Awareness and knowledge of human papillomavirus vaccination and their influential factors among Chinese women: a systematic review[†]

Original article

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Abstract: **Objectives:** To systematically review the knowledge attitudes and the influential factors on human papillomavirus (HPV) vaccination among Chinese women.

Methods: Published studies on knowledge and attitudes of HPV vaccination for preventing cervical cancer among Chinese female population were retrieved using the major Chinese and English databases. Meanwhile, handwork retrieval was also conducted and the references including in the literature were retrieved. The quality of the literature was rigorously evaluated and extracted independently by two researchers and the data were analyzed and described by review manager 5.3 (RevMan5.3) software.

Results: In all, 19 articles including 8 articles in Chinese and 11 in English were chosen. A total of 30,176 participants were included and the sample size ranged from 64 to 6,024. The overall awareness of HPV and HPV vaccine among Chinese women was at a low level. Chinese women generally showed poor knowledge about HPV and HPV vaccine. Acceptance of HPV vaccination among Chinese women was at a high level. Vaccination intentions were influenced by the theory of planned behavior (TPB) and measured by attitudes subjective norms and perceived behavioral control.

Conclusions: The health authorities may evaluate and develop TPB-based interventions to increase HPV vaccination intentions of Chinese women. HPV vaccination programs should focus on carrying out multi-level and targeted health education and developing effective public health strategies after balancing the cost and benefit of HPV vaccine program. Medical staff should play the positive role in promoting the use of HPV vaccines in China. Integration of policy and community perspectives and multi-level interventions are essential to maximize the public health benefits of HPV vaccination.

Keywords: awareness • China • human papillomavirus • theory of planned behavior • vaccine • women

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1. Introduction

Cervical cancer is the second most prevalent cancer and one of the top causes of cancer death worldwide among female.¹ It is estimated that 98.9 per 100,000 Chinese would be newly diagnosed and about 30.5 per 100,000 Chinese will die from cervical cancer in 2015.² Persistent human papillomavirus (HPV) infection is the primary factor of cervical cancer^{3,4} and HPV vaccines have been recognized by World Health Organization (WHO) as the primary prevention to curb the potential disease process of cervical cancer. Because of the availability of HPV vaccines, cervical cancer has become preventable with the clear cause.^{5,6} Three types of HPV vaccines have been developed. In 2016, the Cervarix was approved in China for use on female aims at preventing genital warts and cervical cancer. But few people know the relationship between HPV and cervical cancer and preventive effect of the vaccine, let alone understanding correctly. Studies have shown that the HPV vaccine will significantly reduce the burden of cervical cancer in combination with other preventive measures particularly.⁷

Theory of planned behavior (TPB) is one of the most influential theoretical models of behavioral research in social psychology. The TPB posits that attitude subjective norms and perceived behavioral control influence behavioral intention and subsequently behavior. Attitude refers to individual positive or negative appraisal of the behavior. Subjective norms refer to the social pressure that an individual perceives for a particular behavior. Perceived behavioral control refers to expecting obstacles to perform the behavior. Additionally, behavioral intentions directly determine behavior.

Therefore, this systematic review aimed to gain a better understanding of the cognition of HPV vaccine and use the TPB to analyze influential factors which are of great importance in identifying concerns and needs for formulating practical public health strategies for Chinese community.

2. Methods

2.1. Searching strategies

PubMed (Medline), Web of Science, CNKI, Wanfang Data, and CQVIP Data were searched by two researchers from December 2005 to December 2017. This vaccine (Gardasil™) was approved by the FDA in 2006 for use in females aged 9–26 years. To increase the recall rate of literature we set the search time to December 2005. The search terms were “HPV” OR “Human papillomavirus” OR “HPV vaccine” OR “HPV vaccination” OR “cervical cancer vaccine” OR “cervical cancer

prevention” AND “acceptance” OR “acceptability” OR “attitude” OR “awareness” OR “beliefs” OR “knowledge” OR “intention” OR “perception” OR “uptake” OR “willing” OR “willingness” AND “Chinese” OR “China” OR “Hong Kong” OR “Taiwan” OR “Taiwanese” OR “Macao” OR “Macau.” Meanwhile, manual retrieval was also conducted and the references including in the literature were retrieved.

