

## Preplanned Studies

## Knowledge of Cervical Cancer and HPV, and Willingness to Receive HPV Vaccination Among 20–45-Year-Old Women — Six Provinces, China, 2018

Di Gao<sup>1</sup>; Gengli Zhao<sup>1</sup>; Jiangli Di<sup>2</sup>; Xiaosong Zhang<sup>1,\*</sup>; Linhong Wang<sup>3,#</sup>

### Summary

#### What is already known about this topic?

Cervical cancer is a significant public health problem with approximately 570,000 cases and 311,000 deaths occurring in 2018 globally. It is imperative to raise awareness of cervical cancer and human papillomavirus (HPV).

#### What is added by this report?

Compared to previous studies, this is one of the largest cross-sectional studies of cervical cancer and HPV in Chinese adult females in recent years. We found that knowledge level of cervical cancer and HPV vaccine was still inadequate among women aged 20–45 years old, and the willingness to receive HPV vaccination was highly associated with knowledge level.

#### What are the implications for public health practice?

Intervention programs should aim to improve awareness and knowledge about cervical cancer and HPV vaccines, primarily focusing on women of lower socio-economic status.

Cervical cancer, the fourth most frequently diagnosed cancer and the fourth leading cause of cancer death in women (1), is a significant public health issue that seriously threatens women's health worldwide (2). This cross-sectional study aims to explore the knowledge level of cervical cancer, and willingness to receive human papillomavirus (HPV) vaccination among women aged 20–45 years old. The cross-sectional, community-based study was conducted from June to September 2018 in 6 provinces of China, and a total of 7,240 women aged 20–45 years were surveyed. Overall, 55.3% of women demonstrated low knowledge levels about cervical cancer and HPV vaccination, and only 5.0% correctly answered all 7 questions. High knowledge level was significantly associated with the region, age group, occupation, education level, monthly family income and gravidity. Women with high knowledge levels were significantly

more likely to accept HPV vaccination than those with low knowledge levels. With each point increase in the knowledge score, the likelihood of willingness to vaccinate increased significantly ( $P_{\text{trend}} < 0.001$ ). Our study indicated that the knowledge level of cervical cancer and HPV vaccine was still inadequate among women aged 20–45 years old, especially those of lower socio-economic status. The willingness to receive HPV vaccination was highly associated with knowledge level.

An analysis of 185 countries from the Global Cancer Observatory database shows that approximately 570,000 cases of cervical cancer and 311,000 deaths from the disease occurred in 2018 globally. Meanwhile, China contributed 106,000 cases and 48,000 deaths (3). Increasing the rate of HPV vaccination is an essential strategy for cervical cancer prevention (4). The China Food and Drug Administration approved the HPV vaccine in 2016, but the coverage rate remained low in China. Therefore, it is crucial to improve the target population's knowledge about cervical cancer and HPV vaccination. This cross-sectional study aims to explore the knowledge of cervical cancer and willingness to receive HPV vaccination among women aged 20–45 years old in six provinces, and thus to provide evidence for the future intervention of HPV vaccination in China.

The cross-sectional, community-based study was conducted from June to September 2018 in 6 provinces of 3 socio-economic regions of China: eastern (Jiangsu and Shandong provinces), central (Hunan and Anhui provinces), and western (Shaanxi and Sichuan provinces). The capital of each province was regarded as the representative city, including Nanjing, Jinan, Changsha, Hefei, Xi'an, and Chengdu. In each city, one urban and one rural area were selected randomly as the survey sites. We recruited 490 women of different age groups (10–19 years; 20–39 years; 40–49 years;  $\geq 50$  years) by a multi-stage stratified random cluster sampling at each investigation site. Face-to-face interviews were conducted by community health service workers to collect information on

demographic characteristics, knowledge of cervical cancer and HPV vaccine, and also willingness to receive HPV vaccination. A total of 7,240 women aged 20–45 years were involved in the analysis, with an average age of  $35.1 \pm 7.6$  years. According to the number of correct answers among the 7 knowledge-related questions about cervical cancer and HPV vaccine, a knowledge score (range: 0–7) was assigned to every participant. And then, a score above or below five of seven items was used to define levels of knowledge (low level: score  $<5$ ; high level: score  $\geq 5$ ). In addition, participants were further required to answer their willingness to receive the HPV vaccination. The categorical variables were presented by numbers ( $n$ ) and percentages (%). Univariate and multivariate logistic regression models were used to analyze the related factors of knowledge level, and the association between knowledge score and willingness to receive HPV vaccination. Odds ratios (*ORs*) and 95% confidence intervals (*CI*s) were calculated. Statistical analyses were performed with STATA 14.0 (Stata Corporation, College Station, TX, USA). Statistical significance was assessed by two-tailed tests with a level of 0.05. This study has been approved by the Ethical Review Committee of the Chinese Center for Disease Control and Prevention.

