



# The Influential Factors of Information Exposure and Trust on HPV Vaccination Intention of Female College Students

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**Abstract.** Human papillomavirus vaccine has a certain effect on the prevention of cervical cancer. Female college students, as the appropriate age group for the vaccination, not only pay attention to their health but also have a certain ability to contact information. Taking this group as the research object makes the research have strong pertinency. Understanding the informational elements, psychological factors, and the interactions between them that affect HPV vaccination intentions is crucial for increasing vaccine coverage in this group. This study used a pathway analysis to investigate, using the health belief model, the impacts of exposure to information sources and trust on health beliefs and intention to immunize Chinese students against HPV. Survey results from 456 Chinese college-aged women were used to compile the data. The results demonstrated that formal and informal information sources had a higher influence on vaccination knowledge and desire to use vaccines. The two variables that demonstrate the evaluation of vaccination behavior, perceived susceptibility and perceived benefit, performed substantial mediation roles in this process. This type of mediation effect test may assist female college students give a new theoretical foundation for the strategy for promoting and mobilizing local HPV vaccination in China. It can also enhance the research of the HPV vaccine dispersion model and health transmission impact.

**Keywords:** HPV, vaccination intention, information source exposure, information source trust, HBM.

## 1 Introduction

Cancer of the cervix is the fourth most common type of gynecological cancer, with over 95% caused by sexually transmitted HPV (human papillomavirus) [1]. And China, after India, has the second-highest incidence of cervical cancer worldwide, yet its rate of HPV immunization is still low [2].

One of the reasons is the HPV vaccine was not available on the mainland until 2016, nearly a decade later than in the United States and Europe. According to a 2015 article

on Vaccine, delays between 2006 and 2012 May have caused 59 million girls in the country to miss out. And assuming that this group of girls also did not receive interventions such as screening in the future, there would be more new cases and deaths from cervical cancer [3]. As such, it is very important to popularize the HPV vaccine as early as possible.

For the study of HPV vaccine information transmission and diffusion, foreign journals are relatively abundant, and the perspective focuses on exploring the influencing factors and influencing mechanisms of HPV vaccine vaccination. The main theoretical model employed, Knowledge Attitude Practice (KAP), Health Belief Model (HBM), Theory of Planned Behavior (TPB), etc., demonstrates that attitude has a significant influence on health behaviors. However, most of these studies have investigated the effect of attitude on behavioral intention, but have not paid much attention to how information exposure affects attitude and how it influences behavioral intention of influencing attitude.

Comparatively speaking, domestic research on the HPV vaccine mainly focus on the medical field, whereas there is hardly any study on the variables affecting vaccination intention [4]. At the same time, foreign studies on the health transmission of HPV also lack a comparison of different political, economic, cultural, social, and other backgrounds.

Therefore, this paper corrected for the relevant variables. Based on continuing to use the HBM model, we add information sources as variables to try to understand how formal and informal information sources affect Chinese female college students' health beliefs about the HPV virus and to change the intention of HPV vaccination in their homes in an effort to broaden the sample of this population in China while evaluating the theory's application. In this process, the study will also include the mechanism of information source trust in the analysis category and analyze the mediating role of health beliefs between exposure to social media information sources and vaccination intention. To a certain extent, it may deepen the research on the influence of information source exposure on health behavior and enrich the theoretical system of health behavior research.

## **2 Literature Review**

### **2.1 The Health Belief Model**

In the 1950s, American social psychologists proposed the Health Belief Model (HBM) to explain people's attitudes and behaviors toward tuberculosis examination. In the field of health behavior, this model is now frequently employed as a particular social cognition paradigm.

Taylor, D. et al. summarized that there are some key components contained in HBM, which are perceived susceptibility (the subjective perception of the chances of developing the disease of individuals, be abbreviated as PSU later), perceived severity (the subjective assessment of the severity of the disease's many effects, including symptoms or states, be abbreviated as PSE later), perceived benefits (individuals subjectively perceive the benefits of taking healthy actions to offset perceived threats, be abbreviated

as PBE later), perceived barriers (a negative evaluation of obstacles that may have to overcome in taking health actions, be abbreviated as PBA later), and self-efficacy (individuals' belief in adopting healthy behaviors, be abbreviated as SE later). The first two factors combine to generate the perceived threat, and the last three factors combine to generate the expectation [5].

