

# Knowledge and attitudes toward cervical cancer, human papillomavirus (HPV), and HPV vaccination among women in Taizhou area, China

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## Research article

**Keywords:** Knowledge, Attitudes, Cervical cancer, Human papillomavirus, Vaccines, China

**Posted Date:** January 13th, 2020

**DOI:** <https://doi.org/10.21203/rs.2.20654/v1>

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## **Abstract**

Background: Human papillomavirus (HPV) vaccine has been licensed in mainland China since 2016; however, the acceptability of HPV vaccination is unclear. This study aimed to evaluate women's knowledge and attitudes toward cervical cancer, HPV infection and its vaccination in Taizhou area, southeast of China.

Methods: A cross-sectional survey was conducted among women who visited the gynaecological clinic of Taizhou Hospital using a questionnaire-based interview. The process was divided into two periods, period I was May to August 2017, and period II was January to March 2019.

Results: A total of 819 women were conducted, and 736 were included in the final analysis. Most women (92.4%) had ever heard of cervical cancer. Almost half of women had ever heard of HPV (57.5%) and HPV vaccines (53.1%). Knowledge level of cervical cancer, HPV infection and its vaccines was inadequate; only 12.2% achieved 21-30 scores (at a 30-point scale). Logistic regression analysis showed that marital status, education, occupation, and family annual income were statistically significantly related to the knowledge level ( $P < 0.05$ ). Additionally, 64.8% of women knew that HPV vaccines are now available in mainland China; however, only 4.3% have been vaccinated. 37.8% of women knew about the preventable effect of HPV vaccines on cervical cancer (period I vs. period II, 31.0% vs. 48.9%,  $P < 0.05$ ). Although women with the low awareness of HPV, the willingness to receive HPV vaccination was high (94.1%) in the present study.

Conclusion: Our survey indicated that there is an urgent need for the persistent public health education to ensure successful implementation of HPV vaccination program in Taizhou area, China. Emphasis should be directed to educate the knowledge on HPV infection and its association with cervical cancer, thereby helping to increase HPV vaccination and reduce incidence of cervical cancer.

## **Background**

Cervical cancer ranks fourth in the incidence and mortality of gynecological malignancy worldwide, with an estimated 570,000 new cases and 311,000 deaths reported in 2018 [1]. Over 85% of the global cervical cancer burden occurs in developing countries [1]. China, as one of the top contributors to the global burden of cervical cancer, there was estimated 98,900 new cases and 30,500 deaths attributed to cervical cancer in 2015 [2]. Developed countries have reduced the incidence of cervical cancer due to human papillomavirus (HPV) vaccination, effective cervical screening and early treatment for precancerous lesions, which can eventually eliminate cervical cancer [3]. However, China still has a long way to go before cervical cancer is eliminated. In contrast to the reducing cervical cancer incidence and mortality trends in developed countries [4], a substantial increase in incidence and mortality was seen in China [2]. Multiple factors have been identified as contributors to the incidence of cervical cancer in developing regions of the world, such as lack of vaccines, lack of cervical screening programs, poor treatment

services, and high HPV infection [5]. Additionally, women's knowledge of the association between HPV infection and cervical cancer is very low in developing countries [6–8].

Cervical cancer is one of the greatest threats to women's health in China [1, 2]. It has been established that persistent infection with high-risk HPV may lead to precancerous lesions that may develop into cervical cancer if untreated. Prophylactic HPV vaccines, which are recommended to be a primary prevention for cervical cancer prevention by WHO for national immunization program, have been commercially available in more than 100 countries since 2006 [9]. In mainland China, HPV vaccines have been approved Cervarix in July 2016 for women aged 9–45 years, Gardasil 4 in May 2017 for women aged 20–45 years, and Gardasil 9 in April 2018 for women aged 16–26 years [10, 11] by the China Food and Drug Administration (CFDA). So far, 7 million doses of HPV vaccines have been released to mainland China's target market [11]. It is worth noting that knowledge of cervical cancer, HPV infection and attitudes toward HPV vaccines among the population of mainland China maybe the crucial factors in reducing the burden of cervical cancer and HPV related disease in the future.