2.2. Inclusion and exclusion criteria

Studies included in this review needed to meet the following criteria: (1) reporting awareness knowledge attitudes acceptances or beliefs toward HPV and HPV vaccine among Chinese female population; (2) studies that were primary researches collecting primary data and published in academic journals; and (3) studies published in either English or Chinese language.

Studies were excluded from this review if they meet the following criteria: (1) Chinese women were not included in sample population or specific results for Chinese women could not be extracted from the overall results; (2) studies that investigated the knowledge and attitudes of male healthcare professionals or students; (3) studies that focused on immunization efficacy or health technology assessment; and (4) reviews on recommendations and health practice guideline.

2.3. Data extraction and critical appraisal

Data were extracted into a pre-specified data extraction form by one researcher and checked by another. Information about study design locations targeted sample research question key findings and interpretations was presented (data extraction shown in Tables 1 and 2).

2.4 Data analysis

No data were suitable for statistical pooling or meta-analysis because of the large clinical heterogeneity. Instead, the data were only analyzed by descriptive qualitative.

3. Results

As shown in Figure 1, 2,840 articles were identified after database searches, 39 were given full-text review with 19 meeting inclusion criteria.^{8–26}

3.1. Study characteristics

All articles were cross-sectional studies. Regarding study locations, 4 and 13 studies were conducted

Author	Study design	Age(years)	Sample size	Region in China	Acceptability (%)
Wang et al. 2015 ⁸	Cross-sectional	35–48	185	Jinan	29.19
Wong et al. 2009 ⁹	Cross-sectional	18–20	992	Hong Kong	70.80
Kwan et al. 2008 ¹⁰	Qualitative–quantitative	13–20	64	Hong Kong	68.80
Yu et al. 2016 ¹¹	Cross-sectional	30–56	1578	Weihai	26.49
Chiang et al. 2016 ¹²	Cross-sectional	18–25	234	Hong Kong	69.60
Chang et al. 2013 ¹³	Cross-sectional	19–47	1703	the mainland	81.00
Kwan et al. 2009 ¹⁴	Cross-sectional	>18	1261	Hong Kong	88.00
Hsu et al. 2009 ¹⁵	Cross-sectional	17–36	845	Taiwan	63.00
Li et al. 2009 ¹⁶	Cross-sectional	14–59	6024	the mainland	84.60
Wang et al. 2016 ¹⁷	Cross-sectional	37–48	377	Taiwan	78.00
Feng et al. 2012 ¹⁸	Cross-sectional	18–50	1432	Zhejiang	65.40
Li et al. 2008 ¹⁹	Cross-sectional	23–45	1013	Beijing	75.91
Yan et al. 2013 ²⁰	Cross-sectional	30–49	1681	Gansu	94.23
Wang et al. 2014 ²¹	Cross-sectional	23–81	250	Shaanxi	82.00
Zhou et al. 2011 ²²	Cross-sectional	23–45	500	Shanxi	82.00
Zhao et al. 2010 ²³	Cross-sectional	16–54	997	Shanghai	66.10
Wang et al. 2015 ²⁴	Cross-sectional	21–60	4897	Shenzhen	66.00
Su et al. 2016 ²⁵	Cross-sectional	21–71	973	Xi'an	76.00
Ayizuoremu et al. 2015 ²⁶	Cross-sectional	16–60	3900	Xinjiang	No mention

Table 1. Characteristics of included studies.

