



Willingness to Pay for Human Papilloma Virus (HPV) Vaccine and Its Determinants in Asian Countries: a Systematic Review

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Abstract. Willingness to pay (WTP) for the human papillomavirus (HPV) vaccine is an important indicator of public acceptance and affordability related to cervical cancer prevention efforts. This systematic review aimed to examine the range of WTP values and explore the associated determinants of WTP for the HPV vaccine in Asian countries. A comprehensive search of PubMed, Scopus, ScienceDirect, and SpringerLink was conducted for studies published between 2015 and 2024, following PRISMA guidelines. Quality assessment of the included studies was performed using the Joanna Briggs Institute checklist. Seventeen cross-sectional studies from eight Asian countries (China, Vietnam, Iran, Hong Kong, Malaysia, India, Indonesia, and Thailand) were included, involving 30,159 respondents, primarily female. The reported WTP values varied significantly, ranging from USD 9.71 to USD 790.20, and represented 0.21 % to 10.49 % of GDP per capita across countries. Most of the reported WTP values remained below the actual market price of the HPV vaccine. Determinants influencing WTP were classified into personal factors, behavioral factors, and environmental factors. Tailored policy interventions and education strategies that address these factors are recommended to enhance vaccine accessibility and uptake across Asia.

Keywords: Cancer Prevention, Indonesia, Immunization, Cost Sharing, Health Economics.

1 Introduction

Cancers have become a major challenge for health systems globally [1]. Cervical cancer is a significant kind of malignancy, ranking as the second largest cause of mortality among women aged 15 to 44, following breast cancer [2]. Cervical cancer is the predominant cause of cancer mortality in numerous low- and middle-income countries (LMICs), with around 500,000 new cases identified each year globally, resulting in nearly 250,000 fatalities [3]. Asia accounts for the majority of cervical cancer cases and deaths, with more than half of global incidences and fatalities occurring in the region [4]. Notably, China and India together contribute to nearly 40 % of global cases and deaths from cervical cancer [4]. Epidemiological studies on cancer indicate that cervical cancer caused by HPV is one of the most common types of cancer in Asia [5].

Human Papillomavirus (HPV), especially types 16 and 18, has been recognized as the primary factor in the development of cervical cancer [6]. In 2006, the United States licensed the first HPV vaccine [7]. By the end of 2023, 143 countries had incorporated the HPV vaccine into their national immunization schedules, including 13 countries that recently introduced it, although their immunization coverage remains very low [8]. Although the HPV vaccine is recognized as one of the most effective interventions for preventing cervical cancer, vaccination coverage rates in developing countries, including those in Asia, remain low. One key factor influencing the success of vaccination programs is the public's willingness to pay (WTP) for the HPV vaccine. WTP reflects the extent to which individuals are willing to pay for the vaccine, highlighting their perceived value of its health benefits and the affordability of vaccination costs [9]. Thus, comprehensive knowledge about the factors determining WTP is essential [10]. Studies indicated that the degree of acceptability and willingness to pay for the vaccine may be influenced by variables such as socioeconomic background, perceived risk of HPV, and awareness about cervical cancer [11].

Several studies have investigated WTP for HPV vaccine, providing insights into its economic feasibility. However, existing systematic reviews have only focused on global perspectives without delving into the unique socioeconomic and cultural factors of the Asian region [5]. Moreover, these reviews lack a comprehensive analysis of the determinants influencing WTP in Asian countries, leaving a significant gap in understanding regional dynamics. This systematic review addresses this gap by identifying WTP values for the HPV vaccine across various Asian countries and exploring the determinants influencing these values. This review seeks to enhance the pharmacoeconomic literature and provide information for more targeted policy interventions by elucidating public perceptions and socioeconomic and health-related factors. The findings are expected to offer evidence-based recommendations for expanding HPV vaccination programs, particularly in developing countries, thereby contributing to improved vaccination coverage and cervical cancer prevention efforts across Asia.

2 Methods

The method of this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [41]. Although the review was not registered in any protocol registry, it was conducted with methodological rigor by these guidelines.

2.1 Literature Search

The search was conducted in Scopus, SpringerLink, ScienceDirect, and PubMed to identify studies on the HPV vaccine published between 2015 and 2024. The starting point of 2015 was chosen to ensure the inclusion of recent and policy-relevant evidence, considering that HPV vaccination programs became more widely introduced in Asian countries during this period. Keywords and subject terms, including "Willingness to Pay," "Human Papillomavirus vaccine," and "Determinants," were integrated utilizing Boolean operators. All items were gathered on September 6, 2024.