Taizhou, located in China's most developed southeast coastal region, is known for its thriving economy especially its famed GEELY and FEIYUE. Taizhou has a land area of 9411 square kilometers and a resident population of 61.18 million. Taizhou Hospital is located in the center of the Taizhou area, which is the large-scale general hospital in Zhejiang province. Our previous Taizhou Area HPV study showed that cervical hrHPV infection rate was 17.2% among Taizhou-based general population [12], which was lower than the rates reported in southern China (31.9% in Haikou) or in western China (27.3% in Chongqing) [13], but was higher than the rates in Beijing (9.9%) [14]; these results may be related to economic factors, cultural diversity, education, HPV awareness and lifestyles between geographical regions. To our knowledge, there are no studies exploring Taizhou women's understanding of the importance of the HPV vaccines in a qualitative and in-depth exploration of the topic. In this study, we evaluated women's knowledge of cervical cancer, HPV infection and attitudes toward its vaccines in Taizhou area, southeast of China.

## Methods

### Participants' Recruitment

Women who spontaneously visited the gynaecological clinic of Taizhou Hospital were recruited. The entire survey process was divided into two periods with almost 2-year interval. Period I was May to August 2017, and period II was January to March 2019. Before questionnaires, all participants were given information about the purpose of this survey and assurance the confidentiality of all information provided. Face-to-face interviews were conducted by the trained gynaecologist in their clinic room after receiving consent. At the end of the survey, all participants were given the information brochure on cervical cancer prevention.

# Questionnaires Data

A 44-question questionnaire was designed in the Chinese language, including four sections: 1) demographic characteristics, 2) knowledge of cervical cancer, HPV infection and its vaccines, 3) attitudes toward HPV vaccination, 4) source of information and health willing. Demographic characteristics included ethnicity, age, marital status, education, occupation, personal monthly income, family annual income and smoking habit. For most knowledge questions, the responses were limited to "Yes", "No", or "Don't know". Some questions about information sources had multiple-choice items. Knowledge scores included 11 scores on cervical cancer, 9 scores on HPV infection, and 10 scores on HPV vaccines. For knowledge questions, each correct answer was recorded as 1 score, and each incorrect or "Don't know" answer recorded as 0 score. If the answer was missing or invalid, the question was also recorded as 0 score. Individual score was summed up as a total knowledge scores between 0 and 30.

## Data management and Analysis

All completed questionnaires were sent to the Medical Research Center. To ensure the accuracy of the questionnaires data, two staff members separately entered the survey information into EpiData 3.1 database. Data were analyzed using the SPSS for windows (version 16.0; SPSS Inc., Chicago IL). Percentages were used to describe the demographic characteristics of the survey participants. Based on the demographic characteristics, the survey participants were divided into subgroups in order to link their knowledge of cervical cancer and HPV infection, as well as attitudes toward HPV vaccines. Chi-squared test was used to analyze the differences between these subgroups. Multivariable logistic regression was used to evaluate the role of various variables associated with knowledge of cervical cancer prevention. Statistical tests were two-sided, and  $P < 0.05$  was considered statistically significant.

## Results

### *Demographic Characteristics*

A total of 819 women were surveyed in this study. Of these, 761 accepted the questionnaires and 58 declined (92.9% participation rate). Of the 761 questionnaires returned, 25 were excluded from analysis (15 gave inconsistent or missing information, and 10 lived outside the Taizhou area); a total of 736 women (89.9%) (median age 32.2 years; range 18–64) were included in the final analysis. Demographic characteristics of the survey participants were shown in Table 1. The majority 721 (98.0%) of women were ethnic Han Chinese. 458 questionnaires were carried out from May to August 2017 (period I) and 278 questionnaires were carried out from January to March 2019 (period II).