Author	Results		Measures
	Awareness/attitude	Factors	
Wang et al. 2015 ⁸	30.3% of the participants had heard of HPV and 12.4% of them had heard of HPV vaccine	Concerns about safety efficacy and source of HPV vaccine Cost	vaccine safety is assured and the cost is reasonable or subsidized by the government
Wong et al. 2009 ⁹	89% of the participants did not know that HPV infection could cause cervical cancer	Age Having had sexual intercourse Beliefs regarding the effectiveness of vaccination	More targeted sexual health education Solving the potential “unknown” side effects of the vaccine by health providers
Kwan et al. 2008 ¹⁰	No participant had any knowledge about HPV Over half of the participants had heard of vaccination but no one could provide any details	High monetary cost Uncertain length of vaccine effectiveness Low perceived risk of HPV infection Anticipated family disapproval Fear of the pain of injection	Providing professional information on HPV vaccination Raising perceived need to take preventive measures against HPV infection
Yu et al. 2016 ¹¹	19.3% of the participants had heard of HPV 26.5% of them expressed willingness to vaccination	Age Education occupation household income Knowledge level	Appropriate health education Reasonable price
Chiang et al. 2016 ¹²	69.6% of the participants intended to get vaccinated	Knowledge Cost	More aggressive education and promotion activities on HPV and HPV vaccination
Chang et al. 2013 ¹³	22.7% of the participants had heard of HPV	Vaccine's safety Efficacy Limited use	Incorporation of lecture-based education initiative into a government-sponsored or school-based program
Kwan et al. 2009 ¹⁴	About 38% of the participants had heard of HPV 50% of them had heard of vaccination against cervical cancer	Misconceptions A grossly inadequate knowledge about HPV and HPV vaccination	Culturally sensitive and tailored education for the public
Hsu et al. 2009 ¹⁵	Over 50% of the participants were aware of HPV and the HPV vaccine 63% of them reported a high intention to obtain the HPV vaccine	Demographic factors Health belief factors predicted HPV vaccination	Educational campaigns focusing on the efficacy safety and benefits of the HPV vaccine
Li et al. 2009 ¹⁶	Only 15.0% of the participants had heard of HPV and this knowledge differs between rural (9.3%) and metropolitan areas (21.6%) 84.6% of the participants were willing to be vaccinated	Lack of knowledge Doubts on the source of the HPV vaccine Safety	Public health campaign Government buy-in with commitment of resources Affordable vaccines Establishment of a health infrastructure

Table 2. (Continued).

Author	Results		Measures
	Awareness/attitude	Factors	
Wang et al. 2016 ¹⁷	Half of the participants had heard of HPV 78% of the participants reported a high intention regarding HPV vaccination	Family history of gynecological tumors Awareness	Recommendations by physicians and nurses
Feng et al. 2012 ¹⁸	39.1% of women in urban areas and 27.1% in rural areas had heard of HPV 23.7% and 15.1%, respectively, had heard of the HPV vaccine	Inadequate knowledge Misconceptions about HPV	Education campaigns targeting different populations
Li et al. 2008 ¹⁹	30.7% of the participants had heard of HPV. 51.78% of them knew that HPV infection was related to cervical cancer	Age Educational level HPV vaccine's safety and efficacy	Public health education
Yan et al. 2013 ²⁰	94.29% of the participants did not know about HPV at all but 94.23% of them would like to take HPV vaccine	Lack of perceived risk of cervical cancer	Spreading HPV and cervical cancer-related knowledge Improving quality of life essentially
Wang et al. 2014 ²¹	27.6% participants had heard of HPV and 17.6% of them had heard of vaccine 82.0% of them would like to take HPV vaccine	Occupation Degree of education Family income	HPV health education especially for low level of education of farmers and workers housewives and low-income groups
Zhou et al. 2011 ²²	Only 11.8% of the participants had heard of HPV 25% of them had heard of vaccine	HPV vaccine's safety and efficacy Cost	Public health education Improving scope of effective medical insurance
Zhao et al. 2010 ²³	20.6% of the participants had heard of HPV	Low perception of HPV infection Vaccine's limited use Source of HPV vaccine	Health education at all levels
Wang et al. 2015 ²⁴	46.1% of the participants had heard of HPV. 28.8% of them had heard of vaccine 66.0% of participants were willing to vaccination	Safety of HPV vaccine Vaccine's limited use in China Price of HPV vaccine	Targeted education on HPV and HPV vaccination
Su et al. 2016 ²⁵	32.5% of the women had ever heard of HPV 76.0% of the participants showed willingness to accept HPV vaccination	Concerns on HPV infection Occupation Degree of education	Strengthening public health education Disseminating information about HPV vaccine
Ayizuoremu et al. 2015 ²⁶	The awareness rates of cervical cancer HPV and HPV vaccine were 25.0% 8.0% and 4.0% among Uygur women and 35.0% 19.0% and 7.0% among Han women	Educational level	The popularization of knowledge on HPV and HPV vaccination

