

The Impact of HPV Risk Perception and Efficacy Perception on Women's Willingness to Receive the HPV Vaccine: Based on the Moderating Role of Subjective Norms

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Abstract

One of the three main cancers of the female reproductive system, cervical cancer seriously jeopardizes the health of Chinese women. At the same time, though, the HPV vaccination rate among Chinese women is still alarmingly low compared to infection rates. Therefore, mitigating the hazards posed by HPV-related diseases requires an understanding of how to increase women's desire to obtain the HPV vaccine. Using the Risk Perception Attitude (RPA) paradigm as a guide, this study investigates how women's perceptions of the risk and efficacy of HPV affect their desire to get the vaccine. Subjective norms from the Planned Behavior Theory (TPB) are also included in the study as a mediator factor between vaccination willingness and these two factors. The path that exists between risk perception, efficacy perception, and willingness to receive the HPV vaccination is confirmed by the results of multiple regression analysis. In addition to the path relationship where moderating variables involve subjective norms.

Keywords

Risk communication; risk perception; efficacy perception; subjective norms; HPV vaccination willingness.

1. Introduction

Cervical cancer, one of the three main malignant tumors of the female reproductive system, is extremely dangerous for women's health. The World Health Organization's most recent study on HPV states that 342,000 fatalities and nearly 604,000 new cases of cervical cancer occurred in 2020, 85 percent of these events take place in underdeveloped nations[2]. The Human Papillomavirus, or HPV, is a frequently contracted sexual infection, mainly infects human skin and mucosal epithelial cells, almost everyone who engages in sexual activity runs the risk of contracting the infection, and it is usually not accompanied by malignant symptoms, but persistent infection with high-risk HPV causes 95% of cervical cancers. As the largest developing country, China has one of the highest rates of cervical cancer deaths and incidence globally. In 2020, there were more than 100,000 new cases of diseases in China, including 59,100 deaths[3], accounting for a large proportion of the world's diseases. Despite the fact that China has actively supported vaccination and public awareness of the HPV vaccine recently, but the incidence and mortality of cervical cancer have remained high, the economic and psychological burdens on society and families are still very serious. Research shows that although most women know about the HPV virus and its vaccine, but do not know much about the types of viruses and their risks and dangers [4].

Up to now, in the field of communication studies, aiming at the impact of existing media and health communication perspectives on increasing female HPV vaccination [7], there are many studies on how to disseminate relevant information and shape content, but there are few studies on how individual women's perceived risks and perceived efficacy of HPV affect their

own willingness to be vaccinated against HPV. At the same time, existing health intention change theories focus too much on the individual and ignore the role of the social environment, which is rare to use subjective norms as a moderating variable in a single study[8], considering the moderation of subjective norms, how risk-perceived attitudes influence women's willingness to be vaccinated. Therefore, this paper builds on existing research, comprehensively using relevant academic theoretical concepts such as risk perception attitude framework, subjective norms, etc, to investigate how women's intention of getting an HPV vaccination is affected by the risk perception process and how the influence of the process is influenced by subjective norms, using research methods such as questionnaires and literature reviews, aiming to explore women's risk perception of HPV under the moderating effect of subjective norms - perceived severity of cervical cancer caused by HPV virus infection, as well as the efficacy perception - the impact of perceived self-action on HPV prevention ability on improving women's willingness to get HPV vaccination, in order to provide targeted guidance to increase the willingness of female groups in society to be vaccinated against HPV, and to promote women's actions to prevent HPV viruses and cervical cancer.

2. Literature Review and Hypothesis Development

2.1. Risk Perception Attitude Framework (Rpa)

The Risk Perception Attitudes (RPA) framework is a theoretical perspective that can be used to segment audiences based on individual perceptions of risk and individual perceptions of self-efficacy. The risk attitude perception framework highlights that individual efficacy perception can moderate the impact of personal risk perception on the willingness to engage in self-protective behavior. It is based on the functions of individual efficacy in social cognitive theory and threat perception in extended parallel models[9]. Perceived risk as motivation to avoid disease, which encourages preventative actions to avoid the risk of illness.

The concept of perceived self-efficacy describes a person's confidence in their capacity to carry out an action successfully[10]. Based on perceived risk and efficacy, the RPA framework divides individuals into four categories, assuming that protective action will be motivated by perceived risk.