Many studies on the factors influencing vaccination intention have applied HBM. However, there are few international Communication studies on HBM and HPV vaccination intention in recent years, and there are even fewer related studies in China. Therefore, the study will use HBM to explore the influence of information exposure on HPV vaccination of Chinese female college students.

## 2.2 Relation between information sources exposure and vaccination intentions

The knowledge, attitude, and practice (KAP) model regard that knowledge has a favorable effect on people's attitudes, which in turn influence practices or behavior [6]. For instance, researchers have discovered that increasing social media usage and contacting local influencers can benefit the Omani community's intent to vaccinate against COVID-19 by improving awareness of the vaccine's safety and effectiveness [7].

In the Theory of Planned Behavior (TPB), it is stated that behavioral intention and actual performance are positively correlated [8]. In a study comparing the effect of TPB and HBM models on predicting young adult women's HPV vaccination intention, researchers mentioned that intentions were having a positive effect on vaccine uptake [9].

Today, in the age of the Internet, people are exposed to variable information, these information sources also provide more channels for people's cognitive improvement, increasing the possibility of changing people's attitudes and behavioral intentions. Therefore, the study use information sources exposure as the independent variable to explore its relationship with vaccination intentions.

In addition, the study briefly classified the category of information sources as formal and informal. Formal information sources within the official information management system, such as traditional mainstream media such as television, radio, newspapers, and their new media platforms, as well as experts in the medical field. Informal information sources are avenues for sharing information that are not part of the current official information management system, such as social media, the media, close family and friends, and other channels for interpersonal communication [10]. In this paper, the formal information sources are classified as TV, radio, newspapers, and other traditional mainstream media and its new media platform, as well as experts such as doctors and medical workers; Informal information sources are not included in the existing official information management system information transmission channels, including social media, we media, family members, friends, colleagues, and other interpersonal communication channels [11]. We suggest our study hypothesis in light of the aforementioned:

H1: Exposure to informal information sources had a significant negative effect on Chinese female college students' HPV vaccination intention.

H2: The formation of HBM is significantly influenced by exposure to informal information sources. Among them, exposure to informal information sources can reduce

Chinese female college students' PSE (H2a) and PSU (H2b) of the HPV virus and reduce the PBE of getting vaccination (H2c), enhance the PBA (H2d), and reduce their SE (H2e).

### **2.3 The mediating effect of the HBM**

Due to the relatively complete structure and the detailed division of health beliefs of the HBM model, and its applicability to the situation of this study's topic selection, the study selected HBM as the mediating variable between the independent variable (informal information sources exposure) and the dependent variable (intention to get vaccinated against HPV).

According to the KAP mentioned earlier, on the one hand, information sources exposure will affect Chinese female college students' HBM; on the other hand, their HBM will affect their HPV vaccination intention. One study established that the negative tone of videos on YouTube may affect the HBM of the public and in turn may affect their HPV vaccination intention<sup>[12]</sup>, which provides some ideas for this study. Different from other studies, the innovation of this study lies in adding information source trust as a moderating variable and exploring the influence of Chinese female college students' information sources exposure on the HPV vaccination intention on various Chinese network platforms, which will effectively expand the sample of this type of research model in China. We suggest our study hypothesis in light of the aforementioned:

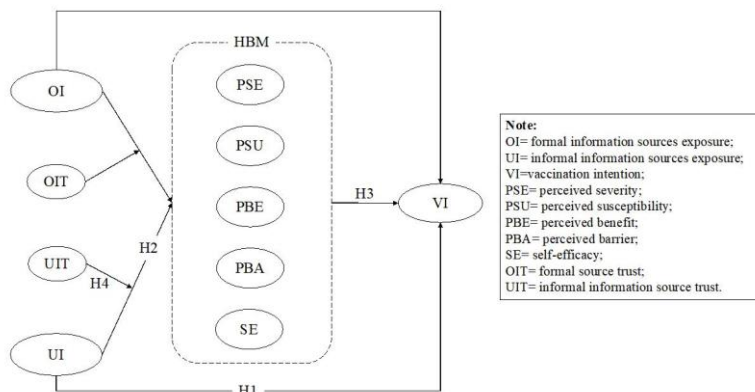
H3: HBM has a significant impact on Chinese female college students' HPV vaccination intention. Among them, PSE (H3a), PSU (H3b), PBE (H3c), and SE (H3e) positively affect vaccination intention, while PBA negatively affect vaccination intention (H3d).

