

# Knowledge, Acceptance, and Willingness to Pay for Human Papillomavirus (HPV) Vaccine: A Systematic Review

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**Abstract.** Cervical cancer is the fourth most common type of cancer incidence in women. It has been recognized that Human Papillomavirus (HPV) is causative agent in the pathogenesis of cervical cancer. In 2022, 117 countries have included HPV vaccine in their national immunization program. Understanding participants' decision regarding their children and themselves being vaccinated is important to ensure high coverage of the vaccine. This study aimed to conduct a systematic review of knowledge, acceptance, and willingness to pay for HPV vaccine. The required information was collected by searching with relevant keywords during October-December 2022 for articles published from 2013 – 2022 in PubMed, Scopus, ScienceDirect, and SpringerLink. The data were analyzed in Excel and reported descriptively. Finally, 22 studies were included to review. Most of the participants were female (96.44%) and the majority had health workers background (50.09%). The knowledge of mostly results was poor (40.9%). The acceptance of HPV vaccine was high, the range vary from 39–98.8%, especially for the vaccine with higher degree, longer duration of protection, lower out-of-pocket, and lower risk of side effects. Overall, the respondents' attitude was positive toward vaccination. The most frequent method used for measuring WTP was CVM (54.54%). The average WTP range from 0.1–17.51% to GDP per capita (9.9–745.25 USD). The cost was the primary reason that impact to the willingness to pay and acceptance. Results showed that the acceptance rate of HPV vaccination and WTP were relatively high when the vaccine was offered for free or reasonable price, even though their knowledge was poor. It is recommended to reduce the cost of vaccination program and to increase knowledge, awareness, and attitude of people.

**Keywords:** willingness to pay, Human Papillomavirus (HPV), vaccine, knowledge, acceptance.

## 1 Introduction

Cervical cancer is the fourth most common cancer among women globally, with an estimated new cases and deaths were more than 600,000 and 300,000 in 2020 respectively. Furthermore, 90% of them occurred in low- and middle-income countries[1]. Human Papillomavirus (HPV), especially variants 16 and 18, has been identified as the causative agent in the pathogenesis of cervical cancer[2]. In 2006, the United States granted a license for the first HPV vaccine[3]. As of March 2022, 117 countries (corresponding to approximately one-third of the global target population) have introduced HPV vaccine into their

national routine immunization schedules, with 10 new introductions planned by the end of 2022[4].

Clinical trials and post-marketing surveillance have shown that HPV vaccines are safe and effective in preventing infections with HPV infections, high grade precancerous lesions and invasive cancer[5]. SAGE advised the following updates to HPV dosage schedules: 1-2 dose schedules for the major target population of girls aged 9 to 14, 1-2 dose schedules for young women aged 15-20, and 2 doses separated by 6 months for women over the age of 21[6]. Since the HPV vaccine should be administered to young adolescents, understanding parents' decision-making processes regarding their children being vaccinated is important to ensure high coverage of the vaccine[7]. Beside the vaccine prices, there were some other obstacles. Barriers include low risk

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perception, parents' beliefs that their daughters do not require vaccinations because they are not sexually active, worries about safety and efficacy, ignorance of the necessity for vaccination, and a lack of information[8].

To help address this gap, this study aimed to conduct a systematic review of knowledge, acceptance, and willingness to pay for HPV vaccine. The analysis was conducted to synthesize evidence of participants' information needs, views and preferences regarding HPV vaccination. The availability of such information is critical for decision-making and planning to implement the most suitable interventions to develop HPV vaccination as one of the most effective cancer prevention programs.

## 2 Methods

Methods are reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist[9].

### 2.1 Data Source and Search Strategy

A search strategy was developed in PubMed, Scopus, ScienceDirect, and SpringerLink. The timeframe selected for searching the articles is the ones which have published during 2013 – 2022. The strategy included an extensive list of keywords and related subject headings to broaden the search by finding articles related to HPV vaccine. The following key words were used in search strategy using operator Boolean construction: “Willingness to Pay” AND “HPV vaccine” AND “knowledge, acceptance, attitude”, and all articles were retrieved from 23rd October to 17th December 2022.

### 2.2 Eligibility Criteria

Studies were included if they were reporting: knowledge, acceptance, attitude, Willingness to Pay and factors associated of participants concerning HPV vaccine. Studies were excluded if they were reviews, abstracts, editorials, conference reports, and not using English language. Furthermore, other economic evaluations such as cost benefit analysis, cost effective analysis, and cost utility analysis were also excluded.

### 2.3 Study Quality Assessment

The quality of included studies was evaluated by reviewer using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist[10]. The checklist options include “Yes”, “No”, “Unclear”, and “Not Applicable”. It is also to identify bias in each study.

### 2.4 Data Extraction

Two forms of data extraction were designed. The 1st form was for extracting general characteristics of the included studies, while the 2nd was for extracting the studies'

results. Key data for general characteristics extracted included author, year, country, aim of study, setting, study design, duration of observation, number of respondents, instrument, and method for measuring WTP. Key data to extract the study results included demographics, % of positive WTP, WTP, % of GDP per capita, knowledge, attitude and acceptance, factors influenced in WTP, reason for not WTP, and other results.