## Knowledge of cervical cancer prevention

Most women had ever heard of cervical cancer (92.4%). Almost half of women had ever heard of HPV (57.5%) and HPV vaccines (53.1%). 52.0% of women believed that HPV infection may cause cervical cancer. But only 38.6% of women knew that HPV infection is sexually transmitted, and 27.9% of women were aware that HPV infection was common among sexually active women. 31.3% of women knew that most HPV infections were asymptomatic, and 21.7% of women thought that HPV could be cleared by the immune system. In addition, most women (85.1%) believed that cervical cancer screening is important for cancer prevention. 59.2% of women agreed that woman should be screened for cervical cancer, even if she has already been vaccinated. Women's knowledge of cervical cancer prevention in Taizhou area was presented in Table 2.

Knowledge level of cervical cancer, HPV infection and its vaccines among women in Taizhou area was inadequate, which scores were presented in Table 3. Only 12.2% women obtained 21–30 scores (at a 30-point scale). 13.9% of women achieved 7–9 scores in the cervical cancer knowledge (at a 9-point scale), 14.3% had 8–11 scores in the HPV infection knowledge (at an 11-point scale), and 29.5% had 7–10 scores in the HPV vaccines knowledge (at a 10-point scale). In addition, we found that statistically significant difference between period I and period II in the overall scores ( $P<0.05$ ).

## Factors related to the level of knowledge

Women's knowledge level of cervical cancer prevention was highly related to the demographic characteristics. Logistic regression analysis showed that marital status, education, occupation, and family annual income were statistically significantly related to the level of HPV related knowledge ( $P<0.05$ ) (Table 4). Women with more education or with medical background were significantly more likely to have knowledge scores of 15 or higher ( $P<0.05$ ). Furthermore, women with higher family annual income were more likely to have good knowledge of cervical cancer prevention ( $P<0.05$ ). However, there was no significant association between knowledge level and age ( $P = 0.158$ ), smoking habits ( $P = 0.807$ ), and personal monthly income ( $P = 0.631$ ).

## Attitudes toward HPV vaccines

Many women (64.8%) knew that HPV vaccines are now available in mainland China; 37.8% of women were aware the preventable effects of HPV vaccines on cervical cancer (period I and period II, 31.0% vs. 48.9%,  $P<0.05$ ). However, only 4.3% of women have been vaccinated. 5.9% of women believed that their risk of developing cervical cancer is low. 21.5% of women concerned about the price of the vaccines. And 16.0% of women questioned the source of HPV vaccines in China. Furthermore, although women with the low knowledge on HPV, the willingness to receive vaccination was high (94.1%).

## Information sources of HPV related knowledge

Among our survey participants, social welfare activities (71.0%) were the main source of HPV awareness, followed by physicians/healthcare providers (46.0%), Internet/television (45.8%), school-based health education (25.8%), and family/friends (23.3%). In addition, 91.8% of women believed that it is necessary to know the hazards of HPV infection and the knowledge on its vaccines. 82.0% of women were aware that they need to improve their knowledge on HPV. They were willing to obtain more HPV related education through information brochure (80.3%) or lecture-based health education in hospital from experts (68.0%).

## Discussion

The present study provided the first insight into women's knowledge and awareness of cervical cancer, HPV infection and attitudes toward vaccines in Taizhou area, southeast of China. Among our survey participants who visited the gynaecological clinic, women had a good knowledge of cervical cancer. 92.4% of women had ever heard of cervical cancer. 85.1% agreed that cervical cancer screening is important for cancer prevention, and 77.3% believed that cervical cancer could be prevented and cured. These findings might be due to the large-scale promotion of National Cervical Cancer Early Detection Program in China since 2009. However, only 14.0% of women correctly answered on the cause of cervical cancer, including HPV infection, sexually transmitted diseases, multiple sexual partners, and smoking habit. The majority of these women (88.3%) who correctly answered on the cause of cervical cancer have college or above education. In previously reported studies, only 35.0% of adolescents had ever heard of cervical cancer [15, 16], this proportion was much lower than that among parents of young adolescents or undergraduates (approximately 79.0%) [17, 18]. In addition, the age of cervical cancer incidence tends to be younger [1, 2]. Therefore, in order to ensure the success of adolescents HPV vaccination in future, it is important to educate women on the ideal time to vaccinate their children. Acquiring knowledge is an important initial step; HPV related health education should be included in the school-based sexual education for adolescents.

