

Factors influencing HPV vaccine acceptance among females in mainland China: A systematic review

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ABSTRACT

Introduction: One of the most common malignant tumors affecting women in China is cervical cancer. In the year 2015, 30,500 fatalities and 98,900 new cases of cervical cancer were reported. By 2030, the number of deaths from cervical cancer will grow by over 50%. China has been strengthening its cervical cancer prevention and treatment service system and enhancing the country's comprehensive prevention and treatment capacity including HPV vaccination.

Objective: A systematic review was conducted to examine and describe factors influencing HPV vaccine acceptance among females in mainland China.

Method: A systematic search of Web of Science, PubMed, Scopus, EBSCOhost, and China National Knowledge Infrastructure (CNKI) was carried out from January 2000 to April 2023 for articles related to factors influencing HPV vaccine acceptability among females in mainland China.

Result: Articles were screened by inclusion and exclusion criteria, and those that met the inclusion criteria were included in the study. Of the 10 included studies, the subjects involved university students, secondary school students, mothers, health professional students, medical professionals, and females. A review of the included studies revealed that there was a low level of acceptance of the HPV vaccine among women in mainland China as a whole. Factors influencing this acceptance included knowledge of the HPV vaccine, hearing about it, family history of infection-related diseases, cost, hearing about HPV/HPV vaccine/cervical cancer, vaccine safety, sex life, and sex education.

Conclusion: Awareness of the HPV vaccine among females in mainland China is low, and this leads to a lack of acceptance of the HPV vaccine among females. The HPV vaccination program will benefit more from targeted HPV vaccine promotion campaigns based on factors influencing females' acceptance of the vaccine, such as those conducted through the media, hospital publicity, and community publicity to increase women's knowledge of the vaccine and improve vaccine acceptance.

1. Introduction

One of the most common malignant tumors affecting women in China is cervical cancer.¹⁻³ In the year 2015, 30,500 fatalities and 98,

900 new cases of cervical cancer were reported. By 2030, the number of deaths from cervical cancer will grow by over 50%.^{4,5} However, cervical cancer is largely avoidable, and early detection and treatment can significantly enhance outcomes.^{6,7} China has been strengthening its

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cervical cancer prevention and treatment service system and enhancing the country's comprehensive prevention and treatment capacity.⁸ In July 2016, China officially approved the marketing of the HPV vaccine. Studies have shown that the awareness rate among women is low about the relationship between HPV and cervical cancer and the preventive effect of the HPV vaccine.⁵ The Healthy China Action Plan (2019–2030) further specified objectives and strategies for gradually improving screening coverage of cervical cancer, promoting Human Papillomavirus (HPV) vaccination, and improving the accessibility of HPV vaccines.^{8,9}

Acceptance of HPV vaccination refers to people's desire and intention to receive or arrange for the eligible population to receive the vaccine considering their favorable attitudes, convictions, and perceptions regarding the vaccine's efficacy, benefits, and advised use.¹⁰ The study aims to systematically review and identify the various factors that affect the acceptance of the HPV vaccine specifically among females in mainland China.

2. Methods

2.1. Article selection criteria

This systematic review was drawn up based on the updated guidelines known as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). The components of mnemonic PEO (population, exposure, outcome) were identified as the following:

- Population: females in mainland China.
- Exposure: associated factors of HPV vaccine acceptance.
- Outcome: the acceptance of the HPV vaccine.

2.2. Search strategy

This systematic review only focuses on HPV vaccination among female in mainland China. This review selected relevant English and Chinese language articles published in peer-reviewed academic journals between January 1, 2000, and April 30, 2023. The following electronic databases related to the subject keywords were identified and searched: Web of Science, PubMed, Scopus, and EBSCOhost for English. Meanwhile, the China National Knowledge Infrastructure (CNKI), which is extensively used in China, was specifically chosen for Chinese literature retrieval. The inclusion of CNKI because the research subjects for this systematic review are women in mainland China. This decision was made to increase the systematic review's credibility. The English and Chinese search terms used are listed in Table 1. All retrieved articles were exported via Microsoft Excel for duplicate article screening.

Table 1
Search terms for English database and Chinese database.

Key concepts	Search terms
HPV and HPV vaccine influencing factors	"HPV vaccine*" OR "Human Papillomavirus" OR "HPV*" OR "factor*" OR "influencing factor*" OR "predictor*" OR "Influential factor" OR "Key factor"
acceptance	"acceptance" OR "approbation" OR "accept" OR "receptivity" OR "adoption" OR "acceptability" OR "intention"
female	"female*" OR "woman" OR "women" OR "girl*" OR "parent*"
HPV and HPV疫苗 (vaccine)	"HPV vaccine*" OR "Human Papillomavirus" OR "HPV*" OR "HPV疫苗(vaccine)" OR "人乳头瘤病毒(Human Papillomavirus)"
影响因素(influencing factors)	"因素(factor)" OR "影响因素(Influencing factor*)"
接受度(acceptance)	"接受(acceptance)" OR "接受度" OR "意愿(intention)"
女性(female)	"女性(female)" OR "女人(woman/women)" OR "女孩(girl)" OR "妇女" OR "父母(parent*)" OR "母亲(mother)"

2.3. Eligibility criteria

The inclusion criteria applied were: (1) publication in the English or Chinese language; (2) publication between 2000 and 2023; (3) the research object is the female audience; (4) original articles, including cohort, case-control, and cross-sectional studies that are related to factors affecting females' vaccine acceptance. Qualitative studies and non-original articles, such as conference proceedings, perspectives, commentary, opinions, reports, systematic reviews, and meta-analyses were excluded.