The search strategy was developed based on the PICO framework to ensure a structured and focused review process. The population targeted in this review consisted of individuals or parents residing in Asian countries who were involved in studies related to HPV vaccination. The intervention was defined as the assessment of WTP for the HPV vaccine. As this review aimed to synthesize observational data without evaluating comparative interventions, the comparison component was not applicable. The outcomes included the reported WTP values and the determinants influencing WTP for HPV vaccination.

Three reviewers independently conducted both the title and abstract screening and the full-text eligibility assessment. Discrepancies were resolved through discussion, and if consensus could not be reached, a senior reviewer made the final decision. Equivalent paragraphs, however, are indented.

2.2 Criteria for Eligibility

Studies were included that reported willingness to pay value, WTP method, and WTP determinations for the HPV vaccine. Studies were eliminated if they were review papers, proceedings, or reports, originated outside of Asia, or were not written in English. Additionally, studies focusing on other types of economic evaluations, like cost-effectiveness, cost-benefit, or cost-utility analyses, were not included.

2.3 Evaluation of Bias Risk

Reviewers assessed the risk of bias in the included studies using the Joanna Briggs Institute (JBI) critical appraisal tools [42]. The evaluation concentrated on multiple criteria: sample inclusion, characterization of study participants and environments, measurement validity and reliability, confounding variables and mitigation measures, and the suitability of the end measure.

2.4 Data Extraction

Data extraction was carried out using three structured forms. The first form was utilized to record the general characteristics of each study, including author(s), year of publication, country, time of study, study setting, data collection method, respondent, vaccination target, and method used to collect the WTP value. The second form focused on extracting key findings, such as WTP in local currency, WTP as a percentage of the market price, WTP converted to USD (2024), WTP as a proportion of GDP per capita, and identified determinants influencing WTP for the HPV vaccine. The third form recorded information related to the existing HPV vaccine program at study time and the current HPV vaccine program.

2.5 Data Analysis

Data obtained from the literature were systematically processed and analyzed using Microsoft Excel. The monetary values reported in the included studies were presented in both their original currencies and converted to USD [12]. This review also expressed WTP as a percentage of the HPV vaccine market price and gross domestic product (GDP) per capita. To calculate WTP as a percentage of market price, the reported WTP value was divided by the corresponding market price of the HPV vaccine. For WTP as a percentage of GDP per capita, the WTP values were first standardized to 2024 USD using the US Inflation Calculator. These values were then divided by the GDP per capita (considering both the lowest and highest WTP values when multiple measurements were available) for the year of study (2024) [13]. GDP per capita data were obtained from the International Monetary Fund [14], and country classification data based on economic status were sourced from the World Bank [15].

3 Results

3.1 Specifications of Included Studies

The initial retrieval from the databases consisted of a total of 350 studies. Out of these, 127 articles were discarded due to database duplication. During the title and abstract screening stage, 163 papers were eliminated. Following a comprehensive evaluation of the texts, 43 papers were removed. Finally, 17 publications satisfied the inclusion criteria and were incorporated into the final analysis, as depicted in Fig.1. All articles in the final set were published within the past decade (2015–2024). Records were excluded because their topics did not align with the research question or were unrelated to WTP for the HPV vaccine. Additional records were excluded as they were not conducted in Asian countries.

3.2 Characteristics of Included Studies

This review included 17 studies undertaken in eight countries: Hong Kong, Vietnam, Malaysia, Thailand, China, India, Indonesia, and Iran, as represented in Table 1. Two studies in high-income economies countries [31–32], 11 studies in five upper-middle-

income economies countries [19-30], and four studies were conducted in two lower- and middle-income economies countries [9,16,17,18]. The country classification was based on the New World Bank Country Classification by Income Level 2023-2024 [15].

Concerning the study population, five studies focused on parents, six on mothers, four on students, one on female healthcare workers, and one on vaccination service users. The total of participants in 17 studies was 30.159, most female (89.64%). The studies included in this review were conducted in various settings to capture diverse populations and contexts. Specifically, five studies were conducted in healthcare facilities, four in colleges, three in schools, two at the district level, one in a public area, one at the mainland level, and one at the provincial level. This variety of settings ensures that the study population reflects a comprehensive view regarding WTP for vaccination services. Among the 17 studies reviewed, the Contingent Valuation Method is the predominant approach to ascertaining WTP values. All studies considered were cross-sectional, utilizing questionnaires as the data collection methodology. Five utilized an online survey, five employed a survey, two implemented a self-administered questionnaire, two adopted a structured questionnaire, one utilized an online form, and two conducted a face-to-face interview.