## 2.5 Data Analysis Method

Extracted data were analysed in Excel. The countries' currency value reported in included studies was presented in original currency and USD[11]. In some studies, the value was reported as a percentage of the participants (e.g: 45.5% participants were willing to pay for the HPV vaccine). To calculate the percentage of WTP from GDP per capita, the amounts of WTP counted by currency in USD were converted to 2022 USD using free online website US Inflation Calculator then were divided by GDP per capita (counting the highest amount if there were some WTP measurements) in the year of study (2022)[12]. The World Bank data were used as a basis for calculating GDP per capita and country segmentation based on economic status[13].

## 3 Results

### 3.1 Details of Included Studies

Out of 487 articles found from databases and other sources, 43 were excluded due to duplication between databases. In the title and abstract screening phase, 117 were also excluded. A total of 97 studies were excluded from full-text review. Additionally, 2 studies were found by hand searching. Finally, 22 articles were included in this study, as presented in Figure 1. All of the studies included in the final set were published in the last ten years (2013 - 2022). The characteristics and results of the reviewed articles were presented in Table 1 and 2.

### 3.2 Characteristic of Included Studies

As shown in Table 1, all of the included studies were conducted in 10 different countries (China, Vietnam, Iran, Jordan, Nigeria, Ethiopia, Hongkong, Malaysia, Thailand, Argentina). Three studies were conducted in 2 low-income economies countries[14]–[16], 5 studies in 2 lower and-middle-income economies countries[17]–[21], 12 studies in 5 upper-middle-income economies countries[22]–[33], and 2 studies in high-income-economies country[34], [35]. The country classification was based on New World Bank Country Classification by Income Level 2022-2023[13].

Regarding their aims, the articles fell into 4 categories. The majority (19) focused on willingness to pay; 14 on knowledge, awareness and acceptance; 8 on attitude; and 3 on factors associated with WTP.

Regarding the study population, 8 studies focused on mothers, 2 on workers, 8 on students, 2 on parents, 2 on

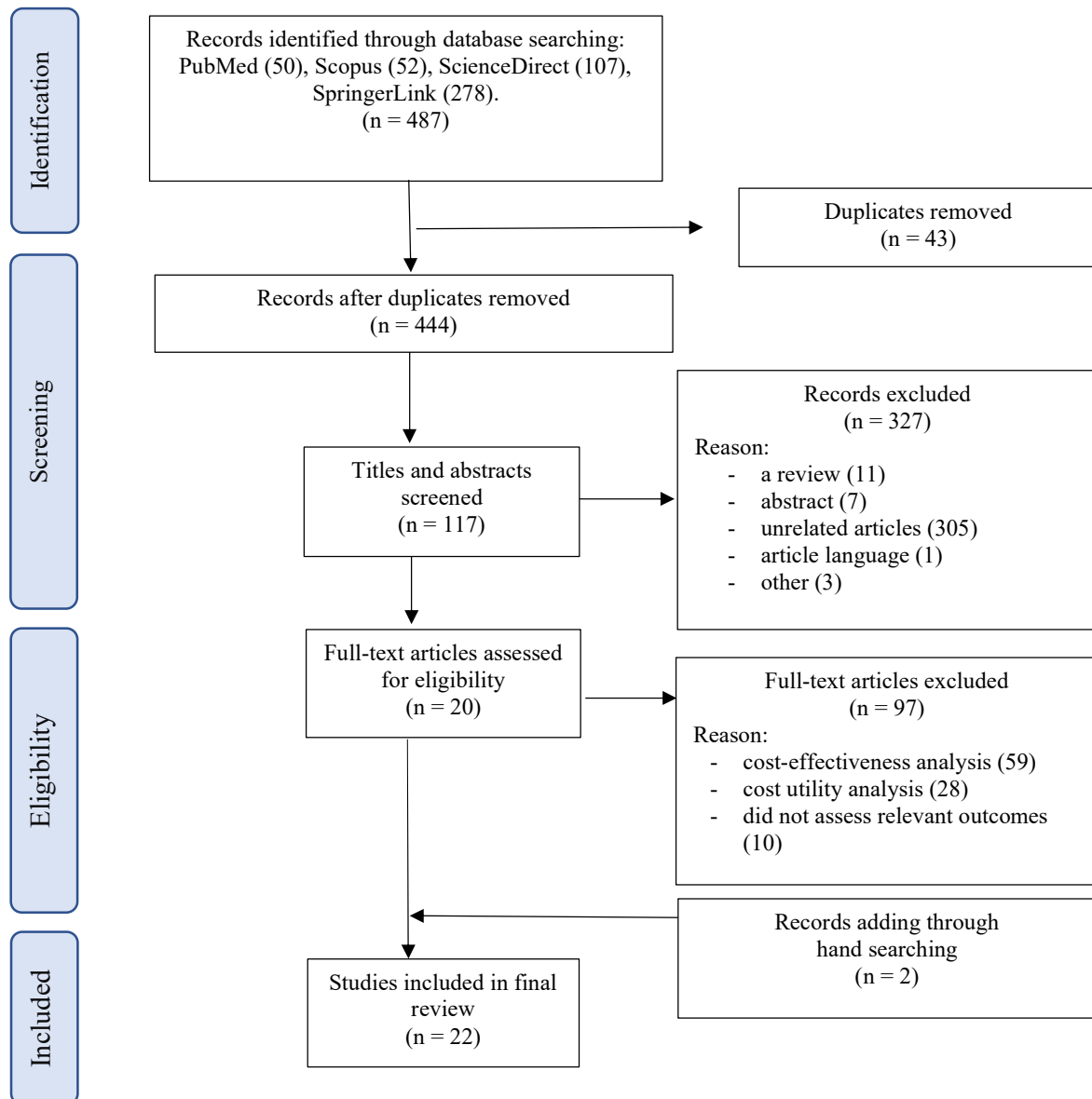
outpatients of hospital/clinic, and 1 on teachers. Total participants of 22 studies were 32,722 and most of them were female (96.44%). The participants background consisted of: 9,125 mothers (27.89%); 1,099 parents (3.36%, both mother and father); 16,392 health workers (50.09%); 377 teachers (1.15%); 606 married women (1.85%); 911 outpatients of hospital/clinic (2.78%), and 4,212 students (12.87%).

