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# Human papillomavirus vaccination intention and its associated factors among female medical college students in Hubei, China: A cross-sectional study

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## Abstract:

**BACKGROUND:** The uptake rate of human papillomavirus (HPV) vaccination in China is low, including among college students. In addition, medical students are the target population for the HPV vaccine, but they have poor uptake of the HPV vaccine. This study aimed to investigate factors related to HPV vaccination intention among female medical college students in Hubei Province.

**MATERIALS AND METHODS:** This cross-sectional study was conducted on 988 female medical college students from six colleges in Hubei Province with a multistage sampling method. The data were collected by web-based online software. Multiple logistic regression was applied to explore the factors associated with the intention of HPV vaccination.

**RESULTS:** The majority of students (85.5%) reported a high level of intention to receive HPV vaccine, about 82.3% have a willingness to pay (WTP) for HPV vaccine, and 51.5% reported that family members had never received the HPV vaccine. The students who had higher scores of knowledge of HPV, HPV infection prevention awareness, the protection motivation theory (PMT)-related factors including perceived severity, perceived response efficacy, perceived self-efficacy, and WTP for the HPV vaccine had higher intention to receive HPV vaccine.

**CONCLUSION:** HPV vaccination intention was high in medical students. Also, it was influenced by knowledge of HPV, PMT-related factors, and WTP for HPV vaccine. Thus, consideration of these factors is important to design the HPV vaccination campaign that can increase the intention to receive HPV vaccine, which in turn may increase the HPV vaccination.

## Keywords:

HPV vaccine, intention, medical students, PMT

## Introduction

Human papillomavirus (HPV) is a prevalent sexually transmitted virus,<sup>[1]</sup> causing 90% of genital warts and 100% of cervical cancers.<sup>[2]</sup> HPV vaccines have been available since 2006 and been adopted in 107 countries by 2020.<sup>[3]</sup> In China, despite the availability of vaccines since 2016, not all are part of the national program, and uptake remains limited. Given rising

sexually transmitted infections among female college students, comprehending vaccination intentions is vital.<sup>[4]</sup> However, only 11.0% of college students have been vaccinated,<sup>[5]</sup> and 23.4% to 46.2% of them have the intention of being vaccinated against HPV.<sup>[5-7]</sup> Additionally, previous research revealed that factors influenced HPV vaccination intentions, including HPV infection prevention awareness, lack of self-perceived risks for an HPV infection,

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willingness to pay for HPV vaccines, costs, and vaccine availability.<sup>[5,8,9]</sup> Other studies have suggested that low vaccination rates may be associated with factors such as lack of knowledge of HPV and HPV vaccination and insufficient or lack of provider recommendation. Of these, likely the most influential factor in the successful delivery of HPV vaccination is an effective recommendation from a healthcare provider.<sup>[10]</sup> Besides, prior research showed that healthcare providers' attitudes toward vaccination and recommendations play a significant role in the general population's trust in vaccination and their HPV vaccination intention.<sup>[11]</sup> Also, the knowledge and a positive attitude toward the vaccine among medical students indicate a favorable outlook for their future actions as health service providers in vaccination programs.<sup>[12]</sup> Therefore, it is critical that the next generations of healthcare providers, including medical students, are appropriately educated about HPV, associated diseases, the importance of HPV vaccination, and how to deliver effective vaccine recommendations.<sup>[10,11]</sup> However, some studies found that the HPV vaccination intention among medical students was varied in Asian countries, like Saudi Arabia (24.1%),<sup>[13]</sup> Turkey (33.7%),<sup>[14]</sup> and India (65.2%).<sup>[15]</sup> A systematic review found that the HPV vaccination intention among Chinese female medical college students was 30.4%,<sup>[16]</sup> which may have contributed to the low HPV vaccination rates among this group.

In Hubei Province, China, the previous studies found that the highest prevalence of HPV infection was found in the aged below 20 years group (47.56%). Also, only 58.7% of the college students have heard of the HPV vaccine, 39.8% thought HPV could cause related diseases, 34.7% considered taking the HPV vaccine, and female college students lack knowledge about the HPV vaccine and HPV-related diseases.<sup>[17]</sup> Thus, maybe Hubei youths were still considered at high risk of HPV-related disease. However, there are a few reports on the willingness to HPV vaccinate, and the evidence for the factors contributing to HPV vaccine intention among female medical students in Hubei remains limited. Thus, this study sought to assess the HPV vaccination intentions and its potential associated factors among unvaccinated female medical college students in Hubei Province, China, which will help us to understand the factors influencing intention to receive the HPV vaccine and provide evidence for health decision-makers to plan or carry out effective strategies to optimize uptake of the HPV vaccine.