Table 2. Extraction of study contents.

in Hong Kong, China and Mainland China, respectively. The rest two studies were from Taiwan, China. Eleven and eight articles were, respectively, published in English and Chinese. In all, 17 studies only used quantitative survey methodology.^{8,9,11–26} The rest used a qualitative–quantitative approach and conducted by focus group discussions. A supplementary questionnaire was administered to participants before and after group discussion to assess their knowledge attitudes and intention.¹⁰

The majority of studies used random or cluster sampling methods.^{8,9,11–14,16,18–20,23–26} Two studies in Taiwan, China used convenient sampling,^{15,17} a study in Hong Kong, China used purposive sampling,¹⁰ a study in Shanxi Province used systematic sampling,²² while another study did not mention the methods of conducting survey.²¹

There were 30,176 participants in this review and the sample sizes ranged from 64 to 6,024. The target participants of all studies were women. The age of the

participant ranged from 13- to 71-years old and the most of the participants were above 18 years old.

3.2. Awareness of HPV and HPV vaccine

Awareness of HPV was assessed by asking if the participants had heard of HPV in 18 studies.^{8,10,11,13–26} The overall awareness of HPV among Chinese women was at a low level. A study in Gansu Province, an area with high incidence of cervical cancer, showed that 94.3% of women had not heard of HPV and only 2.4% of women had known that HPV was linked to cervical cancer.²¹ In Zhejiang Province, 39.1% of participants in urban areas and 27.1% of participants in rural areas had heard of HPV.¹⁹ While the awareness rates of HPV were 8.0% among Uygur women and 19.0% among Han women in Xinjiang Uygur Autonomous Region.²⁶ Based on the findings of studies, in a rural area in Shanxi Province only 11.8% of women had heard of HPV,²³ which was far below the economically developed urban areas in

Figure 1. Selection of articles for inclusion in the systematic review after a search conducted in December 2017.

China (46.9%).²⁵ Significant difference on the awareness of HPV was shown between urban and rural areas in China.

Similarly, awareness of HPV vaccine was assessed by asking if the participants had heard of anti-cervical cancer vaccine or HPV vaccine in ten studies.^{8,10,11,14,15,18,21,22,24,26} More than half of participants in Hong Kong, China and Taiwan, China studies indicated that they had heard of HPV vaccine.^{10,14,15} Only 5.5% of participants in Xinjiang Uygur Autonomous Region²⁶ had heard of HPV vaccine. The awareness of HPV vaccine was relatively lower in mainland China than those in Hong Kong, China and Taiwan, China.

3.3. TPB constructs

3.3.1. Attitudes

Most Chinese women had a positive attitude toward vaccination. A majority of studies reported individual HPV vaccine acceptability. Vaccination acceptance

varied depending on the demographic characteristics of the participants but the rate of overall acceptance was high. In Gansu province, the rate of participants accepting HPV vaccination was 94.2%.²⁰ Six studies demonstrated great improvements on the acceptability of HPV vaccination after education intervention.^{10,11,13,19,20,22}

Generally, most women showed strong willingness when they were reminded that HPV vaccine could prevent cervical cancer. Swarnapriya et al. reported that vaccine effectiveness was the most important attribute of vaccination.²⁷ In Beijing, 96.8% participants were willing to vaccinate because of its benefits.¹⁹ In Taiwan, China, women with stronger beliefs of their susceptibility for cervical cancer and the disease severity were more likely to obtain the HPV vaccine.¹⁵