A total of 7,240 women (age range: 20–45 years) completed the questionnaires. As shown in Table 1, of the women who responded to concerning questions, 91.1% had heard of cervical cancer (Q1), 75.5% knew cervical cancer could be prevented (Q3), 69.1% knew the benefits of regular cervical cancer screening (Q7), 60.3% had heard of HPV vaccines (Q5), and 54.1% knew HPV vaccines could prevent cervical cancer (Q6). However, only 10.9% knew more than half (4/7) of the risk factors for cervical cancer (Q2), and 10.8% knew more than half (4/7) of the prevention measures for cervical cancer (Q4). Overall, 44.7% of all women demonstrated high knowledge levels of cervical cancer and HPV vaccination (5/7), among whom only 5.0% correctly answered all 7 questions. In addition, 59.3% of women were willing to be vaccinated.

Associations of knowledge level with other factors are presented in Table 2. In the multivariate regression models, region, age group, occupation, education level, monthly family income and gravidity were significantly associated with knowledge level. Women from Central and Eastern China were more likely to have a higher knowledge level than those from Western China (Central: *OR*=1.39, 95% *CI*: 1.23–1.57; Eastern: *OR*=1.27, 95% *CI*: 1.12–1.44). Women aged 30–39 years, working as managerial and technical staff, and

having been pregnant one or two times had a higher knowledge level. Women with a higher education level and family income showed a higher knowledge level ( $P_{\text{trend}} < 0.001$ ).

A multivariate logistic regression to evaluate the association of cervical cancer and HPV vaccine-related knowledge score with the willingness to receive HPV vaccination is presented in Table 3. After adjustment for socio-demographic factors, women with high knowledge levels were significantly more likely to accept HPV vaccination than those with low knowledge levels (*OR*=9.98, 95% *CI*: 8.80–11.32). Furthermore, with each point increase in the knowledge score, the likelihood of willingness to vaccinate increased significantly ( $P_{\text{trend}} < 0.001$ ).

## DISCUSSION

The major finding was that more than half of the women had a low level of knowledge, mainly related to the region, age, occupation, education level, family income and gravidity. Furthermore, the willingness to vaccinate increased significantly with the improvement of knowledge level. Thus, improving cervical cancer and HPV vaccine-related knowledge among women, especially those of lower socioeconomic status, will be essential for HPV vaccination programs in China in future.

In this study, 60.3% of women heard of the HPV vaccine, which is much higher than the proportion in a meta-analysis of 58 observational studies in China (15.95%) in 2016 and Shenzhen local residents (35.3%) in 2015. This may be because the survey was conducted after the HPV vaccine entered the market in China and the respondents came from urban and rural areas belonging to the capitals of these provinces (5–6). When compared with data from college students, women aged 20–45 years old had lower awareness of the HPV vaccine, since the proportion was 74.0% in Zhengzhou (7) and 78.6% in Beijing (8), indicating that women at higher education levels may have more about the HPV vaccine.

Despite the high awareness rate of the HPV vaccine, the knowledge level of cervical cancer and the HPV vaccine was still inadequate among women. Only 5.0% of women correctly answered all seven questions, and most women (55.3%) knew answers to fewer than five questions. Lack of knowledge has been identified as one of the main barriers to the implementation of HPV vaccination. As the measurement of cervical cancer and HPV knowledge varied in different studies, it is difficult to compare the knowledge level directly.

TABLE 1. Knowledge of cervical cancer and HPV vaccine and willingness to be vaccinated Among 20–45-Year-Old Women, — 6 Provinces, China, 2018.