2.4. Study selection

Two independent reviewers checked the titles and abstracts of the materials retrieved from each database against inclusion and exclusion criteria. In the event of a dispute between the two reviewers, the potential articles that passed the initial screening were retained and forwarded to a third reviewer for input. After that, a full-text screening was done to weed out any literature that didn't fit the requirements for inclusion.

2.5. Critical appraisal and data extraction

Quality appraisal was conducted using the Mixed Methods Appraisal Tool (MMAT). The MMAT was used to evaluate the quality of the methodological criteria, including five core quality criteria of each selected article.¹¹ This work was done jointly by two reviewers: one reviewer extracted the data, which were then assessed independently by a second reviewer. Eligible articles were analyzed in detail using the content analysis method without any statistical tests.

3. Result

Through the retrieval, a total of 325 articles from Web of Science, 388 articles from PubMed, 343 articles from SCOPUS, 191 articles from EBSCOhost, and 50 articles from CNKI were generated, yielding a total of 1297 articles. After the system automatically identified and deleted duplicates, there were a total of 723 articles. Only 31 articles are included in the full-text assessment after a rigorous selection screening, as shown in the PRISMA flow diagram (Fig. 1). The findings from 10 studies are included in this systematic review, as shown in Table 2. The analyzed articles were published between 2000 and 2023.

A total of 10 studies were included in this paper, focusing on HPV vaccine acceptability among females in mainland China and the factors influencing acceptability. All studies in this systematic review were conducted in mainland China. In the studies included in the systematic review, all investigations had passed the ethical review of relevant departments, and the sample populations were consistent with the research objectives. Among the 10 studies, the minimum sample size was 117 persons, and the maximum sample size was 9865 persons. The 10 studies involved a total of 41,683 samples, of which 35,720 were female. Regarding the language of publication, from the 10 included documents, there were seven English-language papers and three Chinese-language papers, published from 2011 to 2022. Regarding research time, the HPV vaccine was first introduced in China in 2016, in the included literature, five research were conducted earlier than 2016, and five were conducted after the introduction of the HPV vaccine by the Chinese government in 2016. In terms of age, the included literature covered audiences from 12 to 82 years old, with most of the literature featuring female audiences and a few articles including women in the study population, and all the articles were analyzed separately for female acceptability as well as influencing factors. The choice of the study population in terms of occupation included university students, secondary school students, health science students, females in general, and mothers, so two of the articles specifically discussed females' acceptance of HPV vaccination for their children and the factors that influenced it.