All included studies were cross-sectional and used questionnaires as the instrument to data collecting method. Twelve of them used a self-administered

questionnaire, 5 used structured questionnaire, 4 with online survey, and 4 prefer to face-to-face interview.

### 3.3 Knowledge, Attitude and Acceptance of HPV and HPV Vaccine

Mostly studies assessed knowledge of HPV or knowledge of its vaccination. Of the 22 studies included, awareness and/or knowledge were assessed with various method of



**Fig. 1.** PRISMA Flowchart

**Table 1.** Characteristics of the 22 studies

	n	%
<b>Study location</b>		
Asian		
Malaysia	3	14
Thailand	2	9
Vietnam	4	18
China	5	23
Iran	1	5
Hongkong	2	9
Jordan	1	5
Non-Asian		
Nigeria	2	9
Ethiopia	1	5
Argentina	1	5
<b>Study design</b>		
Cross-sectional	22	100
<b>Study setting*</b>		
Healthcare setting	4	18
School setting	6	27
College setting	8	36
General population setting	5	23
<b>Data collection method</b>		
Self-administered survey	10	45
Face-to-face interview	6	27
Online survey	6	27
<b>Sample*</b>		
Adult women		
Teachers, workers	3	13
Outpatients of hospital/clinic	2	9
Mothers	8	35
Mothers and fathers	2	9
Students	8	35
<b>Sample size</b>		
<100	0	0
100 - 500	12	54
501 - 1000	7	32
>1000	3	14
<b>Methods for eliciting WTP**</b>		
CVM		
Bidding game/Double dichotomous choice	6	27
Payment card	2	9
Open-ended questions	5	23
DCE	4	18
Market price offered	6	27

Note: \*some studies were conducted in multiple settings;  
 \*\*some studies used >1 combination methods in eliciting WTP  
 Abbr: WTP = Willingness to Pay, DCE = Discrete Choice Experiment.

measurements. Eight studies assessed awareness with an initial question ‘Have you heard/are you aware of HPV?’ and rows of other ‘‘Yes or No’’ questions related. Other 6 studies assessed awareness and/or knowledge of HPV and HPV vaccination by answering ‘‘True or False’’ questions.

The attitude toward HPV vaccine were positive. Most of them would accept the vaccine for their children or themselves. Acceptance rates in the studies range 39 – 98.8%. Significant factors associated with acceptance are location of high school, study year, paternal educational level, annual household income, monthly disposable income, perceived self-confidence in taking the HPV vaccine in the near future, having no barriers to taking time off to take the HPV vaccination, and regular exposure to HPV vaccination information in the mass media. Despite positive attitude and high acceptance, the awareness and knowledge about cervical cancer and HPV vaccine were poor[15], [17], [20], [22], [24], [26], [27], [29], [31], moderate[30], [32], [33], [35], to high[16], [21], [25], [28]. Lack of knowledge were caused by rare information and difficulty to access[20].

Misconceptions and suspicions related to cervical cancer and the HPV vaccine were also common. Some participants were afraid of the safety and possible side effects due to the vaccine[18], [22], [30]. A small number of studies examined the religious beliefs regarding the HPV vaccine[18]. Religious norms also influenced how parents saw the need for the vaccine. Some parents believed they had raised their children properly and they would not engage in premarital sex, and therefore a vaccine to prevent sexually transmitted infection was not needed at that stage of their lives[7]. Surprisingly, a study mentioned that 70.7 % of its respondents have thought that vaccination will encourage the young population to become sexually active[33].