Knowledge-related questions	Yes [n (%)]	No [n (%)]
Q1: Have heard of cervical cancer	6,595 (91.1)	645 (8.9)
Q2: Knowledge of risk factors for cervical cancer ( $\geq 4$ )	790 (10.9)	6,450 (89.1)
Q2_1: Having multiple sexual partners	2,862 (39.5)	4,378 (60.5)
Q2_2: Had sexual intercourse and children at a young age	1,452 (20.1)	5,788 (79.9)
Q2_3: History of sexually transmitted diseases	2,150 (29.7)	5,090 (70.3)
Q2_4: Smoking	702 (9.7)	6,538 (90.3)
Q2_5: History of HPV infection	1,298 (17.9)	5,942 (82.1)
Q2_6: Aged 30–65 years old	948 (13.1)	6,292 (86.9)
Q2_7: Long-term use of oral contraceptives pills	785 (10.8)	6,455 (89.2)
Q3: Cervical cancer can be prevented	5,468 (75.5)	1,772 (24.5)
Q4: Knowledge of how to prevent cervical cancer ( $\geq 4$ )	781 (10.8)	6,459 (89.2)
Q4_1: Getting vaccinated	3,019 (41.7)	4,221 (58.3)
Q4_2: Having fewer sexual partners	1,567 (21.6)	5,673 (78.4)
Q4_3: Regular cervical cancer screening	2,583 (35.7)	4,657 (64.3)
Q4_4: Using condoms	823 (11.4)	6,417 (88.6)
Q4_5: Late marriage and late childbearing	412 (5.7)	6,828 (94.3)
Q4_6: Avoid smoking	577 (8.0)	6,663 (92.0)
Q4_7: Timely treatment of genital tract infections	1,359 (18.8)	5,881 (81.2)
Q5: Have heard of HPV vaccines	4,365 (60.3)	2,875 (39.7)
Q6: Know HPV vaccines can prevent cervical cancer	3,913 (54.1)	3,327 (46.0)
Q7: Know the benefits of regular cervical cancer screening	5,004 (69.1)	2,236 (30.9)
High Knowledge level ( $\geq 5$ )	3,237 (44.7)	4,003 (55.3)
Willing to be vaccinated	4,296 (59.3)	2,944 (40.7)

Abbreviation: HPV=human papillomavirus.

Nevertheless, most have found that women still lack knowledge. Moreover, it is worrying that women know little about risk factors and prevention measures for cervical cancer, with only 10% of women able to identify more than half of them. Consequently, further health education should highlight the risk factors and prevention measures for cervical cancer.

Several factors were associated with the knowledge level of cervical cancer and the HPV vaccine. Women with older age, low education level, underemployment, low family income and living in the western region are less likely to have a high knowledge level, resulting in a lower willingness to receive the HPV vaccination. These results were similar to previous studies that socio-economic status might play an essential part in the knowledge score of HPV vaccine and cervical cancer (9). These findings highlighted the need for health education for women in the reproductive age group to better understand the significance of HPV vaccination, especially those of low socio-economic

status.

Although the knowledge level was low, women had a more positive attitude towards HPV vaccination (59.3%), similar to previous studies. In other studies, more than half of the respondents were willing to take the HPV vaccine against HPV infection (5,10). In addition, it is very likely that the willingness for HPV vaccination strongly increased with the knowledge score, and the proportion of willingness reached more than 80% when at high knowledge levels (knowledge scores  $\geq 5$ ). In order to enhance the HPV vaccination and decrease the rate of cervical cancer, it is critical to encourage health education for different groups of women, not only for these women in the reproductive age group but also for their children.

Several limitations should be noted. First, the study data were collected from counties/districts in every provincial capital, which might overestimate the awareness and willingness rates of these provinces. However, it did not influence the association analysis.

TABLE 2. Logistic regression analysis on knowledge of cervical cancer and HPV vaccine among 20–45-year-old women, — 6 provinces, China, 2018.

