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# Knowledge and Awareness of Cervical Cancer, Human Papillomavirus (HPV), and HPV Vaccine Among HPV-Infected Chinese Women

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**Background:** It is important to understand the knowledge that various groups of a population have about cervical cancer and human papillomavirus (HPV) and their attitudes toward HPV vaccination, as it will ultimately influence their decision-making for or against the acceptability of vaccines and other preventive methods. This study was designed to determine the level of knowledge and awareness about cervical cancer, HPV, and the HPV vaccine among Chinese women in Yunnan province.

**Material/Methods:** A survey was conducted in Yunnan province by the Laboratory of Molecular Virology in collaboration with the Yunnan First People's Hospital in Feb 2015. A total of 388 women were recruited and asked to participate in a questionnaire-based interview that collected information related to their awareness and knowledge about: (1) cervical cancer, (2) HPV and HPV vaccine and willingness to have their children receive vaccination, and (3) demographic characteristics.

**Results:** A total of 388 HPV-positive women were included; 300/388 (73.3%) were Han, and 88/388 (22.7%) were other ethnicities. Overall, 204/388 (52.6%) of the women were aware of cervical cancer, with a significant difference between Han women and women of other ethnic groups (168/388, 56.0% and 36/88, 40.9%;  $P=0.015$ ). Overall, 26.5% of the women were aware of the role of HPV in cervical cancer; 29.0% of the Han women and 18.2% of women of other ethnic groups were aware of this role of HPV ( $P=0.05$ ). The knowledge that HPV infection leads to cervical cancer was higher among Han women (29.0%) compared to women of other ethnicities (18.2%). Knowledge about the HPV vaccine was very low in all ethnic groups, but the Han women were more willing to allow their children to be vaccinated before they become sexually active. A similar difference has also been found in women from various regions.

**Conclusions:** Although level of awareness and knowledge about cervical cancer was moderate, knowledge and awareness of HPV and the HPV vaccine was very low. Targeted communication is very important among populations in which knowledge gaps exist in order to promote dialogue about the vaccine among patients and their health-care providers.

**MeSH Keywords:** **Health Knowledge, Attitudes, Practice • Papillomavirus Vaccines • Uterine Cervical Neoplasms**

**Abbreviations:** **HPV** – human papillomavirus; **WHO** – World Health Organization; **CDC** – Center for Disease Control and Prevention

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## Background

Cervical cancer is the 3rd most frequently detected cancer among females, with an estimated 530 000 new cases and 275 000 deaths in 2008 worldwide [1]. Developed countries have reduced the incidence and mortality rates of cervical cancer due to the wide application of cervical screening tests and vaccinations [2,3]. It is well established that infection with human papillomavirus (HPV) is a major cause (99.9%) of cervical cancer and is one of the most common sexually transmitted pathogens of the genital system. Approximately 85% of the infections and 88% of the deaths caused by cervical cancer occur in developing countries [4,5]. According to the World Health Organization (WHO) (2006) estimation, multiple factors contribute to higher cervical cancer prevalence and mortality in developing regions of the world, such as lack of awareness about cervical cancer among the people, health care workers, and policy makers, lack of cervical screening programs, and limited access to healthcare facilities [6]. It is also thought that women's knowledge about HPV and cervical cancer is very low in many countries [7–10].

China is the largest developing country, and according to the National Health and Family Planning Commission of the People's Republic of China, it is estimated that there are 130 000 new cervical cancer cases registered annually, and almost 30 000 women die due to disease progression [11]. However, these estimates likely underestimate the true incidence of the disease due to the low number of cervical screening facilities and the substantial number of women living in rural areas, particularly the ethnic populations, who are rarely screened for cervical cancer [12]. Furthermore, many women also fail to get cervical screening tests due to poverty, fatalistic attitude, and lack of knowledge.

Although the knowledge and attitudes about cervical cancer and HPV vary among Chinese women from different regions, most women have a high level of willingness to have their children receive vaccination, with some exceptions [13,14]. Previously published studies documented findings in developed areas, but the large social and economic variations of those areas make the findings less applicable to the whole of Mainland China, particularly Yunnan province. It is important to understand the knowledge of different populations about cervical cancer and HPV and their attitudes toward HPV vaccination acceptability as it will ultimately influence their decision for or against receiving HPV vaccination. Additionally, it is also important to understand the role of socioeconomic and demographic factors because several factors, such as education and interaction with the healthcare system, greatly influence HPV knowledge and vaccine acceptability compared to other factors [15].