### 3.4 Willingness to Pay for HPV Vaccine

Out of the 22 articles reviewed in the study, 12 studies used Contingent Valuation Method (CVM) to elicit WTP, 4 studies used Discrete Choice Experiment (DCE), and 6 studies used market price. In general, cost of the vaccine was viewed as an important factor. Most participants thought that the HPV vaccine was expensive (10 studies), and cost was important factor when deciding whether or not to give the vaccine to their children. Many parents reported a high intention to vaccinate their children if the vaccine was going to be provided for free. Even if it was not free, many stated they were willing to pay for the vaccine so long as the price was reasonable[23].

The WTP were also counted for the proportion based on GDP per capita. The result showed that the percentage of WTP (converted to USD rate in 2022) compared to 2022 GDP per capita range from 0.91–1.34% (9.9–14.49 USD) in low-income economics, 0.1–17.34% (55–417.5 USD) in lower-middle income economics, 0.32–17.51% (41.91–745.25 USD) in upper-middle income economics, and 1.83–1.87% (241–247 USD) in high income economics. Based on economic status of the countries, the highest proportion was in Thailand (UMICs)[29].

**Table 2.** Results of the included studies

NO.	AUTHOR, YEAR, COUNTRY	% OF POSITIVE WTP	WTP (CURRENCY)	WTPAS % OF GDP PER CAPITA	KNOWLEDGE	ATTITUDE AND ACCEPTANCE	FACTORS INFLUENCED IN WTP		REASON FOR NOT WTP	OTHER RESULTS
							SIGNIFICANT	NOT SIGNIFICANT		
1	Zhou et al., 2022 [22] China	92.54	mean values (in RMB) of 1,689.80 (±926.13) or 242.49 USD for imported bivalent, 2,216.61 (±1190.62) or 318.08 USD quadrivalent, 3,252.43 (±2064.71) or 466.72 USD 9-valent vaccines.  910.63 (±647.03) or 130.68 USD, 1,861.69 (±1147.80) or 267.15 USD, and 2,866.96 (±1784.41) or 411.41 USD for their domestic counterparts.	3.53 - 10.97	751 (92.83%) had heard of HPV. 728 (89.99%) had heard of HPV vaccine. The average cognitive score: 13.05 (±5.09) points. The respondents maintained a high level of cognition of HPV infection, transmission, and vaccination population but reported insufficient awareness of postvaccination.	60.82% and 88.01% wished to be vaccinated and support the partners to be vaccinated.  30.90% did not have the willingness to be vaccinated at this stage, and a total of 8.28% were unwilling to be vaccinated.	- educational background - perception of imported vaccine	-vaccine is unnecessary -not once and for all -cost -painful injection -prefer to use condom -Lack of authoritative evidence for long-term side effects	-the average WTP of the vaccines was lower than the market price -the WTP for domestic vaccines was lower than that for imported vaccines	
2	Nguyen et al., 2022 [17] Vietnam	46.87	WTP amount for two doses of HPV vaccine was 3,053,005 VND (137.5 USD) ranging from 200,000 VND (9 USD) to 4,180,000 VND (188.3 USD). Among the parents who accepted to get their sons vaccinated, 63.7% of them were willing to pay <3,580,000 VND (161.2 USD) for two doses of Gardasil	4.43 - 17.34	2/3 of participants had never heard of HPV. Only 18.9% of parents achieved good level of knowledge, only a few of parents (<8%) knew ideal age to receive HPV vaccine, dose of HPV vaccine for children under 15 years old, and asymptomatic HPV infection.	49.2% of the parents agreed to have their son vaccinated. The parents with good knowledge were more likely to accept HPV vaccine compared to those with worse knowledge.  The parents who attained college degree or higher were more likely to get HPV vaccine for their sons than those with a lower level of education	-	knowledge	cost	-

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							SIGNIFICANT	NOT SIGNIFICANT		
3	Lu et al., 2022 [23] China	Initial amount of General WTP: 800 CNY (66.2), 1600 CNY (57.1), 2400 CNY (51.1), 3200 CNY (40.8), 4000 CNY (35.0)	The median general WTP was 2000 CNY (303 USD) (interquartile range, 1000–3200 CNY). The median WTP out-of-pocket was 1250 CNY (189 USD) (540–2000 CNY)	2.29 - 7.12	-	majority of respondents did not change their attitude towards HPV vaccination between two payment scenarios; those with higher price HPV vaccines (51.1%) had higher WTP out-of-pocket (1400 CNY; 560–2250 CNY) than those with cheaper vaccines (39.0%) (1120 CNY; 490–1960 CNY) (P < 0.001).	<p><b>SIGNIFICANT</b></p> <ul style="list-style-type: none"> <li>-cost (payment method)</li> <li>-younger age</li> <li>-unmarried status</li> <li>-higher monthly income</li> <li>-fewer children</li> <li>-more positive vaccination behavior</li> <li>-working in tertiary hospital</li> <li>-higher local GDP and HDI (each P &lt; 0.05).</li> </ul>	<p><b>NOT SIGNIFICANT</b></p> <ul style="list-style-type: none"> <li>-educational level</li> <li>-professional title</li> </ul>	-	-WTP for 9-y vaccine was higher than those for 4-v and 2-v (1400 CNY vs. 1250 CNY and 780 CNY) - Compared to domestic vaccines, WTP for imported HPV vaccines was greater (1120 CNY vs. 1260 CNY)
4	Sargazi et al., 2021 [18] Iran		- bivalent: US \$ – 432 - quadrivalent US \$ 380	0.10 - 0.38	-	-low incidence of cervical cancer cause lack of awareness and weak attitude towards the importance of prevention	<p><b>SIGNIFICANT</b></p> <ul style="list-style-type: none"> <li>-fewer serious side effects</li> <li>-protection against genital warts</li> <li>-protection duration</li> <li>-protection against cervical cancer</li> <li>-cost</li> </ul>	-	-serious side effect -religious and cultural barriers	

