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Do Male University Students Know Enough About Human Papillomavirus (HPV) to Make Informed Decisions About Vaccination?

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Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Background: The aim of this study was to evaluate the awareness of human papillomavirus (HPV), knowledge of HPV-associated diseases, as well as willingness to undergo HPV vaccination among male university students in China, especially factors influencing vaccination willingness.

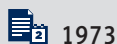
Material/Methods: We conducted a cross-sectional study among university students in Beijing, Tianjin, and Hebei, China by using a convenience sampling method. We assessed a) the awareness of HPV, b) knowledge of HPV-associated diseases, c) willingness to undergo HPV vaccination, and d) sexual behaviors among male university students.

Results: A total of 1274 male university students aged 16 to 26 years old were recruited to complete a self-administered questionnaire. In total, 39.6% of students had awareness of HPV. Among students who were aware of HPV, the percentage of participating students who knew that HPV causes cervical cancer, genital warts, penile cancer, anal cancer, and oropharyngeal cancer were 94.0%, 66.1%, 32.7%, 20.4%, and 18.7%, respectively. In total, 79.0% knew that men can acquire HPV; 38.7% were willing to receive HPV vaccination. Age, region, and major were related to the awareness of HPV. In addition, students who had previous sexual experiences had more knowledge about HPV and were more likely to express willingness to vaccinate.

Conclusions: Male university students do not know enough about HPV infection, and males' attitudes regarding vaccination are not sufficient. Education should be provided to promote awareness of HPV-associated diseases and vaccination.

MeSH Keywords: **Attitude • Awareness • Papillomavirus Vaccines • Students • Young Adult**

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Background

Human papillomavirus (HPV) infection is one of the most commonly encountered sexually transmitted infection (STI) worldwide [1]. HPV can be divided into high-risk and low-risk types according to its malignant potential [2]. Low-risk HPV types generally cause genital warts, while high-risk HPV types are associated with several cancers in different areas of the body, including cervical cancer, anal cancer, vaginal cancer, penile cancer, and oropharyngeal cancer, which together are responsible for 630 000 new cases of cancer per year worldwide [3–5]. Of these diseases, cervical cancer is the most common HPV-associated disease in females [6]. However, it cannot be neglected that HPV infections also remain common in males. According to the results of a population-based study, the prevalence of HPV infection among males in China is 10.5% [7]. HPV concordance levels are high among heterosexual couples, therefore infected males also put their female partners at increased risk of cervical cancer [8].

HPV vaccination is safe and highly effective against targeted HPV types and reduces the burden of HPV-associated diseases [9,10]. However, the HPV vaccine has not yet been approved for males in mainland China. A successful vaccination program depends on the population having adequate HPV-associated knowledge [11].

A number of researchers have investigated the awareness and knowledge of HPV in different populations and their willingness to undergo HPV vaccination [12–14]. Generally, limited HPV-associated awareness and knowledge were observed in China [15–17]. According to a meta-analysis of 58 studies, the awareness rate of HPV among the Chinese population was 16.0% [15]. However, only limited studies assessing the awareness and knowledge of HPV in young males are available. Tian et al. reported that the level of HPV awareness was 47.6% among men who have sex with men [18]. A study investigated a total of 1004 male university students in Hong Kong, revealing that 66.2% of participants had heard of HPV and 23.3% considered vaccinating for HPV acceptable [19]. While more studies are needed for further analyzing the association between sexual behavior and willingness to undergo HPV vaccination.

Young males at high risk for HPV due to risky sexual behaviors such as short-term partnerships, casual partnerships, and high number of sex partners [20,21]. Therefore, the aim of this study was to assess the awareness of HPV, knowledge of HPV-associated diseases, and willingness to undergo HPV vaccination among Chinese male university students.

Material and Methods

Study area and participants

This cross-sectional descriptive study was conducted over a period of 4 months from September 2018 to December 2018. Male university students aged 16 to 26 years were included, and foreign students were excluded. A convenience sampling approach was employed to recruit participants for this study from 16 public universities in Beijing, Tianjin, and Hebei, China. This group represented a population with higher education in China.

The survey was conducted using the Wenjuanxing Online Survey System. Students completed the survey using a smartphone application. All potential participating students accessed the questionnaires by scanning the WeChat (a Chinese social media app) QR code. Participants were each supplied a unique IP address to only submit a questionnaire once.

The sample size was assuming a prevalence of 50% for HPV awareness, a 95% confidence interval, and a sample error of 3%; a sample of 1067 was calculated.

Questionnaires

A modified questionnaire was adopted according to a study published by Blödt et al. [22]. The questions were structured into 4 sections and included 26 items. The questionnaire was pre-tested with 40 university students, and revisions were made after repeated discussions with experts. The final version of the questionnaire is shown in Supplementary Material.