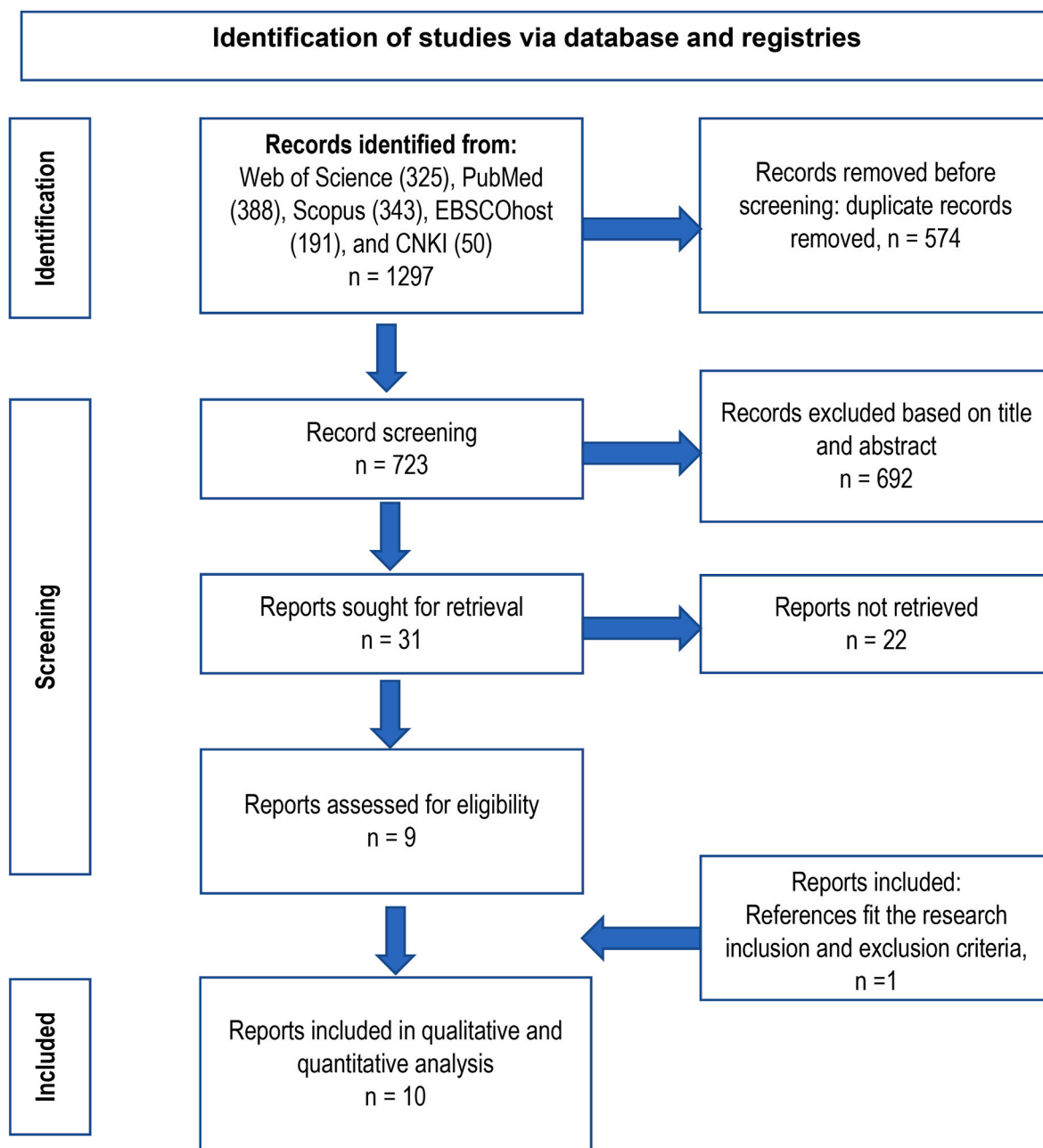


Fig. 1. PRISMA flow diagram for the systematic review.

In terms of the region where the study was conducted, the included literature covered urban and rural regions, and higher education institutions in several regions of China.

3.1. HPV vaccine acceptance

This paper presents 10 studies focusing on the acceptability of the HPV vaccine among females in mainland China and the main factors influencing the vaccine’s acceptability to females. The results of acceptability are shown in Table 3.

As shown in Table 3, of the 10 studies included, the highest level of acceptability was 72.6%¹⁴ in a study of junior high school students, while the lowest level of acceptability was only 32.08%¹³ in a study of female university students. It is worth mentioning that one of the studies compared the acceptance of the HPV vaccine among women with daughters (66.3%) and women without daughters (59.9%).¹⁶ The result showed that females with daughters were more accepting of the HPV

vaccine, and the study showed that there was a higher acceptability of the HPV vaccine for daughters (73.5%) than for themselves (66.3%).¹⁶

Another notable finding was that from the 10 studies, those with low acceptability were all conducted with university students, which means that acceptance of the HPV vaccine among university students in mainland China was low overall, with one study with university students in health science-related majors showing only a 55.2% acceptance of the HPV vaccine among female students.¹⁵ In addition to this, four other studies with university students showed that the acceptability of the HPV vaccine among female students ranged from 32.08% to 44%.^{12,13,17,18}

The highest HPV vaccine acceptance among the 10 included studies showed that although 72.6% of women were willing to receive the HPV vaccine, only 17.1% of schools reported having heard of the HPV vaccine before the survey, and whether or not they had heard of the HPV vaccine, parents’ (guardians’) and teachers’ recommendations, and whether or not they were able to perceive their own risk of cervical or

Table 2
Summary of included articles.

Author(s) (year)	Title	Study design	Sample size	HPV vaccine acceptance	Associated factors
Dai et al. (2022) ¹²	Willingness to human papillomavirus (HPV) vaccination and influencing factors among male and female university students in China	Cross-sectional study	7335 (3765 females)	Outcomes studied: Females are willing to receive HPV vaccine: 1208 (32.1%) Females are unwilling to receive HPV vaccine: 2557 (67.9%)	<ol style="list-style-type: none"> Higher living expenses (AOR = 1.395 and 3.717, 95% CI: 1.071–1.426 and 1.776–7.752). Relatives or friends had certain cancer (AOR = 1.290, 95% CI: 1.095–1.518). Sexual experiences (AOR = 2.628, 95% CI: 1.788–3.863). Consulted on HPV vaccination issues (AOR = 1.612, 95% CI: 1.367–1.901). High HPV knowledge scores (AOR = 1.227, 95% CI: 1.055–1.428). Received sex education (AOR = 1.289, 95% CI: 1.064–1.562).
Si et al. (2021) ¹³	Willingness to Accept Human Papillomavirus Vaccination and its Influencing Factors Using Information-Motivation-Behavior Skills Model: A Cross-Sectional Study of Female College Freshmen in Mainland China	Cross-sectional study	3867	Outcomes studied: Vaccinated: 2.64% Willingness to vaccinate: 32.08%.	<p>Vaccination-related factors:</p> <ol style="list-style-type: none"> Sexual experience (AOR = 1.96, 95% CI: 1.25–3.08). Family members or friends with cancer (AOR = 1.24, 95% CI: 1.04–1.48). Heard of HPV (AOR = 1.23, 95% CI: 1.03–1.47). Searched or asked questions about HPV vaccine (AOR = 1.22, 95% CI: 1.02–1.45). Perceived susceptibility (AOR = 1.20, 95% CI: 1.09–1.31). Perceived severity (AOR = 1.24, 95% CI: 1.11–1.39). Subjective Norm (AOR = 2.09, 95% CI: 1.752.49). Self-efficacy (AOR: 2.95, 95% CI: 2.44–3.58). <p>Factors associated with vaccine hesitancy:</p> <ol style="list-style-type: none"> HPV vaccination is expensive (47.48%). Worry about the possible side effects of the HPV vaccine (44.51%). No sexual activity (43.37%) Safety and effectiveness of the HPV vaccine (29.49%). Possible needle hurts of HPV vaccination (19.16%). Too many needles (17.05%).
Zhang et al. (2021) ¹⁴	HPV vaccine acceptability and willingness-related factors among Chinese adolescents: a nation-wide study	Cross-sectional study	4062 (Female: 1936)	Acceptance of vaccines: 1406 (72.6%) Refused vaccine: 530 (27.4%)	<ol style="list-style-type: none"> From rural areas (AOR: 1.19, 95% CI: 1.02–1.39, p = .027). Sexual education or knowledge (AOR: 1.35, 95% CI: 1.15–1.58, p < .001). Believed that prevention was better than treatment (AOR: 1.45, 95% CI: 1.22–1.72, p < .001) or 4. Believe vaccinations effectively prevent disease (AOR: 1.37, 95% CI: 1.17–1.60, p < .001) Suggestions from parents and teachers (AOR: 1.41, 95% CI: 1.12–1.76, p = .003 and AOR: 1.54, 95% CI: 1.08–2.17, p = .016). Have heard of cervical cancer (AOR: 1.33, 95% CI: 1.12–1.58, p = .001) Have heard of HPV vaccines (AOR: 1.35, 95% CI: 1.08–1.68, p = .008) Perceived risk of developing cervical cancer or other HPV-related cancers (AOR: 2.04, 95% CI: 1.70–2.44, p < .001).
Y. Lin et al. (2019) ¹⁵	Factors influencing intention to obtain the HPV vaccine and acceptability of 2-, 4-and 9-valent HPV vaccines: A study of undergraduate female health sciences students in Fujian, China	Cross-sectional study	997	Acceptance of vaccines: 550 (55.2%) Refused vaccine: 447 (44.8%)	<ol style="list-style-type: none"> High HPV vaccination knowledge score (OR = 1.469, 95% CI: 1.087–1.987) High-risk perception of contracting HPV (OR = 1.466, 95% CI: 1.017–2.114) No perceived barrier to taking time off to obtain the HPV vaccination (OR = 1.727, 95% CI: 1.289–2.313) No perceived serious side effects of HPV vaccination (OR = 1.562, 95% CI: 1.150–2.121) Regular exposure to HPV vaccination information in the mass media (OR = 2.196, 95% CI: 1.625–2.966) Confidence about obtaining the HPV vaccine (OR = 7.281, 95% CI: 4.38512.088)
W. Lin et al. (2019) ¹⁶	Awareness and attitude towards human papillomavirus and its vaccine among females	Cross-sectional study	9855	Acceptance of vaccines: 6241 (63.3%)	<ol style="list-style-type: none"> Younger age (AOR: 1.257, 95% CI: 1.135–1.392)

