How Risk Perception Impacts Cervical Cancer Knowledge Acquisition in China: From an Adapted Cognitive Mediation Model Perspective

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Abstract. As a result of the relatively late implementation of HPV vaccination in China, many young Chinese women have weak awareness and limited knowledge about cervical cancer. This study developed an adapted cognitive mediation model with risk perception as a key factor that prompts serial mediation effects and ultimately influences cervical cancer knowledge acquisition. An online survey was conducted among 1066 Chinese women aged 15-35. The results were analyzed for three age groups, which mostly supported the hypothesized model. Risk perception was positively correlated with elaboration and cervical cancer knowledge acquisition, but only with attention to cervical cancer-related information among participants aged 20-35. Attention to cervical cancer-related information was positively associated with elaboration while having no significant correlation with knowledge acquisition. Elaboration was positively associated with knowledge acquisition. Indirect effects between risk perception and knowledge acquisition through elaboration were found. The impact of risk perception on knowledge acquisition was also sequentially mediated by attention and elaboration among participants aged 28-35. The results indicate a general tendency that an individual's level of risk perception, attention to cervical cancer-related information, elaborative processing of information, and the amount of knowledge gained increase with age. Adolescents aged 15-19 particularly lack risk perception and attention to health information. The implications of the results are discussed in detail based on previous studies. Research limitations and future directions are also suggested.

Keywords: Risk perception; cervical cancer; knowledge acquisition; health communication; social media.

1. Introduction

There are about 110 thousands of cervical cancer new cases in China every year, which makes cervical cancer the second most prevalent gynecological cancer in China [1]. A sexually transmitted infection named the 'human papillomavirus (HPV)' primarily causes cervical cancer [2]. It can be effectively prevented by HPV vaccination. However, China implemented the vaccination relatively late compared to other countries. It was not until August 30, 2022 that the Merck HPV 9-valent vaccine was available to be injected by 9-45 years-old Chinese women [3]. Research indicates that less than 30% of women in China know about HPV [4]. Thus, cervical cancer knowledge and awareness are still very weak among young Chinese women.

Previous studies found that individuals can be driven to generate attention to cancer news and hence gain relevant knowledge [5,6]. Specifically, risk perception plays an important role in motivating people to find information about cancer [7]. Nevertheless, research on how risk perception influences cervical cancer knowledge acquisition through serial mediation effects remains limited, particularly in China. Therefore, this study aims to explore knowledge acquisition of cervical cancer by applying the cognitive mediation model (CMM) and conducting a survey among young Chinese women aged 15-35. The study focuses on examining the impact of risk perception on cervical cancer knowledge acquisition mediated by attention and elaboration, a series of information-processing

activities. Research results of this study should provide directions on how medical, educational, and media sectors could improve health communication of cervical cancer to optimize the early prevention and timely treatment of the disease.

2. Literature Review

2.1. The Cognitive Mediation Model

The CMM was conceptualized by Eveland and explains people's knowledge acquisition from news content [8]. The model investigates how individuals pay attention to news information due to certain motivations. News attention will then generate the elaborative processing of information that ultimately alters knowledge acquisition. Although the CMM originated from research examining individuals' knowledge gained from political news, contemporary studies have adopted and extended the model into health contexts related to cancer news and knowledge [5-7]. For instance, Lee et al. adopted the framework to examine knowledge acquisition from breast cancer-related media information by adding risk perception and structural knowledge as additional dimensions [9]. Based on empirical research in the health communication field, we can explore how risk perception impacts the way people acquire cervical cancer knowledge with the theoretical framework of CMM.

2.2. Risk Perception

Risk perception is at the center of many significant information-seeking and health-related models [7]. It represents individuals' perceived probability of developing disease [10]. Research shows that people who are less knowledgeable about a disease perceive their risk of developing the disease to be lower [11]. Previous studies have integrated risk perception into the extension of the CMM [7,9]. However, few studies explored the direct impact of risk perception on cervical cancer knowledge acquisition. Thus, the research question is developed:

RQ1: Is risk perception positively related to cervical cancer knowledge acquisition?