## Materials and Methods

### Study design and setting

A cross-sectional study was conducted in six colleges in Hubei Province, China, from April to August 2023.

### Study population and sampling

The eligible participants were female medical college students aged 18–26 years with no communication problems who were unvaccinated against HPV and willing to participate, although they were excluded if they provided an incomplete answer or showed a lack of interest in participation. The sample size estimation was calculated using Daniel's formula,<sup>[18]</sup> with an estimator that the total number of female medical college population is 38,000 and the percentage of female college student intention to initiate HPV vaccine in the central part of China being 46.2%,<sup>[5]</sup> and we desire a 95% confidence interval and 3% of precision of estimator. This accounted for 889 participants plus 10% compensation for non-response or dropout. The final sample size was 988. The female college students who met the eligible criteria were enrolled using the multistage sampling method. First, the selection of six colleges was conducted through a lottery method among all 21 colleges with medical majors in Hubei Province. Second, the six faculties of each college were chosen using the lottery method from a pre-defined list. Finally, the student selection process took place within each college, employing a systematic random sampling approach.

### Data collection tool and technique

The structured questionnaires were developed based on a literature review, which consisted of six parts as follows:

**Part 1:** Socio-demographic factors included age, birth place, education background, academic year, parents' education level, yearly household income, sexual intercourse, vaccinated family members, and willingness to pay (WTP) for HPV vaccine. All variables were categorized as dichotomous variables, except for the age variable, which was a continuous variable.

**Part 2:** The knowledge of HPV was assessed using a 15-item HPV knowledge scale adapted from existing published measures<sup>[19]</sup> with all items judged as true or false. Participants received one point for a correct response, with a higher total score indicating a greater level of knowledge of HPV. The HPV-Knowledge scale had good internal consistency (Cronbach's alpha was 0.90).

**Part 3:** The knowledge of the HPV vaccine was measured using an 11-item HPV knowledge scale modified from the Student HPV survey.<sup>[20]</sup> Knowledge of the HPV vaccine is also gained by judging whether it is true or false. Participants received one point for a correct response, with a higher total score indicating a greater level of knowledge of HPV. The HPV vaccine knowledge scale had good internal consistency (Cronbach's alpha was 0.90).

**Part 4:** The intention to initiate HPV vaccination was measured was assessed using one item developed by Huang *et al.*<sup>[21]</sup> The participants were asked to «please rate your intention to get HPV vaccination in the future» from 1 (totally no intention) to 10 (extremely high intention). A higher score on the item indicates a higher willingness to receive vaccinations afterward.

This variable was also divided into two groups (high and low) based on the median method. The median in this study was 5, so we utilized that as our cutoff point. Participants had low intention if they responded less than 5, while they had high intention if they responded 5 or above.

**Part 5:** HPV infection prevention awareness was adapted from previous study.<sup>[22]</sup> The questionnaire consisted of three subscales including HPV infection risk factors (6 items), transmitted ways (3 items), and prevention of HPV infection (7 items), with all items judged as true or false. Participants received one point for a correct response, with a higher total score indicating a greater level of awareness of HPV infection prevention. All three subscales had high internal consistency (Cronbach's alphas were 0.71, 0.78, and 0.83, respectively).

**Part 6:** The protection motivation theory (PMT)-related factors were measured by the PMT scale adapted from Li's research.<sup>[23]</sup> The PMT questionnaire consisted of 4 subscales, including participants' perceived susceptibility (3 items), perceived severity (4 items), perceived response efficacy (4 items), and perceived self-efficacy (5 items). The respondents were asked to rate their agreement on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score on each subscale indicated a stronger presence of the corresponding construct in the participants' responses. All four subscales had high internal consistency (Cronbach's alphas were 0.94, 0.95, 0.97, and 0.96, respectively).