2.2. Perceived Risk, Perceived Efficacy, and Behavioral Intention

According to research by Elena Riza et al. [11], women's risk perception of HPV is one of the important factors affecting their willingness to get vaccinated. Studies have found that many women have misconceptions about the risk of HPV infection, especially among disadvantaged groups. These misunderstandings may lead them to underestimate their risk of infection, thus reducing the willingness to vaccinate. At the same time, due to the insidious nature of cervical cancer, or other diseases caused by high-risk HPV, some women may have a lack of understanding of the seriousness of HPV infection, further affecting the willingness to get vaccinated. At the same time, when individuals perceive the risks of HPV infection, cervical cancer, etc. that may arise from not vaccinating the HPV vaccine, they are more likely to get vaccinated [12]. In the study of Tre Tomaszewski [13], they found the impact of women's perceptions of the effectiveness of the HPV vaccine on their willingness to take it. The results shows women's knowledge of the preventive effect and safety of vaccines directly affects their willingness to be vaccinated. Some women who believe the vaccine is effective and safe are more willing to get it, and women who have misunderstandings or negative views about vaccines are less willing to get vaccinated. Meanwhile, when women think they have easy access to vaccines, at the same time, women are more likely to receive the HPV vaccine when they believe they can easily obtain the vaccine[14].

2.3. Subjective Norms

Subjective norms are taken into account by the Theory of Planned Behavior as a predictor of attitudes toward behavioral control, health-related actions, and behavioral intentions connected to health. Norms can act as a mediator or moderator in addition to being a predictor of behavioral intentions connected to health, according to certain research on the relationship between norms and health outcomes. He might be able to control or arbitrate perceived danger[19], for example, he can have the role of mediating or moderating the relationship between perceived risk [19], perceived efficacy[20] and health-related behavioral intentions. Subjective norms enable individual women to feel group reference effectiveness and social pressure when deciding whether to vaccinate against HPV, this can be seen as a system and norm formed to constrain or guide individual behavior to ensure that group activities become consistent, and can subtly affect individual thoughts and emotions. Women often reassess the significance of HPV vaccination under the influence of subjective norms, and they then modify the influence of perceived risk and perceived efficacy on HPV vaccination intention. Therefore, when the level of subjective norms is high, the positive correlation between perceived risk and perceived efficacy on HPV vaccination will decrease, and when the subjective norm level is low, perceived risk and perceived efficacy of HPV vaccination continue to positively correlate, with little change in this relationship.

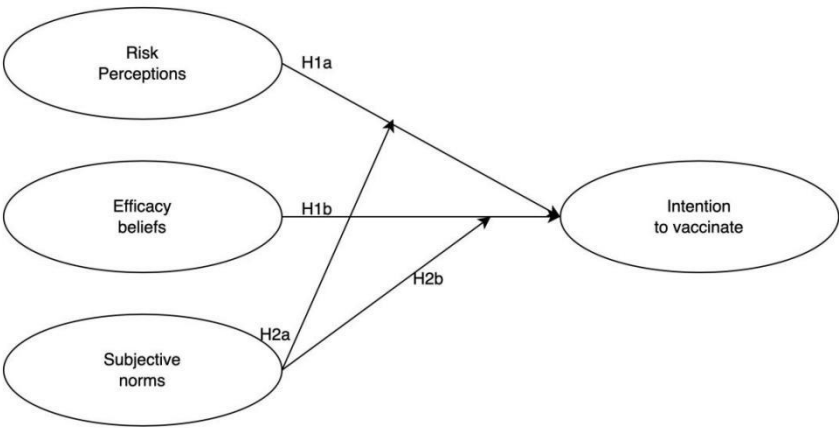
In light of this, the following study models and theories are put forth:

H1a: The risk perception of HPV in women positively affects their willingness to vaccinate HPV

H1b: The self-efficacy of HPV in women positively affects the increase of their willingness to be vaccinated against HPV

H2a: Subjective norms significantly positively moderated the relationship between perceived-risk and women's willingness to vaccinate HPV

H2b: Subjective norms significantly positively moderated the relationship between self-efficacy and women's willingness to vaccinate HPV