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5	Wang et al., 2021 [24] China	-	-making an appointment through school, by phone 291.4 CNY (42.3 USD) - by the internet 241.7 CNY (35.0 USD) -on-site 203.6 CNY (29.5 USD) - WTP more to have the service on both weekdays and weekends 121.9 CNY (17.7 USD). -WTP 25.0 CNY (3.6 USD) but if they had to wait an additional week for immunization after the visit, they would prefer to pay less amount -WTP 171.1 CNY (24.8 USD) but less if they must wait for 30-60 minutes -WTP 297.9 CNY (43.2 USD) but less if they must wait for >60 minutes. reported only among 84 students (16.03%)	0.50 - 1.55	Average score of HPV knowledge * (SD): 4.30 (0.08)	-Class 1 (86.1% of the respondents) chose a vaccine with a greater level of protection, a longer period of time it would last, a lower risk of major side effects, and a lower price. -Class 2 (13.9% of the respondents) seemed unconcerned about the characteristics of the vaccine. 98.8% (of 742 respondents) still chose to receive the vaccine in service-related scenes	-	-	vaccine-related attributes such as the degree and duration of protection, risk of serious side effects, and cost influence the choices	
6	Sallam et al., 2021 [25] Jordan	16.0	-	-	-prior knowledge (62.7) -aware of the existence of HPV vaccines (48.66) -The lowest knowledge level was in nursing students	willingness to receive HPV vaccination if provided freely (75.0%)	cost	the perceived low risk to get HPV infection	HPV vaccine coverage was extremely low (3.6%). vaccine conspiracy beliefs affect willingness to receive vaccine	
7	Enebe et al., 2021 [14] Nigeria	74.3	for three doses of bivalent, out of pocket was 15.01USD (N5,568.0), while among all participants, the average WTP was 11.47 USD (N4, 242.84)	1.16	-	-	-social factors (household) -economic factors (husband's monthly income).	-vaccine high price	WTP was far below market price	

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8	Lin et al., 2020 [26] China	2vHPV (81.2) 4vHPV (75.9) 9vHPV (67.7)	2vHPV: RMB580 (USD 88.27) per shot 4vHPV: RMB798 (USD 121.39) per shot 9vHPV: RMB1298 (USD 197.44) per shot	1.72 – 5.34	high score, aware of HPV and its vaccine (49.1%)	confident in getting the HPV vaccine (84.1%). Intent to obtain HPV vaccine (58.3%).	SIGNIFICANT -Household income -mass media exposure to HPV vaccination, -perceived self-efficacy in HPV vaccination, -spouse/partner approval	NOT SIGNIFICANT	-	-
9	Le et al., 2020 [19] Vietnam	-metropole : 38.2 -non metropole (rural) : 4.4 -mean : 20.4	N/R	-	Participants who knew more about HPV vaccinations and cervical cancer had considerably more intention to be vaccinated.	Positive towards vaccination. Before learning the vaccine price -metropole: 59.3 -non metropole: 90.9 -mean: 75.9	monthly household income	vaccine price	-	-
10	Lin et al., 2019 [27] China	-2vHPV: 78.6 -4vHPV: 68.0 -9vHPV: 49.3	-2vHPV RMB580/ 82.38 USD per shot -4vHPV RMB798/ 113.34 USD per shot -9vHPV RMB 1298/184.36 per shot (1 USD: 7.04 RMB)	1.63 – 5.04	-aware that HPV infection can occur without symptoms: 42.5% -aware that HPV can cause oral cancer: 34.5% -have the misconception that HPV can be cured by antibiotics: 70.7% -hev the misconception if there is a cure for HPV infection: 81.5%	high perception of women's susceptibility to contracting HPV (81.1%), having cervical or vulvar cancer (75.4%), considered that women have a high risk of contracting genital warts (58.8%).	-	-	-	-