### Statistical analysis

Descriptive statistics were performed for all variables. Binary logistic regression was used to assess the potential factors influencing the intention to initiate HPV vaccination. The variables that exhibited significance ( $P < 0.25$ )<sup>[24]</sup> during the bivariate analysis were incorporated into the multivariate logistic regression model. The adjusted OR was estimated from multivariable logistic regression to determine the relationship between knowledge and information-receiving factors, PMT-related factors, socio-demographic factors, and HPV vaccination intention after adjusting for all other predictors. We developed a series model; for example, in model 1, we added three knowledge variables to

the model to assess the association between these factors with HPV vaccination intention only. Then, the PMT-related factors were entered into model 1 to investigate the relationship between knowledge and information-receiving, the PMT-related factors, and HPV vaccination intention after adjusting for each predictor. Finally, all sociodemographic factors were entered into model 3 to examine the association between knowledge and information-receiving, the PMT-related factors, and HPV vaccination intention after adjusting for all socio-demographic variables. The level of statistical significance was set at a  $P$  value  $< 0.05$  in both the bivariate and multivariate analyses. All analyses were conducted using SPSS version 19.0 (IBM Corp., Armonk, NY, USA).

### Ethical approval

The participants were informed of the study's objectives and provided written informed consent before collecting the research information. This research was approved by the Review Ethics Boards of Mahasarakham University (ref no. 090-045/2023).

### Results

The respondents had a mean age of  $19.3 \pm 1.1$  years, and approximately 85.5% reported a high intention to get the HPV vaccine. More than half of them (58.4%) hailed from villages in rural areas (not shown in Table 1) and had attended college (70.2%). Regarding the parents' information, about 65.5% of fathers and 72.2% of mothers had completed lower than high school levels, and approximately 61.5% of the families had an annual income below 50,000 CNY. In addition, only 5.7% of the respondents engaged in sexual intercourse, about 51.5% reported that family members had never received the HPV vaccine, and 82.3% expressed willingness to pay (WTP) for HPV vaccine. Besides the knowledge and information receiving factors investigated, the mean scores for knowledge of HPV, knowledge of HPV vaccine, and HPV infection prevention awareness were  $7.7 \pm 3.01$ ,  $6.7 \pm 2.7$ , and  $11.5 \pm 1.9$ , respectively. Moreover, the PMT-related factors showed the mean scores for perceived susceptibility, perceived severity, perceived response efficacy, and perceived self-efficacy were  $4.9 \pm 2.2$ ,  $12.8 \pm 5.1$ ,  $15.8 \pm 3.5$ , and  $19.4 \pm 4.1$ , respectively [Table 1].

In bivariate analyses, the results showed that higher intention to receive HPV vaccine was strongly associated with knowledge of HPV and HPV vaccine and HPV infection prevention awareness. In terms of PMT-related factors, it was shown that perceived severity, perceived response efficacy, and perceived self-efficacy were linked to heightened intention to receive the HPV vaccine. Additionally, students who had a high intention to

**Table 1: Distribution of sociodemographic factors, knowledge and information received, HPV infection prevention awareness, and PMT factors by HPV vaccination intention**

Variable	HPV vaccination intention		
	Total (n=988) n (%)	High intention (n=845) n (%)	Low intention (n=143) n (%)
Socio-demographic factors			
Age (years)	19.2±1.1	19.2±1.1	19.1±1.1
Education background			
Bachelor degree	294 (28.8)	579 (68.5)	115 (80.4)
College degree	694 (70.2)	266 (31.5)	28 (14.5)
Father's educational level			
Less than high school	642 (65.0)	537 (63.6)	105 (73.4)
High school and above	469 (35.0)	308 (36.4)	38 (26.6)
Mather's educational level			
Less than high school	713 (72.2)	601 (71.1)	112 (78.3)
High school and above	275 (27.8)	244 (28.9)	31 (21.7)
Yearly household income (CNY/person)			
<50 000	608 (61.5)	479 (56.7)	129 (90.2)
50000 and above	380 (38.5)	366 (43.3)	14 (9.8)
Sexual intercourse			
Yes	56 (5.7)	51 (6.0)	5 (3.5)
No	932 (94.3)	794 (94.0)	138 (96.5)
Vaccinated family members			
Yes	479 (48.5)	438 (51.8)	41 (28.7)
No	509 (51.5)	407 (48.2)	102 (71.3)
Willingness to pay for HPV vaccines			
Yes	813 (82.3)	738 (87.3)	75 (52.4)
No	175 (17.7)	107 (12.7)	68 (47.6)
Knowledge and information receiving			
Knowledge of HPV	7.7±3.0	8.1±2.7	5.4±3.7
Knowledge of HPV vaccine	6.7±2.9	7.1±2.4	4.6±3.3
HPV infection prevention awareness	11.5±1.9	11.6±1.8	10.3±2.0
The PMT-related factors			
Perceived susceptibility	4.9±2.2	5.0±2.3	4.6±1.9
Perceived severity	12.8±5.1	13.3±5.0	10.1±4.8
Perceived response efficacy	15.8±3.5	16.2±3.2	13.0±4.1
Perceived self-efficacy	19.4±4.1	19.9±3.9	16.4±3.7

Values are presented as n (%) or mean±Standard deviation; CNY=Chinese Yuan

receive the HPV vaccine had attended college, their father had completed high school and above and had a yearly household income of more than 50,000 CNY, and family members had received the HPV vaccine and were willing to pay for HPV vaccine [Table 2].