### **2.4 Trust in information sources' moderating effect**

There are different levels of perceived reliability among sources of health information<sup>[13]</sup>, and source trust has been proven that it can affect message processing and issue attitudes<sup>[14]</sup>. Many people's vaccination attitudes are shaped by both professional specialists and an array of other information sources. Therefore, Information sources exposure and HBM are moderated by information sources trust. We suggest our study hypothesis in light of the aforementioned:

H4: Trust in informal information sources moderates the association between exposure to informal information sources and HBM, which has a significant effect on the intention to receive HPV vaccine. That is, the higher the degree of trust of Chinese female college students in informal information sources, the more exposure to informal information sources will make their PSE (H4a), PSU (H4b), and PBE higher (H4c), weaken the PBA (H4d), and make SE stronger (H4e).

The hypothetical model is displayed in Fig. 1.



**Fig. 1.** Hypothetical model.

### 3 Methods

#### 3.1 Sample and procedure

In this study, Chinese women college students were studied, primarily on the basis of several considerations: first, while female college students are typically between the ages of 18 and 25, and their vaccination age is quite consistent, the vaccination age for the nine-valent HPV vaccine in China is limited to 9 to 26 years old. Secondly, as one of the main subjects of inoculation, college students have the stronger expression ability and independent thinking abilities compared with middle school students, which could make the results more real and accurate. Finally, college students have more free access to all kinds of media, more time at their disposal, and more energy to invest in their health issues.

In this study, a questionnaire survey was used, and it was distributed starting on April 13, 2023. By combining convenient sampling and random sampling, the survey scope included universities in Hunan, Guangdong, Beijing, and other places. Including those with missing values, invalid, and blank surveys, 517 questionnaires were distributed in total. The effective sample size was 456, and the effective rate was 88.2%.

#### 3.2 Measures

For the measurement of formal and informal information sources exposure of independent variables, this paper mainly asks about the degree of information obtained from the following channels. According to the relevant research scale [2], formal information sources include three topics: (1) Television, radio, and their new media applications and accounts; (2) Newspapers and periodicals and their new media applications and accounts; (3) Doctors and other professionals. Informal information sources exposure includes 10 topics: (1) Commercial portal sites; (2) We Chat; (3) Commercial news

clients; (4) QQ; (5) Microblog; (6) Network forum, network community; (7) Network live broadcast platform; (8) Network video/short video platform; (9) family members; (10) Friends and colleagues. Responses ranged from "never" to "always" (1= never, 7= always), with a higher score indicating the more HPV information the subject received from that channel.

The dependent variable was HPV vaccination intention, this paper rewrite the scale from the previous ones, and the measurement topics of the dependent and mediating variables were shown in Table 1 [4,10]. Data were collected by a Likert seven-level scale (1= strongly disagree, 7= strongly agree).

**Table 1.** Design and reference of questionnaire.

Latent variable	Topics
Vaccination intention	I would contemplate about getting an HPV vaccination (VI1); I anticipate receiving the HPV vaccine (VI2); I think I'm going to get vaccinated against HPV (V3).
Perceived severity	I think having HPV can cause serious health problems (PSE1); HPV infection is a threat to my romantic (marital) relationships (PSE2); Being infected with the HPV virus will affect my social interactions (PSE3); HPV infection is a threat to my life and health (PSE4).
Perceived susceptibility	Many people can be infected with HPV, including my family, partner and friends (PSU1); I will be extremely vulnerable to HPV in the future if I haven't received the vaccine against it (PSU2); I think everyone can be infected with HPV (PSU3).
Perceived benefit	I thought the HPV vaccine would protect me from the HPV virus (PBE1); HPV vaccination works in the prevention of genital warts, cervical cancer and other diseases (PBE2); Getting the HPV vaccine can make sexual behavior safer (PBE3).
Perceived barrier	I lacked basic knowledge of the HPV vaccine (PBA1); A significant amount of time and energy is required to obtain information about the HPV vaccine (PBA2); I fear that the HPV vaccine may cause short-term problems, such as fever or discomfort (PBA3); I am preoccupied with the physical side effects of the HPV vaccine (PBA4).
Self-efficacy	I can timely pay attention to and query information about HPV vaccine (SE1); I have a comprehensive understanding of the HPV vaccine (SE2); Be able to conduct objective and rational evaluation of HPV vaccine without being influenced by others (SE3).