Variable	N	High knowledge level ( $\geq 5$ )			P <sub>trend</sub>
		n (%)	Crude OR (95% CI)	AOR (95% CI)	
Region					
Western	2,364	944 (38.5)	ref.	ref.	<0.001
Central	2,424	1,198 (49.4)	1.56 (1.39, 1.75) <sup>†</sup>	1.39 (1.23, 1.57) <sup>†</sup>	
Eastern	2,452	1,095 (46.3)	1.38 (1.23, 1.55) <sup>†</sup>	1.27 (1.12, 1.44) <sup>†</sup>	
Area type					
Urban	3,619	1,907 (52.7)	ref.	ref.	0.305
Rural	3,621	1,330 (36.7)	0.52 (0.47, 0.57) <sup>†</sup>	0.94 (0.83, 1.06)	
Age group (years)					
20–29	2,140	976 (45.6)	ref.	ref.	0.185
30–39	2,483	1,204 (48.5)	1.12 (1.00, 1.26) <sup>†</sup>	1.25 (1.08, 1.44) <sup>†</sup>	
40–45	2,617	1,057 (40.4)	0.81 (0.72, 0.91) <sup>†</sup>	1.15 (0.99, 1.34)	
Occupation					
Managerial and technical staff	1,412	946 (67.0)	ref.	ref.	<0.001
Commercial/service personnel	1,299	634 (48.8)	0.47 (0.40, 0.55) <sup>†</sup>	0.65 (0.54, 0.77) <sup>†</sup>	
Workers or farmers	3,039	1,098 (36.1)	0.28 (0.24, 0.32) <sup>†</sup>	0.62 (0.52, 0.74) <sup>†</sup>	
Students	287	116 (40.4)	0.33 (0.26, 0.43) <sup>†</sup>	0.53 (0.40, 0.71) <sup>†</sup>	
Unemployed	953	324 (34.0)	0.25 (0.21, 0.30) <sup>†</sup>	0.46 (0.38, 0.56) <sup>†</sup>	
Others	250	119 (47.6)	0.45 (0.34, 0.59) <sup>†</sup>	0.59 (0.44, 0.78) <sup>†</sup>	
Education level					
Primary school and below	1,000	215 (21.5)	ref.	ref.	<0.001
Middle school	2,379	870 (36.6)	2.11 (1.77, 2.50) <sup>†</sup>	2.11 (1.77, 2.52) <sup>†</sup>	
Senior high school or equivalent	1,551	760 (49.0)	3.51 (2.93, 4.20) <sup>†</sup>	3.19 (2.61, 3.90) <sup>†</sup>	
College and above	2,310	1,392 (60.3)	5.54 (4.66, 6.58) <sup>†</sup>	4.49 (3.59, 5.63) <sup>†</sup>	
Monthly family income (CNY)					
<3,000	1,824	624 (34.2)	ref.	ref.	<0.001
3,000–4,999	2,255	930 (41.2)	1.35 (1.19, 1.53) <sup>†</sup>	1.11 (0.97, 1.28)	
5,000–7,999	1,801	867 (48.1)	1.79 (1.56, 2.04) <sup>†</sup>	1.22 (1.05, 1.41) <sup>†</sup>	
$\geq 8,000$	1,360	816 (60.0)	2.88 (2.49, 3.34) <sup>†</sup>	1.61 (1.37, 1.90) <sup>†</sup>	
Marital status					
Unmarried	1,007	467 (46.4)	ref.	ref.	0.827
Married	6,021	2,680 (44.5)	0.93 (0.81, 1.06)	1.04 (0.79, 1.36)	
Divorced/widowed/others	212	90 (42.5)	0.85 (0.63, 1.15)	0.95 (0.65, 1.39)	
Gravidity					
0	1,257	583 (46.4)	ref.	ref.	0.153
1	2,255	1,158 (51.4)	1.22 (1.06, 1.40) <sup>†</sup>	1.45 (1.13, 1.87) <sup>†</sup>	
2	2,190	930 (42.5)	0.85 (0.74, 0.98) <sup>*</sup>	1.38 (1.07, 1.80) <sup>*</sup>	
$\geq 3$	1,538	566 (36.8)	0.67 (0.58, 0.78) <sup>†</sup>	1.17 (0.89, 1.54)	
Smoke					
Never	7,013	3,134 (44.7)	ref.	ref.	0.811
Ever	227	103 (45.4)	1.03 (0.79, 1.34)	1.04 (0.78, 1.37)	

Note: All variables in univariate logistic regression models eventually entered the multivariable logistic regression model.

Abbreviation: HPV=human papillomavirus; CI=confidence interval; OR=odds ratio; AOR=adjusted odds ratio; CNY=China Yuan.

\*  $P < 0.05$ .

<sup>†</sup>  $P < 0.01$ .

TABLE 3. Association between cervical cancer related knowledge score and willingness to receive HPV vaccination among 20–45-year-old women, — 6 provinces, China, 2018.

Knowledge	n (%)	Crude OR (95% CI)	AOR (95% CI)*	P <sub>trend</sub>
Knowledge level				<0.001
Low (<5)	1,556 (38.9)	ref.	ref.	
High (≥5)	2,740 (84.6)	8.67 (7.73, 9.72) <sup>†</sup>	9.98 (8.80, 11.32) <sup>†</sup>	
Knowledge score				<0.001
≤1	198 (19.8)	ref.	ref.	
2	279 (25.8)	1.41 (1.15, 1.73) <sup>†</sup>	1.68 (1.35, 2.09) <sup>†</sup>	
3	416 (40.1)	2.71 (2.22, 3.30) <sup>†</sup>	3.37 (2.72, 4.16) <sup>†</sup>	
4	663 (74.8)	12.03 (9.68, 14.95) <sup>†</sup>	16.35 (12.91, 20.70) <sup>†</sup>	
5	2,010 (84.0)	21.23 (17.56, 25.68) <sup>†</sup>	33.25 (26.81, 41.22) <sup>†</sup>	
≥6	730 (86.5)	25.91 (20.15, 33.31) <sup>†</sup>	43.75 (33.12, 57.79) <sup>†</sup>	

Abbreviation: HPV=human papillomavirus; CI=confidence interval; OR=odds ratio; AOR=adjusted odds ratio.