2.3. News Attention and Elaboration

News attention and elaboration, as information-processing activities, often function mediators for the relationship between surveillance motivation and knowledge acquisition [8]. The original CMM states that surveillance motivation will facilitate individuals to process information through greater attention, which elevates levels of elaborative processing and, in turn, better knowledge acquisition [8]. Specifically, elaboration involves people's cognitive activities to connect beliefs, personal experiences, and past knowledge with new information [12]. Many studies have specified the mediation role of elaboration and news attention in the CMM [5,6]. In the context of adopting risk perception into the CMM, prominent research has identified a positive correlation between risk perception and news attention [9]. Li and Bautista also establish a positive correlation between elaboration and risk perception [13]. Thus, as shown in Figure 1, the following hypotheses are advanced:

H1: Risk perception and attention to cervical cancer-related information are positively associated.

H2: Risk perception and elaboration are positively correlated.

H3: Attention to cervical cancer-related information and cervical cancer knowledge acquisition are positively related.

H4: Attention to cervical cancer-related information and elaboration are positively associated.

H5: Elaboration is positively associated with cervical cancer knowledge acquisition.

H6: Attention to cervical cancer-related information mediates risk perception's impact on cervical cancer knowledge acquisition.

H7: Elaboration mediates risk perception's impact on cervical cancer knowledge acquisition.

H8: Risk perception indirectly impacts cervical cancer knowledge acquisition through multiple mediators (attention, elaboration).

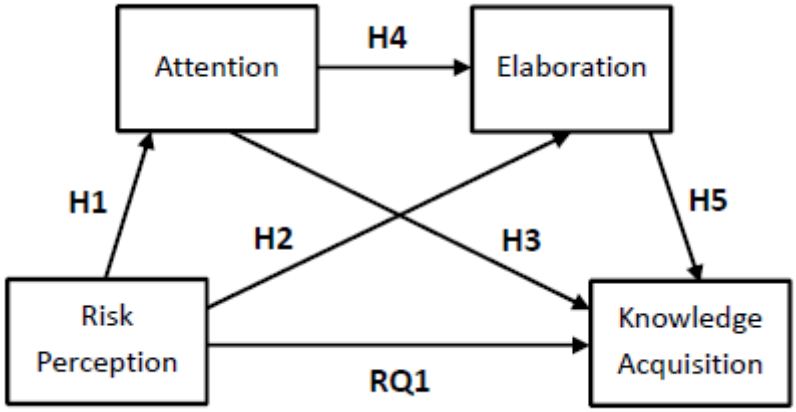

Fig. 1 Hypothetical model

3. Methodology

3.1. Research Procedure & Sample Collection

An online survey designed in Mandarin was conducted in high schools, universities, and company workplaces in China. The study recruited participants using convenience and snowball sampling methods. Before starting the survey, voluntary participation was indicated by all participants. Participants were also informed of the rights of free withdrawal, anonymity, and data confidentiality. A total of 1066 Chinese women aged 15-35 took the online survey. However, the final dataset for analysis consists of only 653 respondents who completed the questionnaire within about 2-6 minutes. Respondents' age range covers women who are relatively young or at a high risk of developing cervical cancer. They are also appropriate for marriage and HPV 9-valent vaccination in China. Most respondents are aged 20-35 (74%). 92.9% of respondents normally gain information from the internet, news, and social media.

3.2. Measures

The age of the participants was controlled by dividing them into three segments. The first segment included teenage girls aged 15-19, which covered 26% of all participants. Chinese adolescents in this age group are likely to have their first sexual behaviour and be exposed to a high risk of developing cervical cancer [14,15]. The second segment consisted of participants aged 20-27 (39%). This segment covered the legal age of marriage for women in China and the average age of Chinese females' first marriage [16]. Women aged 30-35 are more likely to develop the in-situ carcinoma of cervical cancer [17]. Hence, the third age group comprised participants aged 28-35 (35%).

3.3. Research Variables

3.3.1 Risk perception

Four statements from previous research were adopted to examine participants' perceived probability of developing cervical cancer [18, 19]. A 7-point Likert scale was used for answering questions (1 = strongly disagree, 7 = strongly agree) such as "I think I have a higher possibility of developing cervical cancer compared to the average person my age and gender", "I think I am likely to develop cervical cancer in my lifetime", "I think cervical cancer is a very serious disease for women", and "I know well the severe consequences of developing cervical cancer" (e.g., seriously affect my life and family; α = .53, M = 4.33, SD = 0.90).

3.3.2 News attention

To measure news attention, participants were first asked to indicate whether or not they pay attention to cervical cancer-related information on the internet and social media. How much attention

they paid to cervical cancer-related information on the internet and social media was also indicated on a 7-point scale with 1 refers to "never pay attention", 7 refers to "very close attention" (M = 2.9, SD = 0.58) [20, 21].