Yunnan, also called Dian, is located in southwest China. Since ancient times, Yunnan has served as China's gateway to Southeast Asia and South Asia. Additionally, it is a meeting point for Eastern and Western cultures. With its distinct environmental and geographical characteristics, the social characteristics of Yunnan province are also varied. In particular, 26 state-certified ethnic populations are scattered across the remote and hilly region of Yunnan. A significant difference in HPV prevalence and its genotype distribution has already been described in various populations of Yunnan [16,17]. However, no data are currently available regarding knowledge and awareness about cervical cancer, HPV, and vaccine acceptability among Chinese women in Yunnan. Thus, this study was designed to evaluate knowledge and awareness of HPV, cervical cancer, and the HPV vaccine among various populations of women in Yunnan province.

## Material and Methods

### Experimental ethics

A questionnaire was developed for this study. The protocol used in this study was in accordance with the Declaration of Helsinki and was approved by the Ethics Committee at Kunming University of Science and Technology and the Center for Disease Control and Prevention (CDC) in the Yunnan province, China. Written consent was individually obtained from each participant.

### Participant recruiting

A survey was conducted by the Research Center for Molecular Medicine, Kunming University of Science and Technology in collaboration with First Peoples Hospitals of Yunnan. Between January 2014 and March 2015, women who visited the outpatient department of the First People's Hospital of Yunnan were recruited. The First People's Hospital of Yunnan is located in the center of Kunming city, which is the largest city in Yunnan province. The population of Yunnan province is approximately 44 million people. Han are the predominant ethnic group in the Yunnan province, with a population of 29 million. In contrast, other ethnic groups are in the minority and are scattered throughout various parts of the Yunnan province with a combined population of 15 million. A copy of the questionnaire was sent to a gynecologist who worked at the Outpatient Department of the Yunnan First People's Hospital. She consented to appoint the female doctors to collect data from each patient individually. Before starting the interview, a cover letter described the aim of the study, conveyed the guarantee of secrecy, and highlighted that the participant's decision to participate or ignore the interview would not effect of her medical check-up.

For this study, we calculated that the sample size needed to estimate that the knowledge and awareness of HPV, cervical cancer, and the HPV vaccine among various populations of women in Yunnan province as high as 50% with an error rate of 5% was 384. We expected a low response rate, and the sample size was increased to 700 HPV-infected women. The overall response rate was approximately 74.4% (521/700).

### Questionnaire data and process

A 20-question questionnaire was prepared based on a review of the literature and a previously published questionnaire [14,18,19] and was designed in the Chinese language. Every participant appeared in an interview, in which a standardized questionnaire was used to collect information about socio-demographic factors, such as ethnicity, area, regional background, age, education, occupation, marital status, monthly income, their knowledge about cervical cancer, HPV, and the relationship between HPV and cervical cancer and the vaccine.

### Statistical analysis

The data collected from the participants were transferred into a database, and the descriptive and inferential statistics were calculated using SPSS version 20.0 for Windows (SPSS Inc., Chicago IL). The participants were divided into subgroups based on their ethnic background and regional background in order to link cervical cancer, HPV-related knowledge, the attitudes, the behaviors, and the intentions of the participants. Chi-square tests were used to test the differences between the different groups. Awareness and knowledge about HPV, cervical cancer, and the HPV vaccine are shown as percentages. The role of various variables in the knowledge and awareness about cervical cancer and HPV were calculated by a logistic regression model. Knowledge about cervical cancer and HPV were considered independent variables and other variables, such as ethnicity, regions, education, occupation, monthly income and age, were considered independent variables. All of the independent variables were divided into 2 or more categories. All of the statistical tests were two-sided; P values <0.05 were considered statistically significant.

## Results

### Population characteristics

A total of 521 women participated in the study, and 133 women were excluded from the study because of inconsistencies in the information they gave. The remaining 388 were finally included in the study, and 78.9% (306/388) of the participants were from various regions of the Yunnan province, while 21.1% of the women migrated from other provinces of