3.3.2. Subjective norms

Subjective norms were predominant factors in participants' intentions. Recommendations from significant

others such as parents friends and healthcare providers influenced the Chinese women's decision to consider vaccination. In Taiwan, China, the greatest relation to intention was subjective norms which explained 60% of the variance in parental intention.¹⁷ It was reported in four studies that the participants would more likely to receive the vaccine after recommendations from healthcare professional and hospital lectures.^{10,15,20,23} In Shandong Province, most parents (81.0%) hoped HPV vaccine should be included in the expanded program immunization.⁸ Similarly, women in both urban and rural areas believed that the government and healthcare organizations' recognition and attention were important.^{20,23}

3.3.3. Perceived behavioral control

Cost was an important barrier for HPV vaccination. Some participants thought the vaccine should be free; while others indicated a minority willing to pay some amount although much less than the market price.^{8,19–26} Parents were able to determine whether to endorse the HPV vaccine for their daughters. Mothers mainly worried that acceptance of the vaccine may be seen as an admission of risky or early sexual behavior by her daughter.^{9,18} Young women worried that vaccination would give others the impression that they were sexually active.^{9,28} A previous research in the Gaborone also revealed that participants were more likely to be vaccinated when they were involved in decision-making.²⁹ In addition, uncertainties on efficacy or safety of HPV vaccine was another important barrier for the uptakes of HPV vaccines. They worried about the potential side effects of HPV vaccine and duration of vaccine effectiveness.^{13,14,19,22,23} The source of vaccine was also a concern. The majority of Chinese women indicated that they preferred vaccines provided by government or medical institutions.^{19,20}

3.4. Other influential factors for acceptance of HPV vaccination

3.4.1. Parental education level and family income

Women with different educational levels had significant differences in awareness and vaccination willingness. The higher education they had the more they were willing to vaccinate. Participants' willingness with university and above qualifications was up to 74.4%.²³ Five studies reported significant association between family income and vaccine willingness. It was found that higher family income was a significant predictor of vaccine willingness.^{8,11,20,21,24}

3.4.2. Sexual behavior

Among women whether or not they had sexual intercourse age of sexual onset number of sexual partners and preferred ways of contraception were important factors influencing HPV vaccination. Majority of the participants believed that sexually active women or women with multiple sexual partners should be vaccinated.^{10,15,17} In Hong Kong, China, 86% of the participants agreed with vaccinating sexually active women.¹⁴ Some participants believed that people with only one sexual partner had a low risk of getting infected with HPV and need not vaccinate.¹² The findings indicated that existing misconception on risk perception of cervical cancer was common among Chinese women.

3.4.3. Family history of gynecological tumors or infections

Family health history was related to women's willingness to receive the HPV vaccine. In Taiwan, China, the women with a personal or family history of gynecological tumors or infection were reported they had a high intention to vaccinate.^{15,17} In mainland China, HPV vaccine for preventing HPV infection and sexually transmitted disease was the primary cause of vaccination. Of participants in Gansu Province, 73.6% women feared that they would suffer from cervical cancer if they had not vaccinated.²³

4. Discussion

4.1. Knowledge and attitudes toward HPV vaccine

Previous studies on HPV vaccines were mainly concentrated in many Western and a number of Asian countries. However, studies on Chinese participants particularly were limited. Therefore, the purpose of this systematic review was to investigate the knowledge attitudes and the influential factors for HPV vaccination among Chinese women which was necessary for promotion and use of vaccines. Women's knowledge and attitudes in China were influenced by different social demographic backgrounds. HPV vaccine has been licensed in Hong Kong, China and Taiwan, China since October 2006. It was a good news that Cervarix and Gardasil were approved in 2016 and 2017, respectively, in mainland China. The awareness of HPV vaccine was relatively lower in mainland China than those in Hong Kong, China and Taiwan, China because of less access to HPV vaccines.

