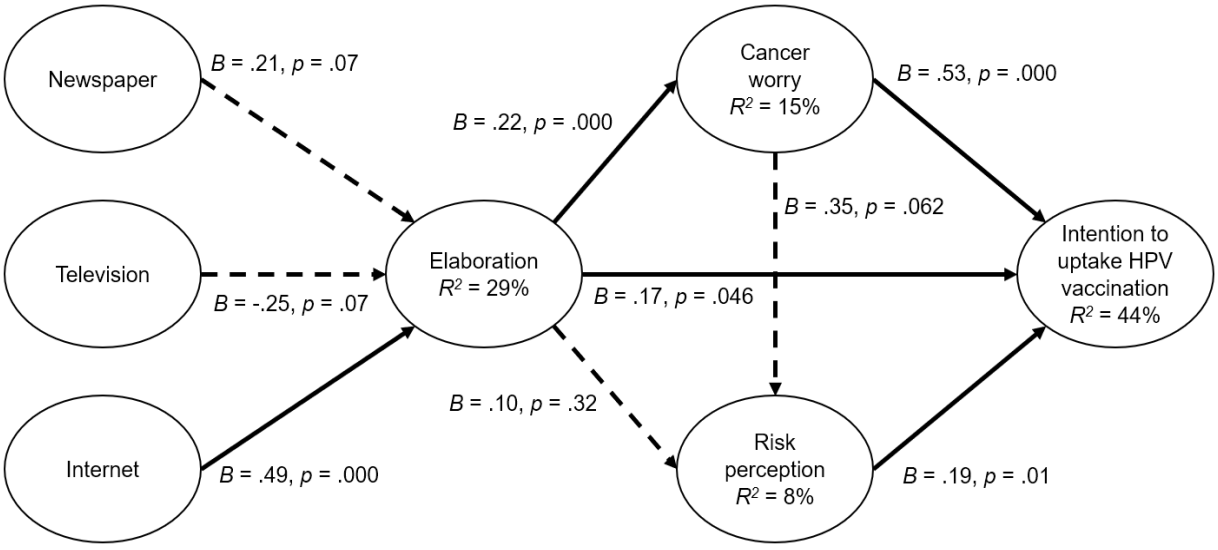

Figure 2. SEM results after controlling for age and grade.

Note. Unstandardized coefficients are based on 10,000 bootstrap samples. Dashed paths are nonsignificant. Model fit: $\chi^2(130) = 304.29$, $X^2/df = 2.34$, CFI = .94, TLI = .92, RMSEA (90% CI) = .058 (.050–.066), SRMR = .050.

Hypothesis Testing

Table 2 shows a summary of the hypothesis testing results. Results show that only news attention on the Internet was positively associated with elaboration (B = .49, p = .000) and not with news attention on newspaper (B = .21, p = .07) and television (B = −.25, p = .07). Thus, H1c was supported and H1a and H1b were rejected.

Table 2. Hypothesis Testing.

Hypothesis	Path	*B*	Decision
H1a	Newspaper → Elaboration	.21	Rejected
H1b	Television → Elaboration	−.25	Rejected
H1c	Internet → Elaboration	.49***	Supported
H2	Elaboration → Intention	.17*	Supported
H3	Elaboration → Risk perception	.10	Rejected
H4	Risk perception → Intention	.19*	Supported
H5	Elaboration → Cancer worry	.22***	Supported
H6	Cancer worry → Risk perception	.35	Rejected
H7	Cancer worry → Intention	.53***	Supported

Note. Unstandardized coefficients are reported. * p < .05, ** p < .01, *** p < .001.

Moreover, elaboration was positively associated with cancer worry (B = .22, p = .000) and intention to uptake HPV vaccination (B = .17, p = .046) but not with risk perception (B = .10, p = .32). Thus, H2 and H5 were supported and H3 was rejected.

Results also show that risk perception was associated with intention to uptake HPV. Thus, H4 was supported. Finally, cancer worry was positively associated with intention to uptake HPV vaccination but not with risk perception. Thus, H7 was supported and H6 was rejected.