3.3.3 Elaboration

Based on items adopted from Lee et al. and Ho et al., elaboration was measured through participants' responses on a 7-point Likert scale with 1 represents "strongly disagree" and 7 represents "strongly agree" for three statements: (1) "After I encounter information related to cervical cancer, I am likely to stop and think about it," (2) "When reading or watching media content, I carefully analyze the information given about cervical cancer," (3) "I often relate what I learnt from the media content about cervical cancer to other things I know" (e.g., personal health, causes of disease, and HPV vaccination; α = .86, M = 5.01, SD = 1.10) [9, 22].

3.3.4 Knowledge acquisition

Knowledge-related items were examined based on previous research and the China Anti-cancer Association [9, 23, 24]. Participants were asked to indicate their levels of agreement with 1 stands for "strongly disagree" and 7 stands for "strongly agree" on the following statements: (1) "The risk of cervical cancer increases with age," (2) "Women who are married or have had sex for 3 years have a higher risk of developing cervical cancer," (3) "Cervical cancer is inherited," (4) "Women with cancer in the uterus have a greater chance of developing new cancers in the same part or other parts of the uterus," (5) "Cervical cancer screening only includes HPV (human papillomavirus) screening," (6) "The highest incidence of cervical cancer is over 35 years of age, so women from age 35 onwards are encouraged to go for annual cervical cancer screening". The answers were coded as 0 = false (from 1 = strongly disagree to 4 = Neither agree nor disagree) and 1 = true (from 5 = somewhat agree to 7 = strongly agree; α = .62, M = 0.52, SD = 0.24).

3.4. Data Analysis

PROCESS in the SPSS program was used to analyze the data [25]. It provides an analysis of the direct and indirect effects of mediation. Specifically, the analysis adopted Model 6 (Serial mediation model) to examine the mediators' (attention and elaboration) effects on the correlation between risk perception and knowledge acquisition. Structural equation modeling (SEM) analysis and bootstrapping methods were conducted to test the hypothesized model. According to the PROCESS procedures provided by Hayes, knowledge acquisition was entered in Block 1; risk perception was entered in Block 2; mediators (attention and elaboration) were entered in Block 3 [25]. The analysis used 5000 bootstrapped samples and 95% of confidence intervals.

4. Results

Figure 2 demonstrates the tested model that underpins the research question and hypotheses. As shown in Table 1, the results suggest that risk perception and cervical cancer knowledge acquisition are positively correlated for all age groups (15-19 years: $R = .06$, $R^2 = .17$, $p < .01$; 20-27 years: $R = .08$, $R^2 = .17$, $p < .001$; 28-35 years: $R = .05$, $R^2 = .12$, $p < .01$). Thus, RQ1 was answered. Evidence was found in 20-27 years ($R = .08$, $R^2 = .02$, $p < .05$) and 28-35 years ($R = .15$, $R^2 = .04$, $p < .05$) age groups to support H1. However, risk perception and attention have nonsignificant correlation for the age group of 15-19 years ($R = .05$, $R^2 = .008$, $p = .26$). Hence, H1 was partially supported. The results of all age groups supported H2 that risk perception is positively associated with elaboration. Nevertheless, no evidence was found in any age groups to support H3 as there is no significant correlation between attention and cervical cancer knowledge acquisition. In contrast, we found relatively strong positive correlations between attention and elaboration for all age groups, which supported H4 (15-19 years: $R = 1.02$, $R^2 = .28$, $p < .001$; 20-27 years: $R = 1.04$, $R^2 = .38$, $p < .001$; 28-35 years: $R = 1.16$, $R^2 = .46$, $p < .001$). Similarly, elaboration is also positively associated with cervical cancer knowledge acquisition for all age groups, which supported H5. The age group of 28-

35 years had the most significant positive correlation compared to other age groups (R = .07, R^2 = .12, p <.001).