Results from this study showed that 57.5% of women had ever heard of HPV, which was higher rate than that reported in underdeveloped western China (28.9%) [19], southern China (37.7%) [20], Shandong province (19.3%) [21], but was consistent with the data reported from Australia (63%) [22]; this results might be due to thriving economy of Taizhou, suggesting that women who lived in richer regions may know more about HPV. However, HPV related knowledge of our survey participants still needs to be improved, including healthcare providers, which reflects the fact that HPV DNA tests in cervical screening programs was difficult to promote in clinic [23]. In addition, only 1.0% (7/736) of women correctly answered all knowledge questions in HPV infection section. Only 27.9% were aware that HPV infection was common among sexually active women. 51.5% of women agreed that HPV infection may cause cervical cancer, but few women knew that HPV infection may also cause penile cancer (9.5%), anal cancer (4.6%), and genital warts (14.8%). The low rates of knowledge of HPV related cancer was consistent with rates reported from United States (approximately 10.0%) [24]. There was no significant difference in the level of HPV related knowledge between period I and period II ( $P>0.05$ ). Low levels of

knowledge on HPV infection and its connection to cervical cancer are considered to be the major hurdle for the successful implementation of HPV vaccination.

With the approval of HPV vaccines in mainland China recently years, women's knowledge and awareness on vaccines in period II was significantly higher than that in period I (68.7% vs. 43.7%,  $P<0.05$ ), which might be due to the Chinese government's role in promoting the HPV vaccines through print and electronic media. Surprisingly, only 4.3% of women have been vaccinated with HPV in this study. 75.9% of women questioned the efficacy of HPV vaccines which were the main problem in hinders the acceptance of HPV vaccination. 37.8% of women concerned the safety about vaccination, and 16.0% of women questioned the source of HPV vaccines in this study. The 2016 vaccines incident of Changsheng Biotechnology and Wuhan institute of Biological Products seriously damaged the confidence of the Chinese public in the vaccine system [25], and rebuilding trust is a daunting task. Although women with the low knowledge on HPV, the willingness to receive HPV vaccination was high (94.1%) if vaccines are available. It is noteworthy that if girls aged 9–15 years are left unvaccinated, about 381,000 cases of cervical cancer and 212,000 related deaths will occur among this group of girls in China [11]. Most importantly, the Chinese government has the responsibility to ensure that HPV vaccines produced and used in China are effective and safe [26]. Furthermore, communication of the benefits of HPV vaccination to these women in a coordinated manner might contribute to the progress of the preventive interventions.

Our results identified several factors which positively correlated with HPV related knowledge: marital status, education, occupation, and family annual income ( $P<0.05$ ). Especially for women with lower education, they should be more educated about HPV related knowledge. In this study, all survey participants got an information brochure on current status of cervical cancer in China, the relationship between HPV infection and cervical cancer, HPV vaccines, and high risk population of cervical cancer, to ensure successful implementation of HPV vaccination program in future. Furthermore, our survey women prefer to obtain health information from trusted sources, including lecture-based health education from physicians and community-based interventions from healthcare professionals. Thus, our future work should ensure regular health education on cervical cancer prevention at a shorter interval to ensure continuous effective [14, 27].

Our study has some limitations. First, the present survey is a cross-sectional study, and owing to its characteristics that prevents us from making any statements regarding causality. Second, all survey participants were patients who spontaneously visited the gynaecological clinic which cannot represent the general population in Taizhou area. Third, this study focused on Taizhou area of Zhejiang province, which located in China's most developed southeast coastal area. Compared with other parts of China, women's HPV related knowledge is relatively higher. Thus, our results may not be generalizable to the entire Chinese population.

## Conclusion

In summary, this study found that women in Taizhou area had higher knowledge on cervical cancer prevention than that reported in underdeveloped western China or southern China; however, women still lack knowledge of HPV infection and its association with cervical cancer which is regarded as one of the major barrier to implementation of HPV vaccination program. Emphasis should be directed to educate the knowledge on HPV and its link to cervical cancer, thereby helping to increase the HPV vaccination and reduce incidence of cervical cancer among women in Taizhou area.