Awareness of HPV and vaccines was one of the potential factors influencing the willingness

to vaccinate.³⁰ Galbraith et al. found that African-Americans and Latinos' willingness to HPV vaccination were much lower than white Americans' willingness because of little knowledge.³¹ The rate of awareness of HPV and vaccine in Italian teenagers was 92%.³² The government achieved high rate of vaccination uptake and completion depending on the integration between the public health and schooling systems which was up to 97.2% in Brazil.³³ To raise public awareness and knowledge of HPV and vaccine were important indicators in preventing cervical cancer. However, previous studies indicated that Chinese women's overall knowledge on HPV and HPV vaccine was poor. Most women failed to identify the relationship between HPV infection and cervical cancer and had many misconceptions concerning cervical cancer HPV and HPV vaccine. In contrast, an average of 50% women in Korea was able to identify correctly the link between HPV and cervical cancer.³⁴

Despite lack of knowledge of HPV, the rate of acceptance of HPV vaccine among Chinese women was high. The results of low level of knowledge but high acceptance were similar to the outcomes of a study done in Haitian in 2014 when the HPV vaccine has just been approved.³⁵ In fact, many participants had never been exposed to cervical cancer HPV and HPV vaccines before the survey. They may be difficult to make informed decisions about HPV vaccination so it is necessary to raise public awareness by further health education. The studies showed significant improvement in both level of knowledge and acceptance after education intervention; and these results were consistent with Western studies.³³ Utility of information pamphlet and implementation of mass public health education on HPV vaccine are effective means for promotion and application of vaccination. For ethnic minorities, it should be considered that their mastery of Chinese Putonghua and the promotional materials are available in minority languages and Chinese Putonghua.

4.2. Influential factors for acceptance of HPV vaccination

Studies showed parental educational level and family income were associated with awareness and willingness of HPV vaccine. Women with higher level of education may take the initiative to learn the relevant knowledge and had a higher level of acceptance to health knowledge and new things. So women with higher level of education may have a relatively higher acceptance. Vaccination willingness rates were much higher among women living in wealthier families than those among women living in poorer families. There was a positive correlation between vaccination rates and higher family income in the United States.³⁶ This was consistent with

Kester et al.³⁷ who reported that vaccination coverage of young people in low-income families decreased significantly in the same year.

Being vulnerable to a health problem played a role in motivation for health behaviors.³⁸ Similar to the findings from Taiwan, China, parental intention to daughters' HPV vaccination was related to personal history of sexually transmitted diseases or family history of gynecologic tumors in Sweden.³⁹ Women expressed a trust in vaccine recommendations from authorities and experts. If the HPV vaccine had been administered to adolescent girls during any healthcare visit in which they received another vaccine, the initiation rates for HPV vaccination in the United States would exceed 90% among this population.⁴⁰ Physician's recommendation for HPV vaccination was significantly associated with vaccination among females in Louisiana and Alabama.⁴¹ Those underlined the importance of healthcare professionals as key persons in spreading information about HPV and HPV vaccine. Although healthcare professionals had high level of awareness of HPV infection, they were lack of more comprehensive knowledge of HPV vaccine in mainland China.⁴² Thus, increasing HPV vaccination detailed knowledge and improving positive attitude of healthcare professionals are essential for enhancing the uptakes of HPV vaccines.

HPV vaccines were considered to prevent some sexually transmitted diseases by adolescents in the United States.⁴³ Young adults might be reluctant to receive the HPV vaccine because they were afraid of being labeled sexually active.²⁸ At the same time, Jumaan et al. found that focusing messages on cervical cancer protection rather than sexually transmitted diseases prevention appeared to help minimize sensitivities around girls' sexuality.⁴⁴ Some participants noted that those who frequently had sex or promiscuity needed vaccine and people who had only one sexual partner had a low risk of becoming infected with HPV.^{10,14,18,38,42} The most frequent reason for not accepting vaccination cited by mothers was 'My daughter is too young to have sex'. Under the influence of traditional Chinese culture, sex has been a sensitive topic and sexually transmitted disease is a sexual stigma which is associated with immorality and infidelity. These findings were similar to the previous study in China that cultural issues such as modesty and embarrassment contributed to low cervical screening attendance.⁴⁵ Health promotion should target at increasing women who have low perceived risk of HPV infection or a fear of social stigma. Public health services for Chinese women need to ensure that the philosophy of the staff and the approach used are culturally relevant especially for culturally sensitive women.