Ethical approval

The study was approved by the Peking University Health Science Center Ethics Committee. Participants were briefed on the purpose of the study. Oral informed consent for participation in the survey was obtained from each university students. All the responses were collected voluntarily, and the information was processed with a high level of confidentiality and anonymity.

Data analysis

Data collection was performed by trained research assistants. The Statistical Packages for Social Sciences (SPSS, version 20.0, IBM) was used for all data entry and analyses. All descriptive statistics were presented as proportions. Chi square tests of heterogeneity were used to compare proportions. *P*-values <0.05 were regarded as statistically significant.

Table 1. Male university students' awareness about HPV based on demographic characteristics.

Characteristics	Distribution	Total	No. of participants aware of HPV	%	P-value*
Age (years)					<0.001
	16–20	774	265	34.2	
	21–26	500	239	47.8	
Ethnicity					0.914
	Han	1178	467	39.6	
	Other	96	37	38.5	
Birth place					0.010
	Northern China	866	364	42.0	
	Southern China	408	140	34.3	
Birth place					0.001
	Urban area	682	299	43.8	
	Rural area	592	205	34.6	
Major					<0.001
	Arts	160	60	37.5	
	Science	162	77	47.5	
	Engineering	424	144	34.0	
	Medicine	172	107	62.2	
	Economics	200	71	35.5	
	Other	156	45	28.8	
Total		1274	504	39.6	

* Pearson chi-square test was used for comparing proportions and continuity correction, or Fisher's exact test was used if appropriate. HPV – human papillomavirus.

Results

Participants' characteristics

The demographic characteristics are shown in Table 1. A total of 1274 male university students participated in the study; the mean±standard deviation (SD) age of participants was 20.4±2.4 years (range 16 to 26 years). Most of participants were Han, which is the main ethnic group in China.

Awareness about HPV

Male university students' awareness about HPV is shown in Table 1. Before the study, 60.4% (770 out of 1274 students) had never heard of HPV. The main variables influencing HPV knowledge were age, region, and education major. Older participants had higher levels of awareness about HPV than the

younger participants (47.8% versus 34.2%, $P<0.001$). Medical students were more aware than students of other majors. The awareness of students from different regions (northern and southern; urban and rural) were also different. Ethnicity was not related to HPV awareness.

Knowledge about HPV-associated diseases

Among the participants who had heard of HPV, 94.0% (474 out of 504 participants) knew that HPV causes cervical cancer, but only 66.1%, 32.7%, 20.4%, and 18.7% knew HPV can cause genital warts, penile cancer, anal cancer, and oropharyngeal cancer respectively. Regarding transmission route, most students (94.0%) knew that HPV might be transmitted through sex, 73.6% knew about blood transmission, and 32.1% knew that close contact was one of the HPV transmission routes. When asked about whether women can acquire HPV, almost

Table 2. Male university students' knowledge about HPV infection.

Variable	No. of correct answers (Total=504)	%
HPV infection may lead to		
Genital warts	333	66.1
Penile cancer	165	32.7
Anal cancer	103	20.4
Oropharyngeal cancer	94	18.7
Cervical cancer	474	94.0
HPV can be transmitted through		
Sex	474	94.0
Blood	371	73.6
Close contact	162	32.1
HPV can affect		
Males	398	79.0
Females	485	96.2

HPV – human papillomavirus.

all participants (96.2%) answered correctly; however, when asked about whether men can acquire HPV, a smaller portion (79.0%) answered correctly (Table 2).

Willingness to undergo HPV vaccination

Among all participants, 38.7% (493 out of 1274 participants) reported being willing to undergo HPV vaccination, 12.4% refused to receive the vaccine, and approximately half of them (48.9%) hesitated to receive the vaccine. As shown in Table 3, age, ethnicity, region, and education major were not related to the willingness to undergo HPV vaccination.

In addition, the reasons for refusing vaccination and the measures to promote vaccination were investigated. The most common reasons for denial of the vaccination were "I'm not at risk for getting HPV" (51.9%), "I worry about the safety of vaccine" (40.5%), and "The vaccine has not been widely used" (38.0%). The main measures to promote vaccination among students who hesitated to take the vaccine included "Doctor recommends vaccination" (80.7%) and "The safety and efficacy of the vaccine are confirmed" (75.4%).

The relationship between the knowledge level regarding HPV and the willingness to undergo HPV vaccination are displayed in Table 4. Students who know that HPV infection may lead to penile cancer, anal cancer, and oropharyngeal cancer were more likely to accept HPV vaccination than students who did

not have previous knowledge ($P<0.05$). Similarly, students who knew that HPV could affect males were more likely to uptake of vaccination than students who did not have the relevant knowledge ($P<0.001$).