(continued on next page)

Table 2 (continued)

Author(s) (year)	Title	Study design	Sample size	HPV vaccine acceptance	Associated factors
	with and without daughter(s) who participated in cervical cancer screening in Shenzhen, China			Refused vaccine: 3614 (36.7%)	<ol style="list-style-type: none"> 2. Temporary residency (AOR: 1.210, 95% CI: 1.052–1.392) 3. Higher education levels (AOR: 1.190, 1.297, 95% CI: 1.061–1.336, 1.121–1.501) 4. Being married (AOR: 1.221, 95% CI: 1.028–1.450) 5. Higher monthly income (AOR: 1.225, 95% CI: 1.034–1.523) 6. Having daughter(s) (AOR: 1.337, 95% CI: 1.219–1.467); 7. Heard of HPV (AOR: 1.287, 95% CI: 1.150–1.440) 8. Knowing that HPV is a sexually transmitted infection (AOR: 1.196, 95% CI: 1.065–1.342) 9. Knowing that HPV vaccine prevents cervical cancer (AOR: 1.582, 95% CI: 1.3671.831) 10. Knowing that HPV vaccination should take place before sexual debut (AOR: 1.284, 95% CI: 1.0671.545).
Gu et al. (2015) ¹⁷	Human papillomavirus vaccine acceptability among female undergraduate students in China: the role of knowledge and psychosocial factors	Cross-sectional study	117	Acceptance of vaccines: 51 (44%) Refused vaccine: 66 (56%)	<ol style="list-style-type: none"> 1. Higher levels of knowledge about the risk factors of cervical cancer (AOR = 2.412, 95% CI: 1.255–4.634) 2. A perception that infected women are responsible for their own infection of HPV (AOR = 1.870, 95% CI: 1.075–3.252), p = 0027)
Deng et al. (2021) ¹⁸	Human papillomavirus vaccination: coverage rate, knowledge, acceptance, and associated factors in college students in mainland China	Cross-sectional study	1022 (Female: 755)	Vaccinated: 3.57% Acceptance of vaccines: 36.9% Refused vaccine: 3.7%	<ol style="list-style-type: none"> 1. Vaccination being an effective safeguard against disease (OR: 2.327, 95% CI: 1.337–4.049) 2. The necessity of receiving all vaccinations (OR: 1.951, 95% CI: 1.349–2.821) 3. Ensuring others' safety by undergoing vaccination (OR: 1.482, 95% CI: 1.030–2.133)
Han et al. (2018) ¹⁹	Analysis of mothers' acceptance of HPV vaccination of adolescent girls in Xiamen	Cross-sectional study	2307	Acceptance of vaccines: 1428 (61.9%)	<ol style="list-style-type: none"> 1. Family history of malignancy (OR: 1.36, 95% CI: 1.02 to 1.82) 2. Known about HPV (OR: 1.32, 95% CI: 1.08 to 1.62) 3. HPV vaccine knowledge (OR: 2.03, 95% CI: 1.56–2.66)
Yuling (2011) ²⁰	Survey on Awareness and Attitude Towards HPV and HPV Vaccination for Cervical Cancer Prevention Among Urban Women and Medical Professionals	Cross-sectional study	9865	Acceptance of vaccines: Screening females: 72.31% would like to receive the HPV vaccine themselves. 72.59% would like to have their daughters vaccinated. Health care providers: 69.77% would like to receive the vaccine themselves. 68.74% would like to have their daughters vaccinated.	<ol style="list-style-type: none"> 1. Highly educated (OR: 3.67–9.70) 2. High income (OR: 2.15–6.68) 3. Older age at first sex (OR: 1.14–1.50) 4. Older age at first pregnancy (OR: 1.36–1.98) 5. Less frequent pregnancies (OR: 1.21–1.34) 6. Had a low number of births (OR: 1.77–2.66) 7. Family member with a tumour (OR: 1.41, 95% CI: 1.20–1.65) 8. Heard of HPV (OR: 2.68, 95% CI: 2.33–3.07) 9. No abnormal vaginal discharge or irritation (OR: 1.73, 95% CI, 1.56–1.92)
Qin et al. (2020) ²¹	Acceptability of vaccination against human papillomavirus among women aged 20 to 45 in rural Hunan Province, China: A cross-sectional study	Cross-sectional study	2101	Acceptance of vaccines: 1230 (58.55%) Refused vaccine: 871 (41.45%)	<ol style="list-style-type: none"> 1. Age (AOR: 1.35, 1.50, 95% CI: 1.18–1.55, 1.04–2.16) 2. Education Level (AOR: 1.13, 1.47, 95% CI: 1.05–1.68, 1.23–2.01) 3. Awareness of prevention of cervical cancer (AOR: 2.01, 95% CI: 1.44–2.82) 4. Awareness of HPV vaccine (AOR: 2.67, 95% CI: 1.20–5.98)