**Table 1.** Demographic characteristics of study participants (n=388).

Characteristics	Frequency	Percent
<b>Ethnicity</b>		
Han	300	77.3
Others	88	22.7
<b>Region</b>		
Central	140	36.1
Northeast	49	12.6
Northwest	42	10.8
Southeast	40	10.3
Southwest	35	9.0
Others	82	21.1
<b>Area</b>		
Rural	110	28.3
Urban	278	71.7
<b>Age</b>		
<30	75	19.3
31–40	148	38.1
41–50	130	33.5
>50	35	9.0
<b>Education</b>		
Graduate	121	31.2
High school	94	24.2
Middle	78	20.1
Primary	53	13.6
Illiterate	42	10.8
<b>Occupation</b>		
Farmers	63	16.2
Government	30	7.7
Private	82	21.1
Self-employed	83	21.4
Teachers	32	8.2
Others	80	20.6
Unemployed	18	4.6
<b>Status</b>		
Married	319	82.2
Single	69	17.8
<b>Monthly Income</b>		
<3000	155	39.9
3100–500	114	29.4
5100–8000	41	10.6
8100–10000	78	20.1

**Table 2.** Knowledge about HPV and HPV vaccination among ethnic groups.

Variable	Han (n=300)	Others (n=88)	P-value	Overall (n=388)
Knows about cervical cancer	168 (56.0)	36 (40.9)	0.015	204 (52.6)
Knows it can be cured by early treatment	114 (38.0)	26 (29.5)	0.16	140 (36.1)
Knows about HPV	113 (37.7)	34 (38.6)	0.9	147 (37.9)
Knows HPV can be transmitted through sex	66 (22.0)	13 (14.8)	0.17	79 (20.4)
Knows that HPV can cause genital warts	67 (22.3)	21 (23.9)	0.77	88 (22.7)
Knows that HPV infection can lead to cervical cancer	87 (29.0)	16 (18.2)	<b>0.05</b>	103 (26.5)
Knows about HPV vaccine	52 (17.3)	11 (12.5)	0.32	63 (16.2)
Received HPV vaccination	6 (2.0)	1 (1.13)	1.00	7 (1.8)
Willing to vaccinate children	254 (84.7)	67 (76.1)	0.01	321 (82.7)
Willing to pay for vaccination	90 (30.0)	23 (26.1)	0.5	113 (29.1)

n=number of participants. Bold type indicates a significant difference (p=0.05).

**Table 3.** Knowledge about HPV and its vaccination among various regions of Yunnan.

Variable	Central (n=140)	Northeast (n=49)	Southeast (n=40)	Southwest (n=35)	Northwest (n=42)	P-value
Knowledge of Cervical cancer	78 (55.7)	16 (32.6)	19(46.34)	15 (42.8)	20 (47.6)	<b>0.07</b>
Knows it can be cured by early treatment	53 (37.8)	14 (29.2)	15 (36.6)	13(37.14)	13 (30.9)	0.75
Knows about HPV	43 (30.7)	12 (24.5)	18 (45.0)	14 (40.0)	15 (35.7)	0.25
Knows HPV can be transmitted through sex	34 (24.3)	9 (18.7)	8 (19.5)	5 (14.3)	8 (19.0)	0.68
Knows HPV can cause genital warts	39 (27.8)	12 (25.0)	8 (19.5)	8 (22.8)	9 (21.4)	0.8
Knows HPV infection can lead to cervical cancer	45 (32.1)	13 (27.1)	12 (29.3)	6 (17.1)	12 (28.6)	0.48
Knowledge of vaccine	21 (10.1)	6 (7.06)	5 (6.76)	9 (6.0)	7 (5.15)	0.52
Received HPV vaccine	6 (2.1)	–	–	–	–	
Willing to vaccinate children	115 (82.1)	37 (75.5)	32 (80.0)	27 (77.1)	34 (80.9)	0.87
Willing to pay for vaccine	40 (28.6)	14 (28.6)	10 (25.0)	9 (25.7)	13 (30.9)	0.97

n=number of participants. Bold type indicates a significant difference (p=0.05).

China. A total of 77.3% of the included women were Han, and 22.7% were other ethnicities. In addition, 28.9% of the women were come from rural areas, and 71.7% came from urban areas. Among the professions, 16.2% were farmers, 7.7% were government officials and 8.2% teachers in addition to other professions. Most of the women (82.2%) were married, and 17.8% were single. A summary of the participants' characteristics is shown in Table 1.

Overall, 52.6% of the women (204/388) had knowledge about cervical cancer, and only 36.1% of the women knew that cervical cancer can be cured if it is diagnosed early. Among them,

37.9% of the women had knowledge about human papillomavirus, and almost twenty percent of the women were aware that HPV infection can be transmitted through intercourse. However, only 22.7% of women reported that genital warts are caused by infection with HPV. Only 16.2% women had knowledge about the HPV vaccine. Overall, the acceptance of the HPV vaccine was high. However, the willingness to pay for the vaccine was very low (Table 2).