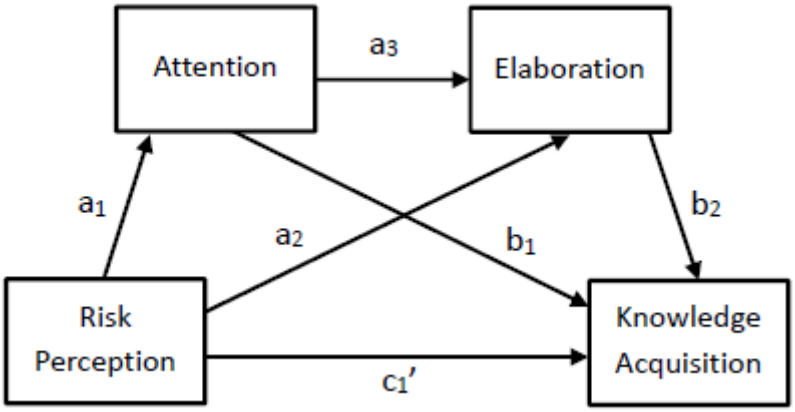

Fig. 2 The tested model

Table 1. Correlations between variables for different age groups

Variables (age group: 15-19)	R	R^2
Risk perception ✕ Attention	.05	.008
Risk perception ✕ Elaboration	.23**	.28
Attention ✕ Elaboration	1.02***	.28
Risk perception ✕ Knowledge acquisition	.06**	.17
Attention ✕ Knowledge acquisition	.05	.17
Elaboration ✕ Knowledge acquisition	.05*	.17
Variables (age group: 20-27)		
Risk perception ✕ Attention	.08*	.02
Risk perception ✕ Elaboration	.18**	.38
Attention ✕ Elaboration	1.04***	.38
Risk perception ✕ Knowledge acquisition	.08***	.17
Attention ✕ Knowledge acquisition	.02	.17
Elaboration ✕ Knowledge acquisition	.04*	.17
Variables (age group: 28-35)		
Risk perception ✕ Attention	.15*	.04
Risk perception ✕ Elaboration	.21***	.46
Attention ✕ Elaboration	1.16***	.46
Risk perception ✕ Knowledge acquisition	.05**	.12
Attention ✕ Knowledge acquisition	-.03	.12
Elaboration ✕ Knowledge acquisition	.07***	.12

Note: Non-standardized coefficients are reported, *p < .05, **p < .01, ***p < .001.

Table 2 reveals the mediation effects of the tested model for different age groups. Risk perception has no indirect effect on knowledge acquisition through attention for all age groups. Hence, H6 was not supported. However, evidence was found in all age groups to support the mediation effect of elaboration between risk perception and knowledge acquisition (15-19 years: B = .01, SE = .006; 20-27 years: B = .01, SE = .005; 28-35 years: B = .01, SE = .006). This supported H7. The results also indicate that there is no indirect effect of risk perception on knowledge acquisition through attention and elaboration in age groups of 15-19 years (B = .00, SE = .002) and 20-27 years (B = .00, SE = .003). In contrast, the results of the 28-35 years age group show an indirect effect caused by multiple mediators (attention and elaboration; B = .01, SE = .004). Therefore, H8 was partially supported.

Table 2. Mediation effects of the tested model for different age groups

Path Effects (age group: 15-19)	B	SE	LLCI	ULCI
Risk perception -> attention -> knowledge acquisition	.00	.003	-.003	.01
Risk perception -> elaboration -> knowledge acquisition	.01	.006	.001	.02
Risk perception -> attention -> elaboration -> knowledge acquisition	.00	.002	-.002	.01
Path Effects (age group: 20-27)				
Risk perception -> attention -> knowledge acquisition	.00	.003	-.005	.01
Risk perception -> elaboration -> knowledge acquisition	.01	.005	-.001	.02
Risk perception -> attention -> elaboration -> knowledge acquisition	.00	.003	-.001	.01
Path Effects (age group: 28-35)				
Risk perception -> attention -> knowledge acquisition	-.00	.005	-.02	.005
Risk perception -> elaboration -> knowledge acquisition	.01	.006	.004	.03
Risk perception -> attention -> elaboration -> knowledge acquisition	.01	.004	.004	.02

5. Discussion

This study proposes a serial mediation model by integrating CMM with risk perception and analyzing the results of different age groups divided from 15-35 years-old Chinese women. Research results provide support for most hypotheses and indicate a general tendency that the older Chinese women are, the more likely they are to have risk perceptions, pay attention to cervical cancer-related media information, and gain knowledge from these contents. Previous study found that risk perception may increase as females become more mature because of greater exposure to health problems, increasing awareness of health warnings, a higher sense of health responsibility, and being less optimistic about avoiding harm [26]. Moreover, Chinese women have paid greater attention to gynecological diseases in recent years because women aged 26-45 are in the stage of a rapid increase in reproductive system anomalies [27]. Hence, those with greater ages are more likely to have risk perceptions that drive them to pay attention to cervical cancer-related media information, and in turn, gain relevant knowledge through elaborative processing of the information.