## **Declarations**

### **Ethics approval and consent to participate**

This study was approved by the Institutional Medical Ethics Review Board of Taizhou Hospital in Zhejiang Province, China (approval # MERB-2017-020). Written informed consent was obtained from each participant before the survey. Data from questionnaires was analyzed anonymously.

### **Consent to publication**

Not applicable.

### **Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the supplementary file.

### **Competing interests**

The authors declare that they have no conflict of interests.

### **Funding**

This work was supported by grants from the Science and Technology Bureau of Zhejiang Province (2016C33231), the Science and Technology Bureau of Taizhou (1802ky11), the National Natural Science Foundation of China (31370920, 81372247), and the Zhejiang Provincial program for the cultivation of high-level innovative health talents.

### **Authors' contributions**

Designed the experiments: HHX JX. Conducted the survey: PXZ XJF. Entered the data: YQ FYP. Performed statistical analysis and drafted the manuscript: HHX ZY. All authors read and approved the final manuscript.

# Acknowledgments

Not applicable.

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## Tables

Table 1. Demographic characteristics of the survey participants (n=736)

<b>Characteristics</b>	<b>Number (n)</b>	<b>Percentage (%)</b>
<b>Ethnicity</b>		
Han	721	98.0
Others	15	2.0
<b>Region</b>		
LinHai	636	86.4
Non-LinHai	100	13.6
<b>Age</b>		
< 31	354	48.1
31-40	252	34.2
41-50	114	15.5
> 50	16	2.2
<b>Marital Status</b>		
Married	586	79.6
Unmarried/Divorced/Widowed/Others	150	20.4
<b>Education</b>		
High School or below	304	41.3
College and above	432	58.7
<b>Occupation</b>		
Government	233	31.7
Medical	112	15.2
Students	29	3.9
Farmers/Workers/service industry	41	5.6
Housewife/Unemployed/Free-lance/Others	321	43.6
<b>Personal Income, monthly</b>		
< 2000	170	23.1
2000-4000	294	39.9
4000-6000	181	24.6
6000-8000	58	7.9

> 8000	33	4.5
<b>Family Income, yearly</b>		
< 5W	104	14.1
5-10W	292	39.7
10-20W	266	36.1
> 20W	74	10.1
<b>Smoking Habit</b>		
Never smoked	709	96.3
Current/former smoker	27	3.7

Table 2. Knowledge of Cervical cancer, HPV infection, and HPV vaccines among women in Taizhou area

	Total (n=736)	Period I (n=458)		Period II (n=278)		<i>P</i> -value
	n	%	n	%	n	
<b>Cervical cancer related</b>						
Have you ever heard of cervical cancer?	680	92.4	425	92.8	255	91.7
Is persistent HPV infection the necessary cause of cervical cancer?	383	52.0	238	52.0	145	52.2
Can cervical cancer be prevented and cured?	569	77.3	352	76.9	217	78.1
Is important to participate in cervical cancer screening?	626	85.1	394	86.0	232	83.5
<b>HPV infection related</b>						
Have you ever heard of HPV?	423	57.5	260	56.8	163	58.6
Is HPV sexually transmitted?	284	38.6	168	36.7	116	41.7
Is HPV infection common among women?	205	27.9	127	27.7	78	28.1
Can HPV infect a man?	262	35.6	153	33.4	109	39.2
Can HPV be effectively treated with drugs?	278	37.8	156	34.1	122	43.9
Can most HPV infections be asymptomatic?	230	31.3	143	31.2	87	31.3
Can HPV be cleared by the immune system?	160	21.7	109	23.8	51	18.3
<b>HPV vaccine related</b>						
Have you ever heard of HPV vaccine?	391	53.1	200	43.7	191	68.7
Can cervical cancer be prevented by HPV vaccine?	278	37.8	142	31.0	136	48.9
Do girls/women need to be screened for HPV before getting vaccinated?	413	56.1	194	42.4	219	78.8
Is it safe to have multiple sexual partners after full course of HPV vaccine?	390	53.0	200	43.7	190	68.3
Do women who have already been vaccinated require cervical cancer screening?	436	59.2	221	48.3	215	77.3

Table 3. Summary of knowledge scores among women in Taizhou

Table 4.