Pic 1 Hypothesis Path Chart

3. Research Design

3.1. Methods and Participants

This research uses a questionnaire survey approach, using Questionnaire Star as the survey platform, targeting all women over the age of 17 across the country and issuing targeted questionnaires. This study uses subjective norms as the moderator variable, to explore the impact of women's perceived-risk and efficacy perception of HPV on improving women's willingness to receive HPV vaccination. According to existing research, the age range for HPV

vaccination is 9-45 years old. Considering the possibility and reliability of questionnaire distribution, the lower age limit is set to 17 years old. Wenzhou and Hangzhou cities in Zhejiang Province were mainly considered for distribution locations, and a small number of research samples from other provinces were obtained through the Internet.

3.2. Definition and measurement of variables

3.2.1. Perceived Risk of HPV

Women's perceived risk variables for HPV were measured using a mature scale produced by scholars in existing studies[22], based on the perceived risk consisting of perceived severity and perceived sensitivity[23], through "I believe infecting HPV is severe" "I think that infecting HPV is serious" "I believe that infecting HPV is significant" "I am at risk for getting HPV" "It is possible that I will contract HPV" "It is likely that I will contract HPV" 6 questions to assess women's perceptions of the HPV virus's risk. A five-point Likert scale, with a "1" representing "strongly disagree" and a "5" representing "strongly agree," is used in the design of the measurement items.

3.2.2. Perceived Efficacy of HPV

Similarly, women's perceived risk variables for HPV are measured using a mature scale produced by scholars in existing studies[23], based on the fact that efficacy perception consists of self-efficacy and reflected efficacy [23], through "I am able to use vaccination prevent getting HPV" "Vaccination is easy to use to prevent HPV" "Using vaccination to prevent HPV is convenient" "Vaccination works in preventing HPV" "Vaccination is effective in preventing HPV" "If I have vaccination I'm less likely to get HPV" 6 questions to examine women's risk perception level of the HPV virus. Measurement items are designed using a five-point Likert scale, involving "1" meaning "strongly disagree" and "5" meaning "strongly agree".

3.2.3. Subjective Norms

Subjective norm defines the pressure an individual experiences to conform to the opinions of those who have greater significance in his life. (Ajzen and Fishbein, 1977). Subjective norm in this context mostly refers to the pressure an individual experiences from those who are comparatively significant to him, such as family, coworkers, or acquaintances, regarding their intention to get the HPV vaccine. The scale in this article is derived from the mature scale in previous research [24]. The measurement items are "Most people who are important to me think that I should get all three doses of the HPV vaccine in the next 12 months" and "My parent(s) or legal guardian(s) would like me to get all three doses of the HPV vaccine in the next 12 months" "Family members other than my parent(s) or legal guardian(s) (for example, sibling, aunt, uncle, grandparent, etc.) would like me to get all three doses of the HPV vaccine in the next 12 months" "My friends would like me to get all three doses of the HPV vaccine in the next 12 months". The measurement items are designed using a seven-point Likert scale, with "1" indicating "strongly disagree" and "7" indicating "strongly agree".

3.2.4. Behavior Intention

HPV vaccination intention adopts a mature scale developed by scholars according to the notion of Ajzen, I., & Driver, B. L. [25] in existing studies [24]. The measurement items are ". I intend to get all three doses of the HPV vaccine in the next 12 months." "I will try to get all three doses of HPV vaccine within the next 12 months." "I plan to get all three doses of the HPV vaccine in the next 12 months".

The measurement items are designed using a seven-point Likert scale, with "1" indicating "strongly disagree" and "7" indicating "strongly agree". In the questionnaire of this study, the difference between bivalent, quadrivalent and nine-valent vaccines is not involved, and they are all collectively referred to as "HPV vaccines".

4. Data

4.1. Data Collection

In all, 402 questionnaires were gathered for this study, with 393 respondents being female and stated that they knew about HPV and its vaccine. These 393 questionnaires were included in the valid questionnaires of this study.

4.2. Reliability Analysis

The reliability coefficient (Cronbach's α) of the four main dimensions in this questionnaire: the respondent's risk perception of HPV, self-efficacy perception, subjective norm and willingness to be vaccinated against HPV was tested. The results are shown in the figure below.