In multivariate analyses, model 1 revealed that three knowledge and information-receiving factors were positively associated with a high intention to receive the HPV vaccine, consistent with the results obtained from the bivariate model. In model 2, the PMT-related factors were added to the model, and the presence of knowledge regarding HPV and awareness of HPV infection prevention remained significantly associated with a higher intention to receive the HPV vaccine. Moreover, three out of the four PMT-related factors showed a positive association with HPV vaccine intention, with the exception of perceived susceptibility. In model 3, socio-demographic factors were added to the

model. The results were identical to those in model 2, and two knowledge and information-receiving factors and three PMT-related factors were significantly associated with a higher intention to receive the HPV vaccine after controlling for other predictors. Additionally, individuals who had willingness to pay for a HPV vaccine had higher HPV vaccination intention.

## Discussion

This present study revealed that knowledge plays an important role in vaccine intention among female medical college students. The students who had higher scores of knowledge of HPV and HPV infection prevention awareness were more likely to express an intention to get vaccinated. This aligns with previous research of NatipagonShah *et al.*<sup>[25]</sup> and Oz *et al.*,<sup>[26]</sup> who reported that intention to obtain HPV vaccine was significantly associated with knowledge of HPV

**Table 2: Odds ratios and 95% confidence intervals from logistic regression for HPV vaccination intention**

Variables	Bivariate		Model 1		Model 2		Model 3	
	Unadjusted OR (95%CI)	P	Adjusted OR (95%CI)	P	Adjusted OR (95%CI)	P	Adjusted OR (95%CI)	P
Knowledge and information receiving								
Knowledge of HPV	1.33 (1.26-1.42)	<0.001	1.27 (1.14-1.41)	<0.001	1.18 (1.08-1.28)	<0.001	1.18 (1.08-1.29)	<0.001
Knowledge of HPV vaccine	1.37 (1.29-1.46)	<0.001	1.18 (1.08-1.29)	<0.001	1.07 (0.97-1.18)	0.156	1.04 (0.94-1.04)	0.421
HPV infection prevention awareness	1.44 (1.30-1.59)	<0.001	1.19 (1.07-1.26)	<0.001	1.25 (1.11-1.40)	<0.001	1.22 (1.09-1.37)	<0.001
The PMT-related factors								
Perceived susceptibility	1.08 (0.99-1.18)	0.069	-	-	1.03 (0.93-1.14)	0.574	1.01 (0.91-1.13)	0.798
Perceived severity	1.13 (1.09-1.18)	<0.001	-	-	1.06 (1.01-1.10)	0.022	1.06 (1.01-1.11)	0.018
Perceived response efficacy	1.26 (1.20-1.32)	<0.001	-	-	1.09 (1.02-1.17)	0.016	1.10 (1.03-1.17)	0.004
Perceived self-efficacy	1.23 (1.17-1.29)	<0.001	-	-	1.12 (1.05-1.19)	<0.001	1.09 (1.00-1.16)	0.040
Socio-demographic factors								
Age (year)	1.15 (0.97-1.35)	0.094	-	-	-	-	0.86 (0.68-1.07)	0.175
Education background (ref.: bachelor degree)	0.53 (0.34-0.82)	0.004	-	-	-	-	0.78 (0.43-1.40)	0.409
Father's educational level: high school and above (ref.: less than high school)	0.63 (0.42-0.95)	0.023	-	-	-	-	0.70 (0.40-1.23)	0.212
Mother's educational level: high school and above (ref.: less than high school)	1.46 (0.96-2.24)	0.077	-	-	-	-	1.02 (0.56-1.86)	0.946
Yearly household income (CNY/person) (ref.: <50 000)	0.14 (0.08-0.25)	0.006	-	-	-	-	0.16 (0.08-0.30)	0.162
Sexual intercourse (ref.: no)	0.56 (0.22-1.44)	0.231	-	-	-	-	1.46 (0.48-4.45)	0.507
Vaccinated family members (ref.: no)	0.37 (0.25-0.55)	<0.001	-	-	-	-	0.73 (0.46-1.15)	0.172
Willingness to pay for HPV vaccines (ref.: no)	0.16 (0.10-0.23)	<0.001	-	-	-	-	0.02 (0.17-0.44)	<0.001