### 3.3 Statistical Analysis

SPSS Statistics 26 software was used to process the data, and the general information of female college students was described by frequency and percentage. The independent variables of this study, formal and informal sources of information exposure, are formative indicators, while variables such as health belief and vaccination intention are reflective indicators. To test the hypothesis and study the problem, this paper employed in path analysis to examine the influence of factors on HPV vaccination behavior using SPSS Process 3.4 to validate the model. Specifically, we build a moderated model to test the effects of informal information source contact (UI), informal information source trust (UIT), and its interaction terms (UI\*UIT) on dependent variables, a mediation model to test the relationship between five health belief variables and vaccine intent and vaccination intention and a moderate mediation model to test the relationship between exposure to formal and informal information sources, trust and their interaction terms and five mediation variables.

## 4 Results

### 4.1 Reliability and validity analysis

The reliability and validity of the scale constructed up of reactivity factors were examined using SPSS 26. First, the scale's reliability was evaluated; as can be shown in Table 2, Cronbach's alpha and Composite Reliability (CR) were both more than 0.637, demonstrating the scale's high dependability and strong reliability. The scale exhibited good validity, as evidenced by the KMO value of the factor analysis of each item being more than 0.644 and the p value of the Barlett test being 0.000. The convergent validity was also examined. Each latent variable's standard factor loading in Table 2 ranged from 0.624 to 0.886, demonstrating the scale's convergent validity.

**Table 2.** Cronbach's  $\alpha$  Coefficient, CR, KMO of Reflective Latent Variables.

Variable	Index	Std. Estimate	Cronbach 's Alpha	KMO	CR
Vaccination intention	VII	0.849	0.880	0.730	0.881
	VI2	0.793			
	VI3	0.886			
Perceived severity	PSE1	0.690	0.715	0701	0.679
	PSE2	0.624			
	PSE3	0.662			
	PSE4	0.672			
Perceived susceptibility	PSU1	0.650	0.685	0.658	0.637
	PSU2	0.676			
	PSU3	0.695			
Perceived benefit	PBE1	0.648	0.794	0.689	0.793
	PBE2	0.784			
	PBE3	0.809			

Perceived barrier	PBA1	0.695	0.770	0.742	0.772
	PBA2	0.641			
	PBA3	0.642			
	PBA4	0.817			
Self-efficacy	SE1	0.698	0.665	0.644	0.646
	SE2	0.635			
	SE3	0.612			

Note: VI=vaccination intention; PSE= perceived severity; PSU= perceived susceptibility; PBE= perceived benefit; PBA= perceived barrier; SE= self-efficacy; OIT= formal source trust; UIT= informal information source trust.

### 4.2 Confirmatory factor analysis

The confirmation variables were examined using Amos24, and the expected outcomes were  $\chi^2/df=4.692$ , RMSEA=0.091, GFI=0.849, CFI=0.837, NFI=0.804, NNFI=0.801, suggesting that no significant bias existed in the data in this study.

### 4.3 Descriptive analysis

The matrix of variable correlation is displayed in Table 3. The table shows that each variable is positively correlated significantly.

**Table 3.** Results of each variable's descriptive statistics and correlation analysis.

	OI	UI	VI	PSE	PSU	PBE	PBA	SE	OIT	UIT
OI	1									
UI	0.649 **	1								
VI	0.692 **	0.502 **	1							
PSE	0.226 **	0.188 **	0.348 **	1						
PSU	0.367 **	0.359 **	0.458 **	0.518 **	1					
PBE	0.232 **	0.544 **	0.781 **	0.392 **	0.450 **	1				
PBA	0.188 **	0.104 **	0.023 *	0.113 *	0.067 **	0.076 **	1			
SE	0.498 **	0.308 **	0.222 **	0.384 **	0.484 **	0.185 **	0.030 **	1		
OIT	0.295 **	0.347 **	0.388 **	0.344 **	0.403 **	0.400 **	0.050 **	0.406 **	1	
UIT	0.262 **	0.257 **	0.089 **	0.064 **	0.159 **	0.165 **	0.320 **	0.159 **	0.198 **	1



M	4.66	4.56	5.11	5.29	4.94	5.04	4.02	4.88	5.09	4.40
SD	1.11	1.47	1.59	1.10	1.21	1.39	1.34	1.13	1.29	1.44

Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$  (two-tailed); OI= formal source exposure; UI= informal source exposure.

#### 4.4 Regression model analysis

The research issue is addressed by the results of the three modules that were built for this study in order to investigate the relationships between variables.