Mediation Analysis

RQ1 asked if news attention on either newspaper, television, or the Internet has an indirect effect on intention to uptake HPV vaccination. Results of the mediation analysis revealed that only news attention on the Internet was indirectly associated with intention to uptake HPV vaccination through two mediators: elaboration and cancer worry (see Table 3). Although news attention on the Internet has a direct effect on intention to uptake HPV vaccination, there are two indirect paths by which elaboration and cancer worry mediated the relationship. First, news on the Internet is associated with intention to uptake HPV vaccination via simple mediation with elaboration (B = .32, 95% CI = .002–.167). Second, news on the Internet is associated with intention to uptake HPV vaccination via serial mediation with elaboration followed by cancer worry (B = .07, 95% CI = .019–.098).

Table 3. Significant Mediation Results.

Path	*B*	*SE*	95% CI
Direct: Internet → Intention	.32	.09	.172–.468
Indirect: Internet → Elaboration → Intention	.10	.05	.002–.167
Indirect: Internet → Elaboration → Cancer worry → Intention	.07	.02	.019–.098

Note. Unstandardized coefficients are reported.

Modified Model

Aside from testing the initial model to validate the hypotheses, this study explored a modified model wherein nonsignificant paths were removed, and new paths were added based on Mplus 7's modification indices. Figure 3 shows the results of the modified model.

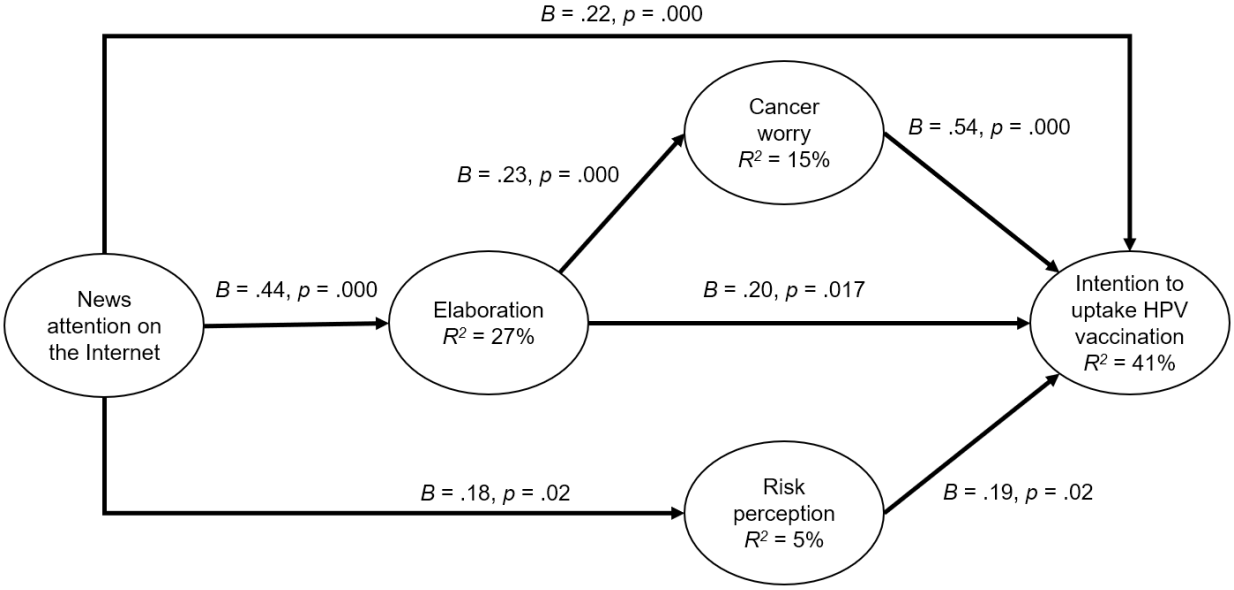

Figure 3. Modified model.

Notes. Unstandardized coefficients are based on 10,000 bootstrap samples. Model fit: $\chi^2(76) = 161.59$, $X^2/df = 2.13$, CFI = .96, TLI = .95, RMSEA (90% CI) = .053 (.042–.064), SRMR = .057.