Note: AOR = adjusted odd ratio; OR = odds ratio; 95% CI = 95% confidence interval; p = p-value.

other HPV-related cancers were the HPV vaccination hospitals.¹⁴ In the study with the lowest acceptance, although 59.89% had heard of HPV, only 32.08% were willing to receive the HPV vaccine in the next 6 months, and among the students who were not willing to receive the HPV vaccine, the expensive price of the vaccine, fear of the possible side effects of the HPV vaccine, not having enough health information to fully understand the HPV vaccine, and not having a sex life were the main reasons.¹³

3.2. Factors influencing HPV vaccine acceptance

Most factors included were HPV vaccine knowledge, heard of HPV/HPV vaccine/cervical cancer, cost, family medical history or infection-related diseases in close people, vaccine safety, sex life, sex education, living area, age, children, education level, income, marital status, dissemination of health information in mass media, etc.

The studies included in this review suggest that factors influencing HPV vaccine acceptance among females in mainland China can be categorized as (1) personal factors, (2) behavioral factors, and (3)

Table 3
The acceptability of the HPV vaccine among females in mainland China.

Author(s) (Year)	Sample Size (only females)	Willingness to vaccinate	Willing to vaccinate daughter	Refusal of vaccination
Dai et al. (2022) ¹²	3765	32.1%		67.9%
Si et al. (2021) ¹³	3765	32.08%		67.92%
Zhang et al. (2021) ¹⁴	1936	72.6%		27.4%
Y. Lin et al. (2019) ¹⁵	997	55.2%		44.8%
W. Lin et al. (2019) ¹⁶	Have daughter 5799	66.3%	73.5%	36.7%
	No daughter 3847	59.90%		
Gu et al. (2015) ¹⁷	117	44%		56%
Deng et al. (2021) ¹⁸	755	36.9%		3.7%
Han et al. (2018) ¹⁹	2307		61.9%	
Yuling (2011) ²⁰	Screening female 9865	72.31%	72.59%	
	Health care provider 780	69.77%	68.74%	
Qin et al. (2020) ²¹	2101	58.55%		41.45%

environmental factors.

3.3. Personal factors

Age: Some studies found age to be an influential factor in HPV vaccine uptake among women in mainland China. Women aged 30–39 years (AOR: 1.257, 95% CI: 1.135, 1.392) or younger were more likely to have the HPV vaccine administered to them than women aged 40 years or older,¹⁶ and the relationship between age and HPV vaccine acceptability was also shown in the study, with women aged 41–50 years having higher acceptance of the HPV vaccine (AOR: 1.25, 95% CI: 1.06, 1.47).²⁰ This result is consistent with the findings of another research which were a positive association between age and vaccination intention.²¹

Education level: In a study in Shenzhen, results showed that higher education levels were an effective contributor to HPV vaccination intention, with women who had university or higher education having a stronger intention to receive HPV vaccination compared to women with high school or lower education (AOR: 1.297, 95% CI: 1.121, 1.501).¹⁶ In a national-level study, the results showed that women's educational attainment was positively associated with HPV vaccine uptake.²⁰

HPV knowledge: A high level of HPV vaccine knowledge was the main influencing factor for HPV vaccine acceptance; this was validated in the results of several studies. In a study of female university students majoring in health sciences in Fujian Province, results showed that the important factor associated with intention to receive the HPV vaccine was the high HPV vaccination knowledge score (OR = 1.469, 95% CI: 1.087–1.987),¹⁵ a result that is consistent with the results of another study showing higher levels of knowledge about the risk factors of cervical cancer being a significant influence on HPV vaccine uptake (AOR = 2.412, 95% CI: 1.255–4.634).¹⁷ In addition to HPV vaccination for themselves, results from a study conducted in Xiamen on mothers' attitudes towards HPV vaccination for their daughters also indicated that HPV vaccine knowledge was a significant influencing factor for mothers' HPV vaccination for their daughters (OR: 2.03, 95% CI: 1.56–2.66).¹⁹ In addition, women who believed that prevention was better than cure vis a vis the HPV vaccine (OR: 1.45, 95% CI: 1.22, 1.72)¹⁴ or who recognized the protective function of the HPV vaccine (OR: 2.327, 95% CI: 1.337–4.049)¹⁸ were also more likely to have a stronger intention to be

vaccinated.