OR=Odds ratio; CI=Confidence interval; ref=Reference group; CNY=Chinese Y

and HPV vaccine. One possible explanation is that comprehensive knowledge empowers individuals with a clear grasp of the potential health risks posed by HPV infection and the preventive efficacy of the vaccine.<sup>[27]</sup> Informed individuals are more likely to perceive a personal susceptibility to the associated health hazards, thus instilling a sense of urgency to proactively safeguard their well-being through vaccination.<sup>[28]</sup>

Our study also found that HPV vaccination intention was influenced by PMT-related factors, particularly perceived severity, perceived response efficacy, and perceived self-efficacy. Thus, participants who perceived HPV infection as severe, believed in the effectiveness of the vaccine, and felt confident in their ability to receive and benefit from the vaccine were more inclined to express an intention to receive it. This is consistent with previous studies of Huang *et al.*<sup>[9]</sup> and Dai *et al.*,<sup>[29]</sup> who postulated that individuals' perceptions of threat and efficacy play a central role in motivating health-related behaviors. However, our study showed that perceived susceptibility to HPV infection and HPV-associated diseases was not a predictor of HPV vaccine intention. A previous study also showed that people with a medical background who believed that they were at low risk of HPV infection had a lower intention to get vaccinated.<sup>[26]</sup> Furthermore, we also found that the willingness to pay for HPV vaccines was related to vaccine intention. This is consistent with the studies conducted in Vietnam<sup>[30]</sup> and Philippines;<sup>[31]</sup>

the willingness to pay was a major factor in the intention to receive the HPV vaccine. However, in China, the HPV vaccine is not currently a part of China's national immunization program or medical insurance. This has resulted in many individuals refusing or delaying getting vaccinated due to the cost of the vaccine. Also, the socio-economic factor has always been a major obstacle to the HPV vaccination behavior<sup>[32,33]</sup> since the high price for three doses of HPV vaccine is still a financial burden. Besides, previous studies revealed that the medical students' average willingness to pay for the HPV vaccines was lower than the market price;<sup>[33]</sup> the majority of doctors and nurses also found the HPV vaccine to be too expensive.<sup>[34]</sup> Thus, strategies aimed at increasing the willingness to receive HPV vaccination among young women with lower incomes should be adopted by the government to increase the rates and intention of HPV vaccination. For example, prior research suggested that the "semi-mandatory HPV vaccination strategy," which subsidizes HPV vaccination targeted at low-income settings for high-risk individuals or demands targeted approaches to enhance the willingness to be vaccinated against HPV in high-risk geographic areas, might lead to a higher willingness to receive HPV vaccination.<sup>[35]</sup>

**Limitations and recommendation**

The several limitations must be acknowledged in this study. First, the cross-sectional design restricted our ability to establish causal relationships between the predictors

and HPV vaccine intention. Further longitudinal research would be beneficial in elucidating the temporal dynamics of these factors. Second, the study relied on self-reported data, which may introduce response biases. Future research could employ objective measures or utilize mixed-method approaches to enhance data validity. Additionally, the study was conducted among a specific population of female medical college students, which limits the generalizability of the findings to other populations. Despite these limitations, our study has a compensatory strength that allows for large sample sizes and controls for a wide range of covariates. Our results provided a better understanding of the complex factors that contribute to HPV vaccine intention and can enable us to identify the barriers to HPV vaccination among female medical students. Additionally, these can be beneficial to designing intervention programs to improve vaccination rates and educational and training programs among female medical students in health schools and colleges for their future actions as health service providers in vaccination programs.

## Conclusion

The study showed that 85.5% of female medical college students currently had a high HPV vaccination intention in Hubei Province, China. Based on the PMT model, this study found that perceived severity, perceived response efficacy, and perceived self-efficacy were associative factors toward HPV vaccination intention. Knowledge of HPV and HPV vaccines and willingness to pay for HPV vaccines were also statistically related to HPV vaccine intention. These results may support targeted educational interventions and strategies based on PMT for promoting HPV vaccination among this population. Thus, efforts to enhance vaccine acceptance and uptake and the design of interventions to address specific barriers and misconceptions associated with HPV vaccination should consider these factors.

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## Conflicts of interest

There are no conflicts of interests.

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