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11	Tarekgn et al., 2019 [16] Ethiopia	85.97	231.34 ETB (US\$8.50) per service	0.91	97.96% had heard about human papilloma virus vaccine. 68.62% had excellent knowledge about cervical cancer danger signs and its risk factors	-	-Age -educational status -knowledge -monthly income	-	-	-
12	Dinh Thu et al., 2018 [20] Vietnam	53.1	US\$23 to US\$46.	1.28 – 5.02	Only 33% of participants had adequate knowledge. Nearly all mothers, whether WTP or not, would like additional knowledge on the pertinent topic (97%).	81.5% WTP mothers and 77.8% not WTP mothers had positive attitude toward the vaccination (mean average: 79.7%)	cost	-	Vaccination high cost	The preferred sources of information were TV broadcast, health staff, and commune loud speakers.
13	Tran et al., 2018 [21] Vietnam	86.6	US\$49.3 (1.119 million VND)	1.37 – 5.38	Typical methods for finding out about HPV vaccine: -Social networks and internet (56.8%), -asking doctors, nurses, and other health professionals (41.9%).  The percentages of subjects correctly answering questions regarding -the best age for HPV vaccination: 67.9%, -the benefits of HPV vaccination: 94.6%, -the target subject for HPV vaccination: 12.3%.	-believed that vaccine was safe (92.8%) and effective (90.8%) -desired to get vaccinated (71.1%),	-high household income -had children > 6 years old -vaccine service user: adult male -age 20-29 -white-collar worker -getting information except from health pro	-being male (33.3%), -high cost (38.2%) -vaccine being seen as unnecessary (34.5%) -unsuitable age (22.6%)	-	-

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14	Wong et al., 2018 [34] Hongkong	-	Maximum WTP for ideal vaccines (i.e., maximum protection, lifetime protection duration, and 0% adverse effects) = HK\$8976 (US \$1129).  The estimated WTP for vaccines currently available was HK\$1620 (US \$208)	1.87	-80% mothers were concerned about their daughters' risk of cervical cancer and HPV infection -More than 50% mothers believed that the vaccines are unsafe and some of them refused the vaccines to be administered to their daughters.	88.4% of mothers made a more sensible decision by opting for more effective protection, lasted longer, cost less out-of-pocket, and had fewer side effects	- high household income -education level except the out-of-pocket cost attribute for primary education level	-	the estimate WTP was lower than the current market price.	
15	Umeh et al., 2016 [15] Nigeria	91.6	The average WTP was US\$ 11.68.	1.34	19.1% ever heard of HPV infection	-7.5 % rejected HPV vaccination of their daughters. -Demands for HPV vaccinations for daughters were 18.8 times more likely to come from mothers who had previously been diagnosed with HPV infection.	-	-	The WTP was opposed to estimated delivery cost of US\$ 18.16 and US\$ 19.26 for urban and rural populations respectively at vaccine price offered by the Vaccine Alliance (Gavi) and US\$ 35.16 and US\$ 36.26 for urban and rural populations respectively at the lowest obtainable public sector vaccine price.	
16	Maharajan et al., 2015 [28] Malaysia	12.25	up to RM 500 / 118.15 USD (1 USD; 4.2319 MYR)	1.12 – 3.48	The mean score for knowledge of HPV, cervical cancer and Pap smear test were 12.2 out of a maximum score of 17±2.54.	overall attitude of participants toward HPV vaccination was positive	knowledge	vaccine cost	-	

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17	Ngorsuraches et al., 2015 [29] Thailand	-	quadrivalent 21,189.9 Baht (593.32 USD), bivalent 10,479.9 Baht (293.44 USD) (1 USD = 35.72 THB)	5.64 – 17.51	90.0% students have a high level of knowledge  fathers might have poor knowledge or awareness of HPV vaccine. Heard about HPV vaccine: 44.0 % fathers, 51.2 % mothers.	-Positive results for the risk factors for genital warts and cervical cancer suggested that parents chose immunizations that lower these risks. -They favored less side effects and paying less for vaccines, as seen by the negative indicators of the typical adverse effects and cost criteria.	-	-	mothers were willing to pay 5232.6 and 2388.6 Baht more than fathers were for the 4-v and 2-v HPV vaccines, respectively	
18	Alder et al., 2015 [30] Argentina	59.8	mean price: 23.20 euro (24.66 USD), with a range of 0.70-128.60 euro/dose (0.74-136.71 USD).	1.30 – 4.03	-52.2%: considered that HPV vaccine should be given to age <14 -45.6%: considered their daughter to be protected against cervical cancer after HPV vaccination. 73.9%: thought it was also necessary to vaccinate boys. 83.3%: aware of cervical cancer	90.1% accept vaccination for their daughter	-gainful employment -household income -awareness of cervical cancer	being unsure about vaccine safety	10.1% unsure/unwilling, even if vaccination was free	