Table 4 compares the model fit parameters between the initial and modified models. Although both models have similar model fit based on traditional parameters (e.g., CFI, TLI, and RMSEA), results suggest that the modified model is better because its Akaike information criterion (AIC) and Bayesian information criterion (BIC) values are lower than the initial model (Vrieze, 2012). Though the significant direct paths from the initial model were still significant, it is interesting to note that new significant direct paths in the modified model include the positive association between news attention on the Internet with risk perception (B = .18; p = .02) and intention to uptake HPV vaccination (B = .22; p = .000).

Table 4. Model Fit Comparison.

Model	AIC	BIC	X^2/df	CFI	TLI	RMSEA (90% CI)	SRMR
Initial	14,481.45	14,776.64	2.34	.94	.92	.058 (.050–.066)	.050
Modified	11,152.14	11,367.54	2.13	.96	.95	.053 (.042–.064)	.057

Mediation analysis for the modified model (see Table 5) shows that risk perception (aside from elaboration and cancer worry based on the initial model) is now a significant mediator by mediating the association between news attention on the Internet and intention to uptake HPV vaccination (*B* = .03; 95% CI = .003–.064).

Table 5. Significant Mediation Results for Modified Model.

Path	*B*	*SE*	95% CI
Direct: Internet → Intention	.22	.06	.102–.343
Indirect: Internet → Elaboration → Intention	.09	.04	.014–.160
Indirect: Internet → Risk perception → Intention	.03	.02	.003–.064
Indirect: Internet → Elaboration → Cancer worry → Intention	.07	.02	.018–.088

Note. Unstandardized coefficients are reported.

Discussion

This study extends the CMM (Eveland, 2001) by examining whether mediators, such as cancer worry and risk perception, serve as outcomes of elaboration and predictors of intention to uptake HPV vaccination among young Chinese women. It also examines whether news attention on newspaper, television, and the Internet are indirectly associated with intention to uptake HPV vaccination through these mediators. The key findings of the study are discussed below.

First, the results show that only news attention on the Internet had a positive association with elaboration. This suggests that the more attention that was given to these news sources on the Internet, the more likely that young Chinese women engaged in the elaboration of HPV vaccine-related news. A potential explanation of this result is that those who were attentive to news about cervical cancer and HPV vaccination on the Internet must deal with greater amounts of misinformation as compared with news from traditional media. Previous studies indicate that the Internet is home to a host of news websites that often discredit vaccines (Arif et al., 2018; Waszak, Kasprzycka-Waszak, & Kubanek, 2018). As such, it might have been pertinent to engage in a great amount of elaboration to weed out misinformation related to HPV vaccination. Based on this result, Chinese health agencies should disseminate more up-to-date HPV vaccine-related information on the Internet to reduce the impact of misinformation on HPV vaccination.

Second, we found that elaboration is associated only with cancer worry and not with risk perception. Consistent with similar research (e.g., Chae, 2015; Lemal & Van den Bulck, 2011), the results suggest that the higher the elaboration, the higher the likelihood that young Chinese women experienced cancer worry. The nonsignificant result for risk perception is also plausible since the elaboration of HPV vaccine-related news may incite cancer worry but not necessarily risk perception. A potential explanation is that young Chinese women may feel worried about having cervical cancer, but they may not have a heightened risk

perception of it because elaboration on news related to cervical cancer and HPV vaccines would suggest that it is a highly preventable disease, especially when one goes for HPV vaccination (Zhu et al., 2014). This is particularly reasonable as recent news shows that the Chinese government has approved its first domestically produced HPV vaccine (Xinhua, 2020). Based on the findings, it might be pertinent for Chinese health agencies to recognize that while disseminating news on cancer can invoke feelings of worry, it is crucial to emphasize that cervical cancer is a highly preventable disease through routine screening and HPV vaccination (Huang et al., 2016; Zhu et al., 2014).

Third, we found that risk perception and cancer worry were positively associated with intention to uptake HPV vaccination. The results suggest that young Chinese women with greater risk perception and cancer worry were more likely to have intentions to uptake HPV vaccination. The significant association between risk perception and intention to uptake HPV vaccination is consistent with most existing health behavior models, such as the health belief model (Janz & Becker, 1984) and research (e.g., Katapodi et al., 2004; Lin et al., 2017) that argue that the more an individual believes he or she is at risk, the greater the likelihood that the person will intend to take preventive measures. The association between cancer worry and intention to uptake HPV vaccination is in line with empirical work in the United States about the positive association between cancer worry and HPV vaccination intention (Krakow et al., 2015). These results suggest that, if Chinese health agencies attempt to encourage the public, particularly women, to uptake HPV vaccination, their campaigns could emphasize on heightening their risk perception and worry about developing cancer.