The independent variable informal source exposure significantly reduced vaccination intention in Tables 4 and Table 5 ( $\beta = -0.045$ ,  $t = -0.937$ ), which supported hypothesis 1. Among these, the establishment of health attitudes was significantly impacted by exposure to informal information sources. Exposure to unofficial sources of information significantly improves perceptions of severity ( $\beta = 0.318$ ), vulnerability ( $\beta = 0.810$ ), benefit ( $\beta = 0.445$ ), and self-efficacy ( $\beta = 0.692$ ). It cannot prove H2 since it damages the perceived barrier ( $\beta = -0.164$ ).

According to Table 5, HBM significantly affects Chinese female college students' intentions to get vaccinated against HPV. They found that self-efficacy ( $\beta = 0.056$ ), perceived severity ( $\beta = 0.010$ ), perceived susceptibility ( $\beta = 0.177$ ), perceived benefit ( $\beta = 0.833$ ), and perceived benefit were all positively correlated with vaccination intention, but felt impairment ( $\beta = -0.08$ ) was negatively correlated, which addressed the question H3. In the meanwhile, confidence in informal information sources strongly influences HPV vaccination intention ( $\beta = -0.106^*$ ) and has a moderating effect on exposure to informal information sources and HBM. Perceived severity ( $\beta = -0.031$ ), perceived benefits ( $\beta = -0.055$ ), perceived susceptibility ( $\beta = -0.109$ ), self-efficacy ( $\beta = 0.071$ ), and perceived barriers ( $\beta = 0.064$ ) are all significantly negatively correlated under the influence of informal information source trust. Therefore, H4 cannot be verified. The final results of the model used in this study are shown in Fig. 2.

**Table 4.** Mediating effect size.

Item	Test Conclusion	c	a*b	c'	Effect proportion calculation formula	Effect ratio
UI=>PSE=>VI	The mediating effect was not significant	-0.422	0.002	-0.223	-	0%
UI=>PSU=>VI	Masking effect	-0.422	0.032	-0.223	a * b / c'	14.382%
UI=>PBE=>VI	Partial mediation	-0.422	-0.254	-0.223	a * b / c	60.280%
UI=>PBA=>VI	The mediating effect was not significant	-0.422	-0.011	-0.223	-	0%

Item	Test Conclusion	c	a*b	c'	Effect proportion calculation formula	Effect ratio
UI=>SE=>VI	The mediating effect was not significant	-0.422	0.032	-0.223	-	0%

Note: Masking effect ratio refers to the proportion of intermediate effect/direct effect.

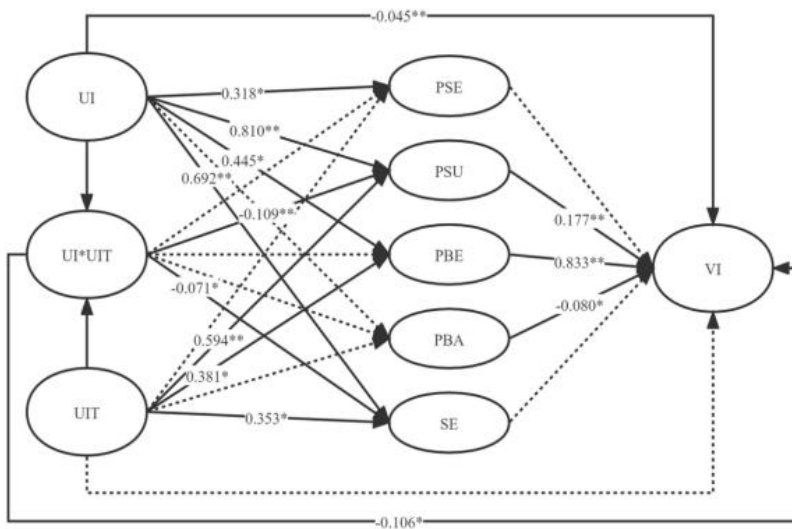
When X is compared to Y, the regression coefficient is represented by the letter "c," when X is compared to M by the letter "a," and when M is Y by the letter "b."

The mediating effect, or a\*b, is the result of a and b.