	Total		Period I		Period II		<i>P</i> -value
	(n=736)	n	(n=458)	n	(n=278)	%	
<b>Scores of Cervical cancer knowledge</b>							<b>0.274</b>
0-3	446	60.6	277	60.5	169	60.8	
4-6	188	25.5	111	24.2	77	27.7	
7-9	102	13.9	70	15.3	32	11.5	
<b>Scores of HPV infection knowledge</b>							<b>0.156</b>
0-3	190	25.8	126	27.5	64	23.0	
4-7	441	59.9	262	57.2	179	64.4	
8-11	105	14.3	70	15.3	35	12.6	
<b>Scores of HPV vaccines knowledge</b>							<b>0.000</b>
0-3	306	41.6	242	52.8	64	23.0	
4-6	213	28.9	112	24.5	101	36.3	
7-10	217	29.5	104	22.7	113	40.7	
<b>Total knowledge scores</b>							<b>0.000</b>
0-10	324	44.0	237	51.7	87	31.3	
11-20	322	43.8	167	36.5	155	55.8	
21-30	90	12.2	54	11.8	36	12.9	

Multivariable Logistic Regression Analysis of Knowledge Scores among women

	HPV knowledge score(≥15) n=281	HPV knowledge score(<15) n=455	OR (95%CI)	P-value
<b>Age</b>				<b>0.158</b>
< 31	162(57.7)	192(42.2)	11.1(0.8-150.4)	
31-40	92(32.7)	160(35.2)	9.3(0.7-125.6)	
41-50	26(9.3)	88(19.3)	6.8(0.5-93.9)	
> 50	1(0.4)	15(3.3)	1	
<b>Marital Status</b>				<b>0.016</b>
Married	212(75.4)	374(82.2)	0.5(0.3-0.9)	
Unmarried/Divorced/Widowed/Others	69(24.6)	81(17.8)	1	
<b>Education</b>				<b>0.000</b>
High School or below	53(18.9)	251(55.2)	0.4(0.2-0.6)	
College and above	228(81.1)	204(44.8)	1	
<b>Occupation</b>				<b>0.000</b>
Government	75(26.7)	158(34.7)	0.7(0.5-1.1)	
Medical	96(34.2)	16(3.5)	11.1(5.7-21.8)	
Students	13(4.6)	16(3.5)	2.3(0.8-6.0)	
Farmers/Workers/service industry	7(2.5)	34(7.5)	1.1(0.4-2.7)	
Housewife/Unemployed/Freelance/Others	90(32.0)	231(50.8)	1	
<b>Personal Income, monthly</b>				<b>0.631</b>
< 2000	60(21.4)	110(24.2)	1.7(0.6-4.5)	
2000-4000	89(31.7)	205(45.1)	1.3(0.5-3.2)	

4000-6000	88(31.3)	93(20.4)	1.6(0.7-3.9)
6000-8000	30(10.7)	28(6.2)	1.5(0.6-4.1)
> 8000	14(5.0)	19(4.2)	1
<b>Family Income, yearly</b>			<b>0.012</b>
< 5W	35(12.5)	69(15.2)	0.5(0.2-1.2)
5-10W	79(28.1)	213(46.8)	0.4(0.2-0.7)
10-20W	125(44.5)	141(31.0)	0.7(0.4-1.3)
> 20W	42(14.9)	32(7.0)	1
<b>Smoking Habit</b>			<b>0.807</b>
Never smoked	272(96.8)	437(96.0)	1.1(0.4-2.9)
Current/former smoker	9(3.2)	18(4.0)	1

OR and *P*-value were obtained using logistic regression analysis model. Last category serves as a reference for OR calculation by logistic regression. *P* values <0.05 were considered statistically significant.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [DataofEpidata.xlsx](#)