\* Adjusted for region, area, age group, occupation, education level, monthly family income, marital status, gravidity and smoking.

<sup>†</sup> P<0.01.

Secondly, considering the cross-sectional study design, the causal relationships between knowledge and willingness cannot be inferred. Thirdly, this study only focused on willingness to receive HPV vaccination, not behavior. Therefore, future studies are encouraged to explore how to improve HPV vaccination behavior and the barriers to prevention.

In summary, our study indicated that the knowledge level of cervical cancer and HPV vaccine was still inadequate among women aged 20–45 years old, and was associated with the region, age group, occupation, education level, monthly family income and gravidity. The willingness to receive HPV vaccination was highly associated with knowledge level. Intervention programs and strategies should aim to improve knowledge levels about cervical cancer and HPV vaccines, primarily focusing on those of lower socio-economic status.

**Acknowledgments:** Appreciation is expressed to all the women who participated in the study. We also express our thanks to the efforts of all staff in the data collection in Jiangsu, Shandong, Hunan, Anhui, Shaanxi, and Sichuan provinces

doi: 10.46234/ccdcw2023.036

# Corresponding authors: Xiaosong Zhang, zhangxiaosong@bjmu.edu.cn; Linhong Wang, linhong@chinawch.org.cn.

<sup>1</sup> Department of Obstetrics and Gynecology, Peking University First Hospital, Beijing, China; <sup>2</sup> National Centre for Women and Children's Health, Chinese Center for Disease Control and Prevention, Beijing, China; <sup>3</sup> National Center for Chronic and Non-Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China.

Submitted: February 02, 2023; Accepted: February 27, 2023

## REFERENCES

- Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2021;71(3):209–49. <http://dx.doi.org/10.3322/caac.21660>.
- Wang LH. Accelerating cervical cancer prevention and control in China to achieve cervical cancer elimination strategy objectives. *China CDC Wkly* 2022;4(48):1067–9. <http://dx.doi.org/10.46234/ccdcw2022.215>.
- Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. *Lancet Glob Health* 2020;8(2):e191–203. [http://dx.doi.org/10.1016/S2214-109X\(19\)30482-6](http://dx.doi.org/10.1016/S2214-109X(19)30482-6).
- Lei JY, Ploner A, Elfström KM, Wang JR, Roth A, Fang F, et al. HPV vaccination and the risk of invasive cervical cancer. *N Engl J Med* 2020;383(14):1340–8. <http://dx.doi.org/10.1056/NEJMoa1917338>.
- Zhang YR, Wang Y, Liu L, Fan YZ, Liu ZH, Wang YY, et al. Awareness and knowledge about human papillomavirus vaccination and its acceptance in China: a meta-analysis of 58 observational studies. *BMC Public Health* 2016;16:216. <http://dx.doi.org/10.1186/s12889-016-2873-8>.
- Lin W, Wang YY, Liu ZH, Chen B, Yuan SX, Wu B, et al. Inequalities in awareness and attitude towards HPV and its vaccine between local and migrant residents who participated in cervical cancer screening in Shenzhen, China. *Cancer Res Treat* 2020;52(1):207–17. <http://dx.doi.org/10.4143/crt.2019.053>.
- Zhang FZ, Li MM, Li XX, Bai H, Gao JL, Liu H. Knowledge of cervical cancer prevention and treatment, and willingness to receive HPV vaccination among college students in China. *BMC Public Health* 2022;22(1):2269. <http://dx.doi.org/10.1186/s12889-022-14718-0>.
- Liu YN, Di N, Tao X. Knowledge, practice and attitude towards HPV vaccination among college students in Beijing, China. *Hum Vaccin Immunother* 2020;16(1):116–23. <http://dx.doi.org/10.1080/21645515.2019.1638727>.
- Lin W, Chen B, Hu HY, Yuan SX, Wu B, Zhong CY, et al. Joint effects of HPV-related knowledge and socio-demographic factors on HPV testing behaviour among females in Shenzhen. *Eur J Public Health* 2021;31(3):582–8. <http://dx.doi.org/10.1093/eurpub/ckab049>.
- He JY, He LX. Knowledge of HPV and acceptability of HPV vaccine among women in western China: a cross-sectional survey. *BMC Women's Health* 2018;18(1):130. <http://dx.doi.org/10.1186/s12905-018-0619-8>.