**Table 5.** Regression model.

	VI	PSE	PSU	PBE	PBA	SE
UI	-0.045** (-0.937)	0.318* (2.405)	0.810** (5.913)	0.445* (2.574)	-0.164 (-0.958)	0.692** (4.724)
UIT	0.038 (0.784)	0.156 (1.069)	0.594** (3.917)	0.381* (1.992)	-0.019 (-0.099)	0.353* (2.177)
UI*UIT	-0.106* (-2.250)	-0.031 (-1.053)	-0.109** (-3.580)	-0.055 (-1.431)	0.064 (1.686)	-0.071* (-2.183)
PSE	0.010 (0.184)					
PSU	0.177** (3.458)					
PBE	0.833** (21.427)					
PBA	-0.080* (-2.330)					
SE	0.056 (1.263)					
R <sup>2</sup>	0.618	0.043	0.158	0.059	0.115	0.138
ΔR <sup>2</sup>	0.612	0.034	0.150	0.050	0.107	0.130
F	F (6,441)= 118.706, p=0.000	F (3,444)= 6.613, p=0.000	F (3,444)= 27.766, p=0.000	F (3,444)= 9.229, p=0.000	F (3,444)= 19.181, p=0.000	F (3,444)= 23.615, p=0.000

Note: \* p<0.05 \*\* p<0.01; t values in parentheses



Note: The solid lines in the figure are significant paths; The dotted lines in the figure are non-significant paths; \*  $p < 0.05$  \*\*  $p < 0.01$

Fig. 2. Model and path coefficient.

## 5 Discussion

According to the data, we found that information sources exposure would influence Chinese female college students' HPV vaccination intention, while exposure to informal information sources would significantly reduce one's intention to vaccinate, which is consistent with the findings of the majority of studies.

There was no mediating effect of the five components of HBM between informal information sources exposure and HPV vaccination intention. Only the research result of the path from HBM to vaccination intention supported H3, while the path from informal information sources exposure to HBM is even the exact opposite of H2, which shows that informal information sources exposure to some extent boosted Chinese female college students' confidence in maintaining their health status and decreased their understanding of the risks of HPV and the advantages of vaccination.

It cannot be confirmed that the informal information trust would have a moderating effect since the result is the exact opposite of H4, which shows that Chinese female college students have a certain degree of independent judgment about the nature of information and will not blindly trust the information source.

### 5.1 Limitations and future directions

There are certain limitations to the study that should be noted and addressed in subsequent research, which are also potential causes of inconsistency with other research.

Firstly, regarding data statistics and analysis, the study's sample size is quite modest, and the sampling method may result in possible demographic differences being ignored among female college students in different regions of China (such as family income gaps and so on), as well as their HPV vaccination status, openness to sex and so on, which may be reasons that caused the non-conformities of our data results. Therefore, the sampling method needs to be improved in the future. Also, the topic of this study is relatively new, the questionnaire used was produced by referring to several previous literatures, and the influence of gender is prominent. Thus, although the scale in this study has acceptable reliability and validity, there may be a deviation in the reliability and validity of the recovered questionnaire, which cannot reflect the possible results well. It is recommended that more research should further refine and consider the changes in the setting of the questionnaire. The validity of the hypothetical model's applicability is a further area for further research and questionnaire and to test the research hypotheses through a more reasonable sampling method and a larger number of sample data.

Secondly, in terms of variable settings, the study divided the contact of independent variable information sources into formal and informal by dichotomy. However, the diversity of information sources also leads to the difference in communication effect, and this variable can be further subdivided in future research. In addition, five components of HBM were considered as mediating variables in the study, but there was relatively less discussion on the relationship between variables of HBM, which could be further studied in future research.

### 5.2 Theoretical and practical implications

In general, the study has certain significance in both theory and practice.

Theoretically, using the HBM model combined with information sources exposure and trust, we explored Chinese female college students' intentions to get vaccinated against HPV, which is a relatively novel attempt.

Practically, our findings on the influence of informal information sources exposure and trust on Chinese female college students' HBM and HPV vaccination intentions, in particular, common convergence results consistent with others' research on the significant effect of informal information sources exposure on vaccination intentions, will further enlighten the government's online public opinion regulation and medical institution publicity work in the future.

## 6 Conclusion

The study examines the degree to which information sources exposure and trust affect Chinese female college students' intention to get vaccinated against HPV, and it's noted that informal information sources exposure has played a significant role in this process.

Increasing HPV vaccination rates requires a strong push from the government, so the government should pay attention to informal information on the Internet promptly and provide some guidance to netizens' speech. At the same time, the government and related medical institutions should popularize the benefits of the HPV vaccine to the public in an appropriate manner and provide sufficient vaccine materials for the public.

## Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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