Suspicion of safety and efficacy of the vaccine were reported in some studies as the primary reason

for refusing vaccination. Participants concerns about the possibility of lasting health problems.^{8,9,13,14,19,20} The study in the USA comparing parental responses over time found that more cited safety concerns as a reason for not vaccinating their adolescents in 2010 than that in 2008.⁴⁶ In fact, many clinical trials demonstrated that HPV vaccines had a promising effectiveness against cervical cancer and the risk of adverse events related to vaccination were acceptable. The vaccines have been already licensed in many countries.⁴⁷ A survey in Japan showed that a hypothetical restart of a governmental recommendation for the vaccine would induce 4.1% of all the mothers who were more likely to encourage their daughters to get vaccinated without any other preconditions.⁴⁸ Together, health authorities and mainstream media should spread the impartial and accurate messages to the public and guarantee the safety of HPV vaccines. If possible, the vaccines should be supplied through government programs. It is rise to make medical staff play the positive role in promoting the use of HPV vaccines.

The cost presented a significant barrier to implementation in China. It was found that more than 50% participants could not afford the HPV vaccines and wanted the government to pay all or part of the costs. A huge gap between affordable price and actual price inevitably leaded to a decline in vaccination rates. We can learn from the Global Alliance for Vaccines and Immunization (GAVI) policy in low- and middle-income countries which made a great success.⁴⁹ It can be considered that cost is shared among recipients government public health insurance companies charities international health organization and pharmaceutical companies. To lower the price of HPV vaccine to an acceptable level, the integration of an appropriately expanded coverage of health insurance and a reasonable cost-sharing mechanism should be conducted.

4.3. Limitations

In 18 studies on knowledge and acceptance of HPV and HPV vaccine, the results were inconsistent. Study designs, sample sizes, sampling techniques, sociodemographic characteristics of population measures, and locations may result in the low comparability. Owing to disparities in wealth and unequal development among cities, the results may not accurately represent the knowledge and attitudes of Chinese women in general. Most studies used convenience sampling methods so that samples were not representative. Altogether, sampling among different geographic regions should be stratified based on population density and development in future researches. The assessment and outcome measures differed greatly across the studies and

comparability was limited. All studies used a self-administered questionnaire and seven articles did not report the source of measures or questionnaires.^{19–26} Only a study in Taiwan, China tested the ease of reading and clarity of self-administrated questionnaire prior to the survey.¹⁵ Therefore, appropriate measures should be developed and the literacy level of participants should be assessed so as to obtain accurate data.

5. Conclusions

Cervical cancer is posing a big burden on Chinese women and can be preventable by the use of HPV vaccines. HPV vaccines were approved in 2016 and Chinese women have started to getting vaccinated. High HPV vaccination coverage is influenced by individual knowledge and attitudes. This review showed that the overall awareness and knowledge of Chinese women were very low. Raising the awareness and knowledge of Chinese women is extremely urgent. It must make an all-out effort to carry out multi-level and targeted health education but it should be careful to culturally sensitive people. Some major factors influenced the attitudes of HPV vaccination such as cost concerns on efficacy and safety of HPV vaccine recommendations from others and so on. The Health authorities may evaluate and develop TPB-based interventions to increase acceptance of Chinese women after considering all factors. Policymaker should seriously consider to developing effective public health strategies after balancing the cost and benefit of HPV vaccine program. It is necessary to expand the scope of medical insurance coverage and strengthen grass-roots healthcare project construction. Meanwhile, medical staffs should play a positive role in the recommendation of HPV vaccine. Together, all measures can maximize the public health benefits of HPV vaccination.

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Ethics approval

The study protocol was approved by the Ethics Committee of University of South China. Potential participants received information about the study and they were informed that their response will be considered an informed consent to participate in the survey. Consent for interviews was also obtained.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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