Table 1 Reliability Analysis Result

Variable	Number of Questions	Number of Sample	Reliability Coefficient
Risk Perception	6	393	0.840
Self-Efficacy	6	393	0.890
Subjective Norm	4	393	0.978
Vaccination Intention	3	393	0.986

As Table 1 shown, the reliability coefficients of risk perception, self-efficacy, subjective norms, and vaccination willingness reached 0.840\0.890\0.978\0.986 respectively. The above reliability coefficients are all above 0.80, which demonstrates the questionnaire's perfect dependability.

4.3. Validity Analysis

Scales used in this article are all based on in-depth reading of the literature, drawing on mature scales from domestic and foreign scholars, and have been carefully reviewed and modified by relevant experts and scholars. Therefore, the scale used in this article has good content validity. This article adopts construct validity, conducts exploratory factor analysis test on the questionnaire, and uses SPSS statistical software to obtain the KMO and Bartley sphericity test values.

Table 2 KMO and Bartley Sphericity

KMO and Bartlett test		
KMO Sampling suitability quantity		0.904
Bartlett's test of sphericity	approximate chi-square	6910.329
	degrees of freedom	171
	Sign.	.000

As Table 2 shows, The whole questionnaire has a KMO score of more than 0.9. At the same time, the KMO values of risk perception, self-efficacy, subjective norms, and vaccination willingness reached 0.877\0.903\0.856\0.774 respectively. The above reliability coefficients are all above 0.75, showing that the Bartlett test p values are both less than 0.01, suggesting that the questionnaire has strong validity, and both values satisfy the requirements for factor analysis's subsequent stage.

Construct validity is an indicator used to evaluate whether a scale can measure the latent variable to be measured. It mainly includes tests of convergent validity and discriminant validity of the scale. Convergent validity means that all observation items measuring the same latent variable should be highly correlated. It is generally tested using the standardized loading coefficient and average variances extracted (AVE) of the observation items. At the same time, the standardized loading coefficient of the observation item is required to be greater than 0.5 (Anderson and Hkansson et al., 1994).

After using SPSS statistical software to obtain the values of each factor analysis, the factor analysis results show that 4 factors were extracted, the cumulative variance explained by the factor is 73.342%, greater than the recommended cumulative interpretation standard, in the field of sociology, explaining more than 60% of the variance is considered a good explanation level. As a result, it is determined that the scale utilized in this study has good convergent and discriminant validity for each measurement index.

4.4. Descriptive Analysis

Table 3 Basic Characteristics of Samples

Descriptive Analysis				
	Maximum	Minimum	Average	Sd.
Risk Perception	1.17	4.83	3.1751	0.70876
Self-Efficacy	1	5	3.0237	0.83715
Subjective Norm	1	7	3.9587	2.15733
Vaccination Intention	1	7	5.531	1.73016
Number of valid cases (in columns) : 393				

In this study, we conducted detailed data analysis on 393 respondents, to assess their cognitive and attitudinal levels in terms of risk perception, efficacy perception, subjective norms and willingness to be vaccinated, the result is shown as. The data reveals that the risk perception level of the respondents is at an upper-middle level, and the data is relatively concentrated with little volatility. The risk perception level of the respondents is at an upper-middle level, and the data is relatively concentrated with little volatility. The respondents' subjective norm level falls between the middle and lower levels, with scattered and highly volatile data. The risk perception level of the respondents is at an upper-middle level, and the data is relatively scattered and highly volatile.

5. Result

5.1. Correlation

The research utilizes SPSS.20 for operations. When analyzing the data, hypotheses were analyzed using Pearson's correlation coefficient, a two-tailed significance test was used. The results are shown in Table . The p values between the four variables are all less than 0.01, indicating that there is a significant correlation between the variables, and the next step of data analysis and hypothesis testing can be carried out.

Table 4 Correlation Test

Correlation				
	Risk Perception	Self-Efficacy	Subjective Norm	Vaccination Intention
Risk Perception	1			
Self-Efficacy	.483**	1		
Subjective Norm	.263**	.288**	1	
Vaccination Intention	.457**	.454**	.303**	1
** Correlation is significant at the 0.01 level (2-tailed).				