Income: Both studies showed that women's income levels were positively associated with their willingness to receive HPV vaccination in mainland China.^{16,20}

Residential area: The study showed that the level of knowledge about HPV, HPV-related diseases, and the HPV vaccine was significantly higher among young people from urban areas than among those from rural areas. However, rural teenagers were more likely to receive the HPV vaccine than urban teenagers (AOR: 1.19, 95% CI: 1.02–1.39).¹⁴ In another study, the results of the residence survey showed that residents and non-permanent residents were more likely to receive HPV vaccination than a mobile population.¹⁶

Sexual activity: The presence or absence of sexual experience is one of the influencing factors for HPV vaccine acceptance. In a study of university students, results showed that willingness to receive the HPV vaccine was influenced by sexual experience (AOR = 1.96, 95% CI: 1.25–3.08),¹³ and similar results were found in another study where female students were more likely to receive the HPV vaccine if they had had sexual experience (AOR = 2.628, 95% CI: 1.788–3.863).¹²

Marital status: The results of a study showed that those with a spouse (AOR: 1.09, 95% CI: 0.87 to 1.37) showed higher acceptance of the HPV vaccine than those without a spouse.²⁰ This result is in line with another study that showed people with marital status being more concerned about the HPV vaccine and more likely to receive HPV vaccination than single females.²¹

Parenthood status: Study found that having a daughter (AOR: 1.337, 95% CI: 1.219, 1.467) became an important factor for HPV vaccine vaccination in women.¹⁶ Another study showed that females who were older than 31 years old at first pregnancy (AOR: 1.98, 95% CI: 1.15 to 3.41) or had already given birth to a child (AOR: 2.78, 95% CI: 2.28 to 3.40) had higher acceptance of the HPV vaccine.²⁰ This also means that females who are "mothers", especially those who have daughters, are more interested in HPV vaccination and are more likely to accept it.

Risk perception: Study found that for adolescents, those who perceived themselves to be at risk for cervical cancer or other HPV-related cancers were more likely to receive the HPV vaccine (AOR: 2.04, 95% CI: 1.70–2.44, $p < .001$).¹⁴ Similar results were obtained in another study, where an important factor associated with willingness to receive the HPV vaccine was females' perceived higher risk of HPV infection (OR = 1.466, 95% CI: 1.017–2.114).¹⁵ In a study of factors influencing HPV vaccine acceptance based on the Information-Motivation-Behavioral (IMB) model, results showed that "perceived susceptibility" (AOR = 1.20, 95% CI: 1.09–1.31), "perceived severity" (AOR = 1.24, 95% CI: 1.11–1.39), "subjective norms" (AOR = 2.09, 95% CI: 1.75–2.49) and "self-efficacy" (AOR: 2.95, 95% CI: 2.443.58) scores were higher for women with higher acceptance of the HPV vaccine.¹³

3.4. Behavioral factors

Vaccine hesitancy: Lack of information on HPV vaccination and concerns about side effects and potential safety issues were the main reasons for females' vaccine hesitancy, and the results showed that such vaccine hesitancy hindered HPV vaccination efforts among females in mainland China.¹⁸ Results from another study showed that the high price of the HPV vaccine, concerns about the possible side effects of the HPV vaccine, lack of sexual intercourse, and too many shots to guarantee time also emerged as the main reasons for vaccine hesitancy.¹⁵ In studies conducted with rural females, never having heard of the HPV vaccine and concerns about the effectiveness and safety of the vaccine were the main reasons for females' vaccine hesitancy.²¹ In addition, in a study of mothers' attitudes toward their daughters' HPV vaccination, "concern about the safety of the vaccine" was also the main reason for mothers' hesitation.¹⁹

Knowledge-seeking behavior: In a study conducted with mainland female university students, it was found that those who actively

searched or inquired about the HPV vaccine via the internet (AOR = 1.22, 95% CI: 1.02–1.45) had a stronger intention to receive the HPV vaccine.¹³ Results from another study conducted with university students showed the same trend, with female university students who actively consulted about HPV vaccination (AOR = 1.612, 95% CI: 1.367–1.901) being more likely to receive the HPV vaccine.¹²

3.5. Environmental factors

Influence of advice from others: Studies of minors have shown that students who value the advice of their parents and teachers are more likely to receive the HPV vaccine (AOR: 1.41, 95% CI: 1.12–1.76, AOR: 1.54, 95% CI: 1.08–2.17).¹⁴ In a study of female undergraduate students between the ages of 19 and 23, the results showed that doctors were the most perceived support from others towards HPV vaccination.¹⁷ This is consistent with the results of another study where the main factors associated with vaccination acceptance were the advice of doctors and nurses.¹⁸ In a study specifically looking at mothers' acceptance of the HPV vaccine for their daughters, the results also showed that hospital or school health education and the recommendation of a doctor or nurse were the most common channels of HPV vaccine promotion.¹⁹