NO.	AUTHOR, YEAR, COUNTRY	% OF POSITIVE WTP	WTP (CURRENCY)	WTP AS % OF GDP PER CAPITA	KNOWLEDGE	ATTITUDE AND ACCEPTANCE	FACTORS INFLUENCED IN WTP	REASON FOR NOT WTP	OTHER RESULTS
19	Kruiroongroj et al., 2014 [31] Thailand	68.9: bivalent 67.3: quadrivalent	33.33% participants would copay less than 500 baht or approx US\$16.67 (30 baht = approx US\$1) while other 30% would pay 500-1,000 baht (approx US\$33.33) for three doses of bivalent vaccine, respectively.	0.32 - 0.98	Knowledge regarding the HPV vaccine among parents was quite low. 49.2% knew about the link between HPV and cervical cancer while 28.5% knew that the vaccine should be administered to the children before they become sexually active. -Had heard of HPV: 28.8% schoolgirls, 40.5% mothers2008, 68.5% mothers2012. -Had heard of HPV vaccines: 40.3% schoolgirls, 68.3% mothers2008, 43.7% mothers2012.	Acceptance if vaccine was offered for free: 76.9% for the 2-v and 74.4% for 4-v vaccine. if it was not totally free: 68.9% for 2-v to 67.3% for 4-v vaccine.	-	financial limitations (39%-43%)	The main reason for non-acceptance was concern about the HPV vaccines' side effects
20	Choi et al., 2014 [35] Hongkong	27.5: mothers in 2008. 37.6: mother in 2012 27.1: schoolgirls	for full-course vaccination among mothers had a median of US\$128/HK\$1000 (50% central range = US\$64–192/HK\$500–1500), i.e: substantially lower than the current market price	1.83		one third of mother 2008, mothers 2012 and schoolgirls were willing to be vaccinated at market price. regardless of vaccine price, the overall acceptability was 44.6% (mother 2008) and 66.7% (mothers 2012) and 54.8% (the unvaccinated schoolgirls 2008).	-	Vaccine price	respondents in Mothers2012 were significantly more willing to have their daughters vaccinated against HPV than those in Mothers2008
21	Rajiah et al., 2017 [32] Malaysia	-	Most of the participants: RM 500 (122.25 USD) or less for themselves, and the number of students kept declining as the price went up. The total mean of WTP for themselves: RM 1304 (318.83 USD) In future aspect of vaccination for their children: mean amount of RM 1477.7 (361.30 USD)	3.32 – 10.31	Knowledge on HPV and cervical cancer did not impact on attitudes towards vaccines. Mean knowledge score was 10.43. The majority of students had moderate knowledge (57.7%). Knowledge of students predicts 23% (R2 = 0.232, F = 60.55, P< 0.01) of their WTP.	The mean attitude score for students was 3.86 (SD = 0.37, median = 3.83). The majority of students (66.2%) had a positive attitude toward HPV	-	-	55% participants felt that there is less risk involved in being vaccinated with HPV vaccines, not confident on HPV vaccines

NO.	AUTHOR, YEAR, COUNTRY	% OF POSITIF WTP	WTP (CURRENCY)	WTP AS % OF GDP PER CAPITA	KNOWLEDGE	ATTITUDE AND ACCEPTANCE	FACTORS INFLUENCED IN WTP	REASON FOR NOT WTP	OTHER RESULTS
22	Rajiah et al, 2015 [33] Malaysia	-	The average amounts: -USD 108.66 for themselves. --<50% respondents want to spend around USD 200 for their children	1.90 – 5.90	-Mean knowledge score: 9.3 (moderate) out of 17 --there was a significant difference in knowledge between genders (12 ± 4.23 males vs. 14 ± 2.24 females; p = 0.003)	-positive, mean attitude score: 34.8 -there were significant differences in attitude by the respondents' living condition.	SIGNIFICANT	-	-
							SIGNIFICANT	-The government should cover the cost of vaccination	
							NOT SIGNIFICANT		

Some studies cited reasons for unwillingness to pay related to unwillingness to accept. In 10 out of 22, the cost was the main reason. Other reasons were afraid of safety and side effects of the vaccine[18], [22], [30], religious belief[18], felt unnecessary to be vaccinated[21], [22], [25], being male[21], unsuitable age[21], and presumption that vaccinating young will encourage sexual activity[33].

### 3.5 Factors Associated with Willingness to Pay

Sixteen studies assessed some factors that influenced WTP for HPV vaccine. The significant factors influenced WTP were: educational background[16], [22], [34], knowledge[28], [30], [32], [35], perception of imported vaccine[22], younger age[16], [21], [23], [35], unmarried status[23], household income[14], [16], [19], [21], [23], [26], [30], [33], [35], fewer children[23], behavior/ perception of health[23], [35], working site[23], gainful employment[30], higher local GDP[23], fewer serious effects[18], protection duration[18], efficacy/higher degree of protection[18], [21], [26], has examined reproductive health[21], cost[18], [20], [23], [25], mass media exposure[21], [26], and partner/spouse approval[26]. Other factors such as knowledge[17], educational level[23], professional title[23], vaccine safety[21], and history of family's sexual transmission infection[21] had no significant influences.