Finally, we find partial support for our extended CMM since the results suggest that only news attention on the Internet was indirectly associated with intention to uptake HPV vaccination via elaboration, risk perception, and cancer worry. Notably, the results show three possible pathways by which these variables are mediated: two short pathways (i.e., simple mediation) and one long pathway (i.e., serial mediation). The first short pathway reflects the expected findings when using the CMM wherein news attention on the Internet was positively associated with intention to uptake HPV via elaboration (as demonstrated in the initial and modified model). This finding is consistent with studies that show that elaboration is positively associated with intention to uptake HPV vaccination (Ho et al., 2013; Nenkov, Inman, Hulland, & Morrin, 2009). Nonetheless, the study contributes to the theory by showing that the extended CMM is possible. This is exemplified by the second short pathway in the modified model (i.e., a simple mediation where news attention on the Internet was positively associated with intention to uptake HPV through risk perception) and a long pathway in both initial and modified models (i.e., a serial mediation where news attention on the Internet was positively associated with intention to uptake HPV through elaboration and cancer worry). Such pathways explain the role of elaboration, cancer worry, and risk perception in studies that show the link between news attention and intention to take vaccination (Chae, 2015; Krakow et al., 2015; Lemal & Van den Bulck, 2011).

Conclusion

We acknowledge several limitations of this study. First, the cross-sectional data collected in this study do not imply causation. Subsequent studies could use longitudinal designs to validate the results of this study and to integrate an objective measure of HPV vaccination (i.e., uptake of HPV vaccine in time 2).

Second, the sample included only female university students aged 18–25 years to represent young Chinese women. As such, the results may not represent women of various ages and background that can benefit from HPV vaccination. In the future, scholars can emphasize the generalizability of the findings by including more heterogenous respondents (e.g., educational level and urban or rural setting). Third, data were collected only from women who had heard of the HPV vaccine. We are unsure if the factors identified in the current study can be relevant for those who have not heard of HPV vaccination at the time of data collection. Thus, conclusions about this study should be taken with caution. Finally, the study may not have captured most factors to predict intention to uptake HPV vaccination. For instance, our conceptualization of risk perception accounted only for the dimension of perceived susceptibility. Following Eveland's (2001) recommendation of adding variables that can improve the CMM, we will add other variables (e.g., factual and structural knowledge; Lee et al., 2016), add other news sources (e.g., magazines, podcasts, and television), and expand the conceptualization and operationalization of cancer worry (e.g., using the two factor model of dispositional cancer worry; Jensen et al., 2015) and risk perception (e.g., by adding perceived severity) in subsequent studies.

Despite the limitations, this study has several implications for theory and practice. First, this study contributes to a growing number of studies that identify factors associated with intention to uptake HPV vaccination among young Chinese women. The findings provide important knowledge that can be used to persuade them to receive HPV vaccine. Second, this study contributes an extended CMM that explains Chinese women's intention to uptake HPV vaccination. The original model postulated elaboration only as a mediator of media attention and behavioral intention. However, this study's model shows that media attention on the Internet is associated with intention to uptake HPV vaccination via serial mediation with elaboration followed by cancer worry. Therefore, it is important that future studies employing the CMM take cancer worry into consideration to understand the public's intention to take preventive measures toward cancer in other geographical contexts. Third, this study shows that news messages via different media platforms influence individuals' elaborative processing process differently. Thus, instead of treating media attention as an aggregated composite variable in CMM, media attention should be decomposed into three distinct latent factors (i.e., news attention on newspaper, news attention on television, and news attention on the Internet). In a practical sense, the extended CMM that was tested in this study can be used by Chinese health agencies and public health professionals as a framework when developing information dissemination strategies to improve HPV vaccination uptake. For instance, Chinese health agencies need to be aware that the influence of media news on an individual's HPV vaccine intention is mediated by elaboration and cancer worry. Thus, it is crucial to disseminate cancer-related news that can invoke elaboration and worry in HPV vaccination campaigns.

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