Health communication on social media: Regular exposure to HPV vaccination information in the mass media (OR = 2.196, 95% CI: 1.625–2.966) was a significant factor associated with intention to receive HPV vaccination.¹⁵ In a study on HPV vaccine acceptability among rural women in Hunan Province, more than half of the respondents explicitly expressed a desire to obtain HPV and HPV vaccine-related information through WeChat or Weibo, television programs, and the internet.²¹ Several studies have shown that although there were differences in the socio-cultural backgrounds and HPV awareness levels of the survey participants, many participants were willing to be vaccinated to prevent cervical cancer. The reason for this high acceptance of the HPV vaccine is mainly due to the fact that cervical cancer is a common disease among women and is widely publicized in the media.²⁰ The media became an important information channel for the study participants to obtain information about HPV and the HPV vaccine. The mass media became an important information channel for the study participants to obtain information about the HPV vaccine and became an important factor influencing the acceptance of HPV vaccine.¹⁵

Cost of payment: Research has shown that one of the main reasons the HPV vaccine is currently not fully rolled out in China is the high price.²² The same results were obtained in a study conducted with university students, for whom cost was an important factor in their willingness to be vaccinated,¹⁸ as the vaccine is expensive and therefore the cost of living needs to be considered when considering vaccination to support the cost of the vaccine.¹² In another study, the high cost of HPV vaccination was the main reason for refusing the vaccine.¹³

Sex education: Among female students, those who had received sex education (AOR = 1.289, 95% CI: 1.064–1.562) were more likely to be vaccinated against HPV.¹² In another study with female university students, the same results were shown, with female students who had received sex education showing a higher acceptance of HPV vaccination (AOR: 1.35, 95% CI: 1.15–1.58).¹⁴

Family history of related diseases: Among female students, those with relatives or friends with certain types of cancer were more likely to be vaccinated (AOR = 1.290, 95% CI: 1.095–1.518).¹² Participants with a family member or friend with cancer (AOR = 1.24, 95% CI: 1.04–1.48) were more likely to receive the vaccine.¹³ This was also a finding confirmed in another national study, where women with a family history of malignancy were more likely to receive the HPV vaccine, both for themselves and for their daughters.²⁰

3.6. Risk of bias

In this review, the methodology quality of all 10 studies was

appraised using the Mixed Methods Appraisal Tool (MMAT) based on five criteria.¹¹ Table 4 shows the details of this assessment. Results showed that the 10 included studies all met the requirements for evidence-based research and were of high quality overall.

4. Discussion

In this review, factors influencing HPV vaccine acceptance among females in mainland China were identified and grouped into three categories: (1) personal factors; (2) behavioral factors; and (3) environmental factors. Adequate interventions to address these influencing factors can effectively moderate the acceptability of the HPV vaccine among females in mainland China. This coincides with the Healthy China Action Plan (2019–2030) further specified objectives and strategies for gradually improving screening coverage of cervical cancer, promoting Human Papillomavirus (HPV) vaccination, and improving the accessibility of HPV vaccines.^{8,9} In addition, it is consistent with the National Health Commission of the People's Republic of China which released an Action Plan for Accelerated Elimination of Cervical Cancer (2023–2030), specifying the goals to be achieved by 2025 and 2030.^{23,24}

Age is significantly associated with HPV vaccine acceptance. Sexual activity, marital status, and parenthood status are all factors that influence HPV vaccine acceptance among females in mainland China. This is because the incidence of diseases such as cervical cancer caused by HPV infection increases with age, and older women are more worried about being at high risk, and those who have had sex are more likely to be infected and therefore have a significantly higher uptake of the HPV vaccine.²¹ In addition, a lack of knowledge about HPV was identified as one of the main barriers to increasing HPV vaccine acceptability, especially for Chinese adolescents, with HPV knowledge and HPV vaccine knowledge being the most significant factors associated with their willingness to receive the vaccine.¹⁴

Vaccine hesitancy refers to the delay in acceptance or refusal of vaccination despite the availability of vaccination services.²⁵ Vaccine hesitancy is the antithesis of vaccine acceptance in vaccination intentions. Vaccine hesitancy may also contribute to women's resistance to the HPV vaccine. Studies have shown that misinformation in the media, fear of vaccine side effects, and a lack of knowledge or understanding of HPV and its associated risks contribute to females' lack of choice when faced with the HPV vaccine.¹³ In a study conducted in 2011, the results showed that the main reason for vaccine hesitation was women's perception that the HPV vaccine had not yet achieved widespread uptake in the Chinese region²⁰ and that the HPV vaccine was rolled out in China after 2016. Further research could be conducted in the future on whether this is still a reason for vaccine hesitation and thus vaccine uptake. Regarding knowledge-seeking behavior, studies have shown that when women hear about HPV or the HPV vaccine but do not know about it, some women choose to actively search or consult about it, and these women also have a higher acceptance of the HPV vaccine.¹²

The advice and influence of others on women's willingness to receive the HPV vaccine were discussed several times in the 10 included studies, with parents and teachers being the main sources of influence for minors,¹⁴ while healthcare professionals were the main source of information for adults or parents of minors, and the mass media being one of the main sources of active information or women's access to health information about the HPV vaccine.¹⁹ The high cost of the HPV vaccine is one of the barriers to its introduction in almost all studies.¹³ Family history of HPV-related diseases or friends with HPV-related diseases is more likely to increase women's acceptance of the HPV vaccine.¹² Some studies have shown that people with high education, high income, a family history of tumors, and those who have heard of HPV have a stronger willingness to be vaccinated.²⁰ Sexuality education is also an influential factor in HPV vaccine acceptability, especially for adolescents, and sexual health education can have a positive impact on adolescents' better knowledge of the HPV vaccine and HPV vaccination.¹⁴

Table 4
Details of the MMAT assessment.