At baseline, the Han women (56.0%) were significantly more aware about cervical cancer than the women of other ethnicities (40.9%). Only 38.0% of the Han and 29.5% of the women of other

ethnicities had heard about cervical cancer prevention through early treatment. Surprisingly, knowledge about HPV and its role in genital warts was little higher in the women of other ethnicities than among the Han women. Only 38.6% of the women of other ethnicities and 37.7% of the Han women had knowledge about HPV, while 23.9% of the women of other ethnicities and 22.2% of the Han women knew that HPV infection leads to genital warts. However, knowledge about the role of HPV infection in cervical cancer was significantly high among the Han women compared to that of the women of other ethnicities. The baseline knowledge about cervical cancer and HPV is shown in Table 2.

Knowledge about cervical cancer and HPV was higher in the central region women than for those of the Southeast, Southwest, Northeast and Northwest regions (Table 3). Most of the participants from the central region were Han, lived in an urban area, were well educated, had a higher monthly income, and had healthcare access compared to their regional counterparts. The participants from the other regions mostly belonged to other ethnicities, lived in rural areas, were more likely to be middle and primary school graduates, and had a low average (<3000) monthly income and had inadequate healthcare access.

#### Knowledge and acceptability toward the HPV vaccine

Knowledge about the availability of HPV vaccine was very low in both groups. However, willingness to vaccinate their children with the HPV vaccine before they become sexually active was high in both groups. Such a variation has also been observed in various regions of Yunnan province. The baseline attitudes and vaccine acceptability are shown in Table 2.

#### Factors related to the level of knowledge

The knowledge and awareness about cervical cancer and HPV was highly related to the socio-demographic characteristics in both groups. Women with more education had significantly better knowledge and more awareness about cervical cancer and HPV than those with less education. Furthermore, settler women had significantly higher knowledge about cervical cancer and HPV than the local women. Those who had ever been married and those with a monthly income of more than 5000 Yuan were more likely to have good knowledge and awareness about HPV and cervical cancer. Additionally, women who worked in government departments or who worked in education were more knowledgeable about HPV and cervical cancer than those in other professions in both ethnic groups (Tables 4, 5).

## Discussion

It is well recognized that mass immunization with HPV vaccines has the potential to reduce the incidence of cervical cancer.

Although 2 prophylactic HPV vaccines have been approved in over 140 countries, these vaccines were not approved by the Chinese government due to an absence of Chinese patient clinical data [20]. In 2008, 2 WHO-recommended vaccine companies began phase III Chinese clinical trials, and it is expected that they will obtain approval very soon [21]. Considering the high variations in the knowledge and awareness about cervical cancer, HPV and the attitude toward HPV vaccine acceptance in the world, particularly in China, investigations of these parameters in various Chinese populations would be ultimately helpful for designing strategies for cervical cancer screening and for introducing the HPV vaccine in Yunnan province, China.

This is the first study to evaluate the knowledge and awareness of cervical cancer, HPV, and HPV vaccine among Chinese women living in Yunnan province. It is clear that knowledge about cervical cancer (52.6%) and HPV (37.9%) is low, and specific knowledge about the HPV vaccine (16.2%) is very poor. Many studies conducted in Asian countries report that 50–85% of women were aware about cervical cancer [22,23], which is consistent with the results of the present study, in which more than half of the current study participants were also aware of cervical cancer. A low level of knowledge and awareness about HPV is consistent with the data reported from P.R. China [18] and Hong Kong [24]. A low level of HPV knowledge was also reported in developed countries, such as the UK and the USA [25,26]. Interestingly, in the present study, participants' knowledge and awareness about HPV was higher than in previously reported studies [14,18]; however, there is still need for improvement. Additionally, the participants' awareness was also lower than in the data reported from Australia, which showed a higher rate of HPV knowledge (51.2%) among the general population, which might be due to the large-scale promotion of HPV vaccination through electronic and print media [27]. A low level of knowledge about HPV is considered to be a major hurdle for the successful implementation HPV vaccination at the national level [28]. Thus, it is very important that high-profile and persistent public education efforts be started through electronic and print media to raise awareness about HPV infection and vaccination.