Sexual behaviors of participants

Among male university students, 75.7% of participants (965/1274) had no sexual experience. In total, 24.3% (309/1274) had sexual experience, of whom 64.2% reported that the age of sexual debut was ≤ 20 years old, only 58.5% reported that a condom was always used during sexual intercourse, and 87.0% reported that the number of sexual partners was ≤ 3 (Table 5).

In addition, students who had sexual experience had a higher level of awareness of HPV (50.5% vs. 36.1%, $P<0.001$), and were more likely to express willingness to vaccinate (44.7% vs. 36.8%, $P=0.016$). The awareness and attitude were negatively associated with the age of sexual debut, number of sexual partners, and condom usage ($P>0.05$).

Discussion

Vaccinating males is expected to reduce virus transmission, enhance herd immunity, and prevent HPV-associated diseases in both genders [23]. Higher education is associated with better awareness of health [24]. In our study, we chose male

Table 3. Attitude of male university students towards HPV vaccination based on demographic characteristics.

Characteristics	Distribution	Total	No. of participants willing to undergo vaccination	%	P-value*
Age (years)					0.378
	16–20	774	292	37.7	
	21–26	500	201	40.2	
Ethnicity					0.515
	Han	1178	459	39.0	
	Other	96	34	35.4	
Birth place					0.327
	Northern China	866	327	37.8	
	Southern China	408	166	40.7	
Birth place					0.065
	Urban area	682	280	41.1	
	Rural area	592	213	36.0	
Major					0.632
	Arts	160	63	39.4	
	Science	162	67	41.4	
	Engineering	424	166	39.2	
	Medicine	172	72	41.9	
	Economics	200	68	34.0	
	Other	156	57	36.5	
Total		1274	493	38.7	

* Pearson chi-square test was used for comparing proportions and continuity correction, or Fisher's exact test was used if appropriate. HPV – human papillomavirus.

university students as the target population, which has higher education and more knowledge about HPV. The level of knowledge about HPV in the male general population may be lower than the target population. In addition, university age males are potentially the most interested in HPV vaccination and other preventive measures.

Our data showed that 39.6% had previously heard of HPV, and the results were similar to recent studies [19,25–27]. Of note, the awareness rate of HPV vaccines in China are lower than those in some developed countries (e.g., the United States, Italy, and Korea) [28–30]. Among participants who had heard of HPV, the majority correctly recognized that HPV is the cause of cervical cancer (94.0%). However, the relationship between HPV and other cancers, such as penile cancer (32.7%), anal cancer (20.4%), and oropharyngeal cancer (18.7%), is less known. Knowledge about the association of HPV with male cancer types

was also low in other studies [19,31,32]. Whether in males or females, HPV is actually a very common infection. However, in our research, 3.8% of the population were unaware that HPV could affect females, and 21.0% were unaware that HPV could affect males. These findings reflect these male university students had poor knowledge about HPV-related diseases. Due to most participating students from national key universities, we can infer that the general male population lacks knowledge of HPV. This knowledge gap should be filled by strengthening HPV-associated health education.

In our study, 38.7% of participants indicated they would agree to be vaccinated, 48.9% were unsure whether they would receive vaccination, and 12.4% refused to be vaccinated. Lower acceptability was found in several studies [33]. The results of a survey conducted in the United States showed that the 28.9% of male university students aged 18 to 27 years had

Table 4. Male university students' attitude towards HPV vaccination based on HPV knowledge.

Variable	Total	No. of participant willing to undergo vaccination	%	P-value*
HPV infection may lead to				
Genital warts				0.85
Correct	333	185	55.6	
Incorrect	171	93	54.4	
Penile cancer				0.045
Correct	165	102	61.8	
Incorrect	339	176	51.9	
Anal cancer				0.026
Correct	103	67	65.0	
Incorrect	401	211	52.6	
Oropharyngeal cancer				0.006
Correct	94	64	68.1	
Incorrect	410	214	52.2	
Cervical cancer				0.852
Correct	474	262	55.3	
Incorrect	30	16	53.3	
HPV can be transmitted through				
Sex				0.575
Correct	474	263	55.5	
Incorrect	30	15	50.0	
Blood				0.542
Correct	371	208	56.1	
Incorrect	133	70	52.6	
Close contact				0.389
Correct	162	94	58.0	
Incorrect	342	184	53.8	
HPV can affect				
Males				<0.001
Correct	398	238	59.8	
Incorrect	106	40	37.7	
Females				0.252
Correct	485	270	55.7	
Incorrect	19	8	42.1	
Total	504	278	55.2	

* Pearson chi-square test was used for comparing proportions and continuity correction, or Fisher's exact test was used if appropriate.
HPV – human papillomavirus.