As can be seen from Table , the correlation coefficient between the perceived risk dimension data and the willingness to be vaccinated is 0.457 ($p < 0.01$), reaching a significant correlation level and showing a positive correlation result, indicating that there is a relationship between

women's perceived risk of HPV and their willingness to be vaccinated. Significant positive correlation. It was found that the correlation coefficient between perceived efficacy dimension data and willingness to get vaccinated was 0.454 ($p<0.01$), reaching a significant correlation level and showing a positive correlation result, revealing a strong positive association between women's willingness to get vaccinated and their opinion of the effectiveness of HPV.

5.2. Regression Effect

5.2.1. Validation of the relationship between HPV risk perception and HPV vaccination intention in women

The first regression analysis was conducted with women's willingness to vaccinate against HPV as the dependent variable and women's perceived risk of HPV as the independent variable, and the results of the analysis are shown in Table . As can be seen in Table , the F-value is 103.411 ($p<0.001$), indicating that the overall regression model is significant. The model R-squared is 0.209 and the adjusted R-squared is 0.207, indicating that the dimension of risk perception explains 20.7% of the variation in the willingness to vaccinate, showing the model is well constructed.

Meanwhile, the unstandardized regression coefficients and standardized regression coefficients of risk perception were 1.116 and 0.457, respectively, with a t-value of 10.169, both of which showed significance at the p-value of 0.001, indicating that women's risk perception significantly and positively affects the willingness to increase the willingness to receive HPV vaccination. Hypothesis H1a is accepted.

Table 5 Linear Regression Result for Risk Perception

	usc		sc.	t	p
	B	basic mistake	Beta		
constant	1.986	0.357		5.561	<0.001
risk perception	1.116	0.11	0.457	10.169	<0.001
R square: 0.209					
R square after adjustment:0.207					
F: 103.411 ($p<0.001$)					

5.2.2. Validation of the relationship between HPV self-efficacy and HPV vaccination intention in women

Women's willingness to receive the HPV vaccine is the dependent variable in Hypothesis H1b of this study, while women's perception of the vaccine's efficacy is the independent variable in the second regression analysis. The analysis's findings are displayed in

Table. As viewed from

Table, the F-value was 101.237 ($p<0.001$), showing that the overall regression model was significant. The model R-squared is 0.206 and the adjusted R-squared is 0.204, indicating that the dimension of risk perception can explain the reason for the 20.4% change in the willingness to vaccinate, and the model is well constructed.

The unstandardized regression coefficients and standardized regression coefficients of risk perception are 0.937 and 0.454, respectively, with a t-value of 10.062, both of which show significance at the p-value of 0.001, indicating that women's efficacy perception significantly and positively influences the increase in willingness to be vaccinated with HPV vaccine. Hypothesis H1b is accepted.

Table 6 Linear Regression Result for Self-Efficacy

	usc		sc.	t	p
	B	basic mistake	Beta		
constant	2.697	0.292		9.228	<0.001
self-efficacy	0.937	0.93	0.454	10.062	<0.001
R square : 0.206					
R square after adjustment:0.204					
F : 101.237 (p<0.001)					

5.3. Regulation

5.3.1. The moderating role of subjective norms: When risk perceptions influence vaccination intentions

The independent variable is risk perception and the dependent variable is willingness to vaccinate, as can be seen through the regression equation test, the R-square is 0.3426, which indicates that the regression equation is able to explain 34.26% of the variation in the willingness to vaccinate, and the p-value of the F-test is less than 0.05, which achieves the level of significance and proves that the regression model is valid. Meanwhile, as the data in Table show, the significance of risk perception is less than 0.05, and the regression coefficient is 1.1937, and the significance of the interaction term between risk perception and subjective norms after adding subjective norms is less than 0.05, with a regression coefficient of 0.340, and the regression coefficients of both are greater than 0, while the confidence intervals don't include 0, which suggests that, in the positive correlation between risk perception and willingness to be vaccinated, subjective norms play a positive moderating role.