There are 56 state-certified ethnic groups in China; 26 of these live in Yunnan province, and the Han group has been declared the major ethnic group, with a population of 29 million. In contrast, other ethnic groups are in the minority and are dispersed mainly in remote areas of Yunnan province, with a combined population of 15 million. Several studies reported data only from Han women and from well-developed areas, such as Beijing and Guangzhou. However, no study has considered ethnic differences in knowledge and awareness about cervical cancer, HPV, and vaccination in China. Additionally, many researchers have addressed the importance of adding ethnic categories in epidemiological studies [29,30]. In the present

**Table 4.** Logistic regression analysis for knowledge about cervical cancer.

Characteristics	Total	Knowledge	OR (95%CI)	P-value
<b>Ethnicity</b>				<b>0.008*</b>
Han	300	168 (56.0)	1	
Others	88	36 (40.9)	2.48 (1.27–4.82)	
<b>Region</b>				<b>0.006*</b>
Central	140	78 (55.7)	1	
Northeast	49	16 (32.6)	1.97 (0.86–4.51)	
Northwest	42	20 (47.6)	0.78 (0.34–1.81)	
Others	82	56 (68.3)	0.4 (0.2–0.79)	
Southeast	40	19 (47.5)	1.29 (0.56–2.95)	
Southwest	35	15 (42.8)	1.53 (0.6–3.93)	
<b>Residence</b>				0.8
Rural	110	53 (48.2)	1	
Urban	278	151 (54.3)	0.92 (0.48–1.76)	
<b>Age</b>				<b>0.026*</b>
<30	75	39 (52.0)	1	
31–40	148	88 (59.4)	0.43 (0.22–0.84)	
41–50	130	63 (48.5)	0.76 (0.38–1.52)	
>50	35	12 (34.3)	1.18 (0.44–3.17)	
<b>Education</b>				<b>0.001*</b>
Graduate	121	89 (73.5)	1	
High school	94	49 (52.1)	2.04 (1.06–3.94)	
Middle	78	36 (46.1)	3.45 (1.65–7.23)	
Primary	53	11 (20.7)	12.52 (4.89–32.1)	
Illiterate	42	19 (45.2)	2.99 (1.24–7.2)	
<b>Occupation</b>				0.20
Farmers	63	28 (44.4)	1	
Government sector	30	22 (73.3)	0.73 (0.23–2.33)	
Private	82	38 (46.3)	2.46 (0.66–9.1)	
Teachers	32	23 (71.9)	1.89 (0.84–4.27)	
Workers	80	38 (47.5)	1.91 (0.84–4.32)	
Others	83	47 (56.6)	1.29 (0.56–2.97)	
No work	18	8 (44.4)	0.75 (0.24–2.33)	
<b>Status</b>				0.12
Married	319	173 (54.2)	1	
Single	69	31 (44.9)	1.67 (0.87–3.21)	
<b>Monthly income</b>				0.11
<3000	155	72 (46.4)	1	
3100–500	114	70 (61.4)	0.59 (0.33–1.06)	
5100–8000	41	24 (58.5)	0.69 (0.3–1.58)	
8100–10000	78	38 (48.7)	1.28 (0.65–2.52)	

1 – OR and P-value were obtained using logistic regression analysis model. First category serves as a reference for OR calculation by logistic regression. \* Statistically significant.

**Table 5.** Logistic regression analysis for knowledge about HPV.

Characteristics	Total	Knowledge	OR (95%CI)	P-value
<b>Ethnicity</b>				0.28
Han	300	113 (37.7)	1	
Others	88	34 (38.6)	1.45 (0.74–2.84)	
<b>Region</b>				0.001*
Central	140	43 (30.7)	1	
Northeast	49	12 (24.5)	0.8 (0.33–1.97)	
Northwest	42	15 (35.7)	0.49 (0.20–1.19)	
Others	40	18 (45.0)	0.22 (0.11–0.44)	
Southeast	35	14 (40.0)	0.33 (0.14–0.79)	
Southwest	82	45 (54.9)	0.56 (0.21–1.46)	
<b>Residence</b>				0.91
Rural	110	38 (34.5)	1	
Urban	278	109 (39.2)	0.96 (0.49–1.87)	
<b>Age</b>				0.016*
<30	75	20 (26.7)	1	
31–40	148	66 (44.6)	0.47 (0.23–0.97)	
41–50	130	42 (32.3)	1.12 (0.54–2.35)	
>50	35	19 (54.3)	0.53 (0.19–1.45)	
<b>Education</b>				0.001*
Graduate	121	72 (59.5)	1	
High school	94	34 (36.2)	2.46 (1.29–4.7)	
Middle	78	23 (29.5)	4.23 (1.97–9.12)	
Primary	53	5 (9.4)	19.92 (6.35–62.48)	
Illiterate	42	13 (30.9)	3.35 (1.36–8.28)	
<b>Occupation</b>				0.54
Farmers	63	17 (27.0)	1	
Government sector	30	18 (60.0)	0.64 (0.2–203)	
Private	82	29 (35.4)	2.69 (0.64–11.22)	
Teachers	32	19 (59.4)	1.32 (0.55–3.17)	
Workers	80	26 (32.5)	1.25 (0.53–2.98)	
Others	83	33 (39.7)	1.21 (0.49–2.97)	
No work	18	5 (27.8)	0.76 (0.25–2.32)	
<b>Status</b>				0.21
Married	319	126 (39.5)	1	
Single	69	21 (30.4)	1.56 (0.78–3.12)	
<b>Monthly income</b>				0.21
<3000	155	47 (30.3)	1	
3100–500	114	52 (45.6)	0.58 (0.32–1.05)	
5100–8000	41	19 (45.2)	0.53 (0.23–1.24)	
8100–10000	78	29 (37.2)	0.87 (0.43–1.77)	