Table 5. Association of sexual behaviors with awareness about HPV and willingness to undergo vaccination.

Characteristics	Total	Awareness about HPV			Willingness to undergo vaccination		
		No.	%	P-value*	No.	%	P-value*
Sexual experience				<0.001			0.016
Yes	309	156	50.5		138	44.7	
No	965	348	36.1		355	36.8	
Age of sexual debut (years)				1.000			0.095
≤20	197	99	50.3		95	48.2	
>20	110	56	50.9		42	38.2	
Blank**	2						
Number of sexual partners				0.234			0.058
≤3	260	126	48.5		110	42.3	
>3	39	23	59.0		23	59.0	
Blank**	10						
Condom use				0.643			0.294
Always	179	92	51.4		85	47.5	
Not always	127	61	48.0		52	40.9	
Blank**	3						

* Pearson chi-square test was used for comparing proportions and continuity correction, or Fisher's exact test was used if appropriate; ** omitted from % calculations. HPV – human papillomavirus.

positive attitude toward HPV vaccination [34]. The findings in our study support that there is a clear need for improving the knowledge about HPV infection and the corresponding vaccines among young males, with the goal to reduce HPV-associated diseases burden.

The results indicated university students may not be aware of their risk for HPV or other STIs, and many of them had unprotected sexual behaviors. 51.9% of participants who refused to be vaccinated declared that they were not at risk of HPV infection. When we investigated factors that would increase the willingness among the participants who hesitated to be vaccinated, doctors' recommendation ranked as the top factor (80.7%). While recommendations to be vaccinated from parents or friends did not seem to have a major impact on vaccination acceptance. Interestingly, participants were more likely to uptake vaccination if they were aware that men were susceptible to HPV infection.

Furthermore, the results showed that among medical students, 62.2% had heard of HPV, significantly higher than other majors; while 41.9% were willing to receive HPV vaccination, no difference from other majors. The difference between awareness of HPV and willingness of vaccination in medical students, suggested that vaccination intention might not be only influenced by the level of medical knowledge, but also by economic, cultural, policy, and other factors.

The results in the study have some limitations. First, because of limited manpower available, we used convenience sampling for data collection. The sample may be not representative of all male students in these study universities; in addition, the results cannot be generalized to other types of colleges in China. Second, this study was reliant on self-reported data. Therefore, responses to sensitive questions may be biased.

Conclusions

Male university students in China were not knowledgeable about HPV, and they did not have enough information to make an informed decision about HPV vaccine. There are numerous barriers to HPV vaccination in young adults. Considering the present findings, future research should evaluate interventions that could effectively enhance the awareness and knowledge of HPV-associated diseases, develop strategies to remove barriers to immunization and achieve high level of immunity in the young adult males.

Supplemenatry Data

Supplementary Material 1. Human papillomavirus (HPV) survey.

Human papillomavirus (HPV) survey

1. Personal Characteristics

- 1.1 Age: _____
- 1.2 Ethnicity: _____
 - Han
 - Other: _____
- 1.3 Birth place: _____
 - Urban
 - Rural
- 1.4 Major:
 - Arts
 - Science
 - Engineering
 - Medicine
 - Economics
 - Other: _____

2. Awareness and Knowledge of HPV Infection

- 2.1 Have you ever heard of human papillomavirus or HPV?
 - Yes
 - No

2.2 If you checked “Yes”, please answer the following questions

HPV infection may lead to

Genital warts	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Penile cancer	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Anal cancer	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Oropharyngeal cancer	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Cervical cancer	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect

HPV can be transmitted through

Sex	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Blood	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Close contact	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Food and water	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Mosquito bites	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Respiratory droplets	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect

HPV can affect

Male	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Female	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect

3. Attitude towards HPV vaccination

3.1 Are you willing to receive the HPV vaccine if it is licensed for males in mainland China?

- Yes No Unsure

3.2 If you checked “No”, please answer the following questions

What is the main reason you would NOT want to receive the vaccine?

- I'm not at risk for getting HPV.
 HPV infection causes serious health problems.
 I'm concerned about safety or side-effects.
 The vaccine is not effective.
 The vaccine costs too much.
 The vaccine is not available.
 Other: _____

3.3 If you checked “Unsure”, please answer the following questions

What would prompt you to receive the HPV vaccine?

- Doctor's suggestion
 Parents' suggestion
 Friends' suggestion
 Media's suggestion
 Health authority's suggestion
 Other: _____

4. Sexual Behaviors

4.1 Have you had a sexual experience?

- Yes No

4.2 If you checked “Yes”, please answer the following questions

What age did you have your first sexual experience?

- ≤20 years old >20 years old

How many lifetime sexual partners have you had?

- ≤3 >3

Condom use frequency?

- Always Not always

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