Table 7 Moderating Effect of Subjective Norms on Risk Perception

Regression Equation		Regression Coefficient					
Dependent	Independent	B	basic mistake	t	p	LLCI	ULCI
	(Constant)	5.3944	0.0753	71.6129	0	5.2463	6.5425
Vaccination Intention	Risk Perception	1.1937	0.1105	10.8068	0	0.9766	2.4109
	Subjective Norm	0.1309	0.035	3.7353	0.0002	0.062	1.1998
	Risk Perception*Subjective Norm	0.3404	0.0526	6.4761	0	0.2371	1.4438
R square : 0.3187							

F: 60.6487p<0.001)

This study further made a simple slope plot of risk perception acting on vaccination intention at different levels of subjective norms, as shown in Figure 3, when the level of subjective norms was higher (+1SD), the positive relationship between risk perception and vaccination intention was stronger ($p<0.01$); when when the level of subjective norms was lower (-1SD), the positive relationship between risk perception and vaccination intention was weaker ($p<0.01$). Therefore, the H2a hypothesis was supported.

5.3.2. The moderating role of subjective norms: When self-efficacy influence vaccination intentions

With willingness to vaccinate as the dependent variable and perception of efficacy as the independent variable, the regression equation test shows that the p-value of the F-test is less than 0.05, which satisfies the level of significance and establishes the validity of the regression model. The R-square is 0.3128, indicating that the regression equation is able to explain 31.28% of the variation in willingness to vaccinate. Meanwhile, as the data in

Table show, the regression coefficient of risk perception is 1.0103, with significance less than 0.05, and the regression coefficient of the interaction term between risk perception and subjective norms after adding subjective norms is 0.2802, with significance less than 0.05, and both of them have regression coefficients less than 0.05, while the confidence intervals don't include 0, which suggests that, in the positive correlation between efficacy perception and willingness to be vaccinated, subjective norms play a positive moderating role.

Table 8 Moderating Effect of Subjective Norms on Self-Efficacy

Regression Equation		Regression Coefficient					
Dependent	Independent	B	basic mistake	t	p	LLCI	ULCI
	(Constant)	5.3853	0.76	70.8552	0	5.2359	5.5348
Vaccination Intention	Self-Efficacy	1.0103	0.591	10.6238	0	0.8233	1.1973
	Subjective Norm	0.12	0.0355	3.3769	0.0008	0.0501	0.1898
	Self-Efficacy* Subjective Norm	0.2802	0.0431	6.4988	0	0.1954	0.365
R square : 0.3128							
F : 59.0213 (p<0.001)							

This study further made simple slope plots of the effect of efficacy perception on vaccination intention at different levels of subjective norms, as viewed in Figure 4, when the level of subjective norms was higher (+1SD), the positive relationship, between risk perception and vaccination intention was more obvious($p<0.01$), and when when the level of subjective norms was lower (-1SD), the positive relationship between risk perception and vaccination intention was weaker ($p<0.01$). Therefore, the H2b hypothesis was supported.

5.4. Hypothesis Testing Summary

Chapter 5 tested the data for all the hypotheses in this paper, and this subsection summarises the results for these four research hypotheses, as shown in

Table , all 4 research hypotheses are valid. In summary, the model of the effect of risk perception and efficacy perception on women's willingness in receiving HPV vaccine with the moderating effect of subjective willingness is valid.

Table 9 Hypothesis Testing Result

Number	Hypothesis	Result
H1a	The risk perception of HPV in women positively affects their willingness to vaccinate HPV	Success
H1b	The self-efficacy of HPV in women positively affects the increase of their willingness to be vaccinated against HPV	Success
H2a	Subjective norms significantly positively moderated the relationship between risk perception and women's willingness to vaccinate HPV	Success
H2b	Subjective norms significantly positively moderated the relationship between self-efficacy and women's willingness to vaccinate HPV	Success

6. Discussion

Based on the theoretical framework of risk perception attitudes and the theory of planned behaviour, this study developed a structural equation model of women's risk perception of HPV, self-efficacy and willingness to be vaccinated against HPV, and subjective norms that play a moderating role between them, using questionnaire survey method for data collection, and SPSS and PROCESS plug-ins for data analysis. The study found that the higher the risk perception of HPV among women (including perceived sensitivity and perceived severity), the higher their willingness to receive HPV vaccine; The higher a woman's level of self-efficacy against HPV (including self-efficacy and reflected efficacy), the higher her willingness to get the HPV vaccine. Meanwhile, the study discovered that risk perception or self-efficacy have a greater influence on women's desire to have an HPV vaccination under the moderating influence of subjective norms at higher levels of subjective norms.

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