## 4 Discussion

Most of the reviewed studies were conducted in Asian, especially South East Asian countries, others were in Africa and South America. These setting areas were aligned with the Globocan Data Report 2020 that mentioned cervical cancer caused by HPV as the most commonly diagnosed cancer and the leading cause of cancer death in those regions[1]. Epidemiological studies of cancers, especially cervical cancer, have shown that this type of cancer is one of the most common cancers in these regions. In addition, cervical cancer-related deaths in South East Asia are among the highest in the world[36]. For the past few decades, mortality and incidence rates of cervical cancer actually have decreased in the majority of the world's regions. The decreases are attributed to elements that are either associated with rising socioeconomic averages or a declining risk of persistent infection with high-risk HPV as a result of advances in genital cleanliness, decreased parity, and a declining prevalence of sexually transmitted diseases. Despite the observations of rising risk among younger generations of women in some countries which may in part reflect changing sexual behavior and increased transmission of HPV that is insufficiently compensated by screening approach, cervical cancer screening programs have accelerated declines in many countries in Europe, Oceania, and Northern America. Although incidence rates are still high, rates have also fallen in the 2000s throughout the Caribbean and in Central and South America (such as Argentina, Chile, Costa Rica, Brazil, and Colombia). Furthermore, premature cervical cancer mortality has increased dramatically in recent generations in regions lacking efficient screening, such as Eastern Europe and Asia[1].

One of the studies focused on vaccination for boys. An interesting finding is that no participant mentioned their sons'

prior HPV immunization. This is understandable as many countries still targeting girls aged 9-14 as priorities. WHO recommends that where possible and practical, vaccination of secondary targets, such as boys and older females, is advised, after the primary target girls were highly achieved[37]. Some of high-income countries that have achieved high coverage of girls vaccinated start planning to move from a girls-only HPV vaccination strategy to universal or gender-neutral strategy[38]. This may affect the availability and adequacy of the HPV vaccine worldwide.

According to some studies, people considered HPV vaccination was only for female, and male did not need it[21]. The same circumstances regarding knowledge level of people about HPV vaccine and related disease also happened in other countries. In Indonesia, a study conducted a structured-educational intervention to parents because of their low level of knowledge about HPV infection and the vaccines. Only 48.8% of parents and 49.2% of parents, respectively, had heard of the vaccine and HPV infection before receiving the intervention[39]. Meanwhile in Vietnam, only 18.9% of the parents achieved good level of knowledge about HPV and HPV vaccine[17]. Along with the knowledge level findings, it is recommended to policy makers to create innovative approaches to raise the people knowledge level widely. However, our findings showed that the HPV vaccine acceptance was relatively high. Significant factors associated with acceptance are location of high school, study year, paternal educational level, annual household income, monthly disposable income, perceived self-confidence in taking the HPV vaccine in the near future, having no barriers to taking time off to take the HPV vaccination, and regular exposure to HPV vaccination information in the mass media, similar with the previous systematic review in 2018[40].

The result also showed a relatively high WTP if vaccine was offered free or at reasonable price. These results were in line with previous systematic review of ASEAN countries[7]. This may also due to high prevalence of this type of cancer and its association with high-risk sexual behavior, also the growth of educational level and higher household income. As WHO recommends the HPV vaccine be included in countries vaccination program since had been introduced in 2006, about one third of global population in 117 countries has been introduced HPV vaccination as national immunization program today, making it become one of the most common types of cervical cancer prevention. This action was taken early based on many previous studies stated that HPV vaccination was very cost effective, measured with every disability-adjusted life-year averted costing less than the gross domestic product per head in 87% or 156 of 179 countries[41].

As the WTP was high before learning the vaccine price then dropped after knowing the high price offered, it is important to pay more attention to the policies and strategies provided by many organizations including WHO and Government in each country as policymakers, in order to gain better control and to increase cost-effectiveness of prevention methods. Reducing the cost, simplifying the access of the vaccination program, maintaining the vaccine availability and its supported cold chain facilities, followed by developing user-friendly and all over information system will be beneficial. HPV vaccination should be part of a multifaceted public health strategy entailing screening, condoms, and

education of all stakeholders to reduce the significant burden of sexual transmitted diseases[42].

On the other hand, the results study also showed that people's knowledge and awareness of HPV infection and HPV vaccination were poor. In this regard, developing effective interventions to increase those things that related to acceptance and WTP is critical.

This systematic review provided summaries of the concerns in all included studies. However, this review had several limitations. The author could not conduct a meta-analysis due to the type of data reporting. In this study, only published articles in English version that were reviewed due to author's language literacy. In addition, although it is easier to identify published articles with the use of online databases in this study, evidence selection biases from missed studies continue to be a problem when systematically reviewed. Moreover, unpublished studies that have related topic but cannot be included here potentially will be publication bias. These conditions can lead to reporting bias toward its findings. Therefore, findings from this review should be interpreted cautiously.

## 5 Conclusion

Results showed that the acceptance rate of HPV vaccination and WTP were relatively high among individuals when the vaccine was offered for free or reasonable price, even though their knowledge was poor. According to the results of this study, it is recommended for the government to reduce the cost of vaccination program and to increase knowledge, awareness, and attitude of people through better healthcare interventions and suitable approaches.

## Conflict of Interest

The author declares that she has no conflict of interests or personal relationships that could have appeared to influence the work reported in this study.

## Acknowledgments

This study was a part of thesis' requirement in Master in Pharmacy Management Program, Faculty of Pharmacy at Universitas Gadjah Mada.

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