Author(s)	Type of Study	1.1 Is the sampling strategy relevant to address the research question?	1.2 Is the sample representative of the target population?	1.3 Are the measurements appropriate?	1.4 Is the risk of nonresponse bias low?	1.5 Is the statistical analysis appropriate to answer the research question?
Dai et al. (2022) ¹²	Quantitative descriptive study	Yes	Yes	No	Yes	Yes
Si et al. (2021) {13}	Quantitative descriptive study	Yes	Yes	No	Yes	Yes
Zhang et al. (2021) ¹⁴	Quantitative descriptive study	Yes	Yes	No	Yes	Yes
Y. Lin et al. (2019) ¹⁵	Quantitative descriptive study	Yes	Yes	No	Yes	Yes
W. Lin et al. (2019) ¹⁶	Quantitative descriptive study	Yes	Yes	Yes	Yes	Yes
Gu et al. (2015) ¹⁷	Quantitative descriptive study	Yes	Yes	Yes	Yes	Yes
Deng et al. (2021) ¹⁸	Quantitative descriptive study	Yes	Yes	Yes	Yes	Yes
Han et al. (2018) ¹⁹	Quantitative descriptive study	Yes	Yes	Yes	Yes	Yes
Yuling (2011) ²⁰	Quantitative descriptive study	Yes	Yes	No	Yes	Yes
Qin et al. (2020) ²¹	Quantitative descriptive study	Yes	Yes	Yes	Yes	Yes

4.1. Recommendations

HPV infection is one of the main causes of cervical cancer, with data showing that over 95% of cervical cancers are caused by HPV.³ The HPV vaccine was introduced in China in 2016 and is still in the roll-out phase there²⁶; as this review has shown, it is essential to understand the factors influencing females in mainland China's acceptance of the HPV vaccine to increase HPV vaccination rates and lower the risk of cervical cancer and other related diseases. These selected studies provide significant evidence of factors associated with the HPV vaccine acceptance among females in mainland China and provide targeted guidance for improving the acceptance of the HPV vaccine among females of appropriate age in mainland China.

HPV knowledge, perceived risk of HPV infection, HPV vaccine, and family diseases among women of the appropriate age become important factors influencing HPV vaccine acceptance. The cost of the vaccine and the correct perception of sexuality influence females of the appropriate age's decision to receive the vaccine, and the health communication of social media and the guiding advice of medical practitioners become important channels for females in mainland China to obtain information about the HPV vaccine.

Based on this, in addition to traditional ways of obtaining health information, social media also can become an important platform for achieving health communication Ref. 27: strengthen the health communication pattern on social media platforms, standardize health communication content, guide positive public opinion orientation, and strengthen the target population's awareness of HPV knowledge base, improve risk perception, strengthen women of certain age groups' accurate understanding of HPV infection and vaccines, reduce public hesitancy, and ultimately promote the acceptance of HPV vaccines Ref. 28

Policy-level interventions can significantly contribute to this endeavor by implementing targeted educational initiatives through social media platforms. These initiatives are designed to address knowledge gaps within the broader population. Simultaneously, policymakers are encouraged to actively champion research and development efforts focused on domestically produced HPV vaccines. The incorporation of HPV vaccines into existing HPV services not only serves to expand vaccine production but also contributes to alleviating the economic burdens experienced by the target population.

Within healthcare institutions, healthcare organizations are poised to enhance communication strategies related to HPV vaccination. This involves the provision of HPV education to target populations seeking health services through traditional healthcare channels. In addition, healthcare providers, especially those appointed as "health experts", should use social media platforms to disseminate accurate, clear, and influential information to help target populations develop comprehensive knowledge of HPV and increase their perceived risk of HPV infection, and to increase trust in social media health communication.

4.2. Limitation

Like other systematic review studies, this study also has certain limitations. There may be publication bias in this systematic review as grey literature was excluded. Although systematic procedures were used to search for relevant journal articles, not all scientific databases were covered, and it would not have been possible to cover information on all articles studied in different databases.

5. Conclusion

Awareness of the HPV vaccine among females in mainland China is low, and this leads to a lack of acceptance of the HPV vaccine among females. The HPV vaccination program will benefit more from targeted HPV vaccine promotion campaigns based on factors influencing females' acceptance of the vaccine, such as those conducted through the media, hospital publicity, and community publicity to increase women's knowledge of the vaccine and improve vaccine acceptance.

Ethics statement

Ethical approval was obtained from the Ethics Committee for Research Involving Human Subjects of Universiti Putra Malaysia (JKEUPM– 2023–1146).

Author contributions

All authors were involved in the conceptualization of methodology, extensive search of articles, critical review of articles, result syntheses, and original draft write-up. All authors have read and agreed to the

published version of the manuscript.

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Informed consent statement

Not applicable.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of competing interest

The authors declare no conflict of interest.

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