1 – OR and P-value were obtained using logistic regression analysis model. First category serves as a reference for OR calculation by logistic regression. \* Statistically significant.

study, we also compared the knowledge and awareness related to cervical cancer, HPV, and the vaccine in Han and other ethnic groups. We found that the Han women had more knowledge about cervical cancer and the HPV vaccine than did women of other ethnicities. However, knowledge and awareness about HPV was the same in both groups. Our study results are in line with other studies reported in the USA and Europe that showed racial differences in knowledge about cervical cancer, HPV, and HPV vaccine [31,32]. Overall, knowledge and awareness about the HPV vaccine was very low in both ethnic groups. These observations are also concordant with the data reported from Malaysia [33], China [14], and the USA [34].

In the present study, only 26.5% of Han women and 20.4% of women of other ethnicities answered that HPV can cause cervical cancer and that it can be transfer through sexual intercourse. The vast majority of women of both ethnic groups also had little awareness about the etiological role of HPV in cervical cancer and other diseases, such as genital warts. This low level of knowledge about HPV infection-related complications is in agreement with data reported from Brazil [35,36]. Our observations indicate that greater knowledge and awareness about cervical cancer and HPV does not assure a high level of awareness about its consequences. On the basis of this widespread lack of knowledge about HPV and its consequences, we urge the initiation of a high-priority public education program about HPV infection and its consequences, which explicitly addresses the knowledge deficits among the general population, particularly in minority ethnic groups.

With respect to vaccine acceptability, it is true that knowledge about the availability of the HPV vaccine is very low. Most of the participants stated that they did not get the vaccination but that they will vaccinate their children before they become sexually active if the vaccine is available. Many studies report a favorable attitude toward vaccination in China [14,18] and other countries [18,25]. Interestingly, we asked the participants if they were willing to pay for vaccination and most of the women were reluctant to do so. Yunnan is an underdeveloped province of China, and the poverty ratio is a little higher compared with the rest of China, and people in Yunnan do not have enough money to pay for HPV vaccination. On the basis of these observations, we suggest that the HPV vaccine must be introduced in Yunnan province under a government subsidy program rather than through private sectors.

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Our study has several limitations. First, all of the participants were HPV-positive patients. Second, Yunnan province is distinct from the rest of China due to its diverse social and geographic characteristics. Han people are the Chinese ethnic majority; they tend to have higher levels of education and to live in urban and suburban areas, while the other ethnic groups tend to live in remote mountainous areas, have less education, and have limited access to healthcare facilities. Thus, our results may not be generalizable to the entire Chinese population.

## Conclusions

In summary, we found significant ethnic and regional variation in knowledge and awareness about cervical cancer, HPV, and HPV vaccination. The Han ethnic group women had higher knowledge and awareness about cervical cancer and HPV than did other ethnic groups. Although the awareness and knowledge about cervical cancer was at a moderate level, the knowledge and awareness of HPV and HPV vaccine was very low. It is important to target communication to population groups with knowledge gaps in order to promote dialogue about the vaccine among patients and their healthcare providers. Additionally, our study also shows the importance of developing and implementing public education programs to educate women about HPV, cervical cancer, and its consequences.

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## Competing interests

The authors declare that they have no competing interests.

## Ethics and consent to participate

Ethics approval was obtained from the Ethics Committee of Kunming University of Science and Technology and the Center for Disease Control and Prevention (CDC) in Yunnan province, China. Written consent was individually obtained from each participant.



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