To discuss some notable findings for the age group of 15-19 years, H1 was not supported due to the nonsignificant correlation between risk perception and attention. This may be because adolescents tend to underestimate their chances of experiencing health problems or perceive themselves as being immune or invulnerable to the risks [28]. Such perception bias leads to lower risk perceptions of teenage girls, which consequentially reduces their attention to cervical cancer-related information and knowledge acquisition. This also explains why the results did not support H3, H6, and H8. However, the results for H4 and H5 indicate that adolescents who pay attention to cervical cancer-related information will gain knowledge through elaborative activities. This is consistent with the original CMM and relevant studies in the health communication field [8, 9, 22]. We also found support for H2 and H7 that elaboration has a positive mediation effect between risk perception and knowledge acquisition. This points out that attention may not be a precondition for knowledge acquisition through elaboration. The previous study proposed that individuals with cancer risk perceptions will actively seek related information and conduct greater cognitive-processing activities (i.e. elaboration), and consequentially, acquire more knowledge [7]. Thus, information-seeking may be another factor that mediates the effect between risk perception and elaboration. This also points out why the results answered RQ1 with a positive correlation between risk perception and knowledge acquisition. A possible explanation could be that other factors (e.g. information-seeking) were mediating the influence of risk perception on knowledge acquisition.

The results for the age groups of 20-27 years and 28-35 years were similar. First, we found evidence to support H1, H4, and H5 for both age groups. This means that risk perception can

positively give rise to greater attention and hence facilitate better knowledge acquisition through a higher level of cognitive activity (i.e. elaboration). This is also consistent with previous findings that risk perception may motivate people to actively find and pay attention to relevant information due to the desire of reducing uncertainty [9]. As previously discussed, women of older ages will perceive higher health risks. Therefore, different from adolescents, adult women tend to have more attention to cervical cancer-related information driven by risk perceptions. However, similar to the results for H3 and H6 in the age group of 15-19 years, attention alone cannot mediate the effect between risk perception and knowledge acquisition as it has no significant correlation with knowledge gain. Considering that people have different educational backgrounds and will receive information actively or passively, different levels of information-processing activities may affect the amount of knowledge extracted from the information. Nevertheless, evidence was found to support H2 and H7. Together with previously mentioned results, this demonstrates that elaboration can positively mediate the impact of risk perception on knowledge acquisition across women aged 15-35. Notably, the results were more significant in the 28-35 age group than in other age groups. This agrees with the overall tendency and may also be caused by the greater abilities of mature women to conduct complex information-processing activities and extract more knowledge. Finally, as for the age group of 15-19 years, the results of the other two age groups for RQ1 also presented a positive correlation between risk perception and elaboration.

Based on the findings that risk perception can positively facilitate attention, elaboration, and knowledge acquisition, the medical and media sectors should generate more high-quality cervical cancer information to stimulate individuals' risk perceptions. Considering individuals' various educational backgrounds and different levels of abilities to conduct information-processing activities, professional information about cervical cancer should be practically delivered in plain language that is easy to understand by the general public for the purpose of encouraging more cognitive activities such as elaboration. In particular, as teenagers aged 15-19 are less likely to perceive health risks and pay attention to health-related content while still having a high risk of developing cervical cancer due to their first sexual behavior, educational institutions should put extra effort into promoting cervical cancer information, enhancing proper sex education, and combating risk perception bias.

6. Conclusion

The study aims to explore how individuals can be motivated to acquire cervical cancer knowledge through cognitive information-processing activities. A proposed serial mediation model based on CMM demonstrates that risk perception is a vital factor in causing a series of information-processing activities (attention, elaboration) and consequentially increasing individuals' knowledge about cervical cancer. In this way, we contribute to the exploration of the CMM framework integrated with risk perception in the contexts of cervical cancer and young Chinese women. By comparing and contrasting the results of several age groups, this study suggests a general trend that women with older age tend to have stronger risk perceptions, pay more attention to cervical cancer-related information, engage in elaborative processing of information, and gain a greater amount of cervical cancer knowledge. The implication of our results also highlights the need for relevant government and social sectors to effectively communicate high-quality cervical cancer media information to the public, especially for adolescents. However, some research limitations should be considered as well. First, the convenience and snowball sampling methods used in the research lacked sample representativeness. This might affect the research validity to some extent. Second, the survey questions designed in Mandarin could be improved to facilitate participants' better understanding. Third, other mediated factors might exist between certain variable correlations, which were not included in this study. Therefore, future studies could investigate more potential mediated variables and conduct the survey using probability sampling methods to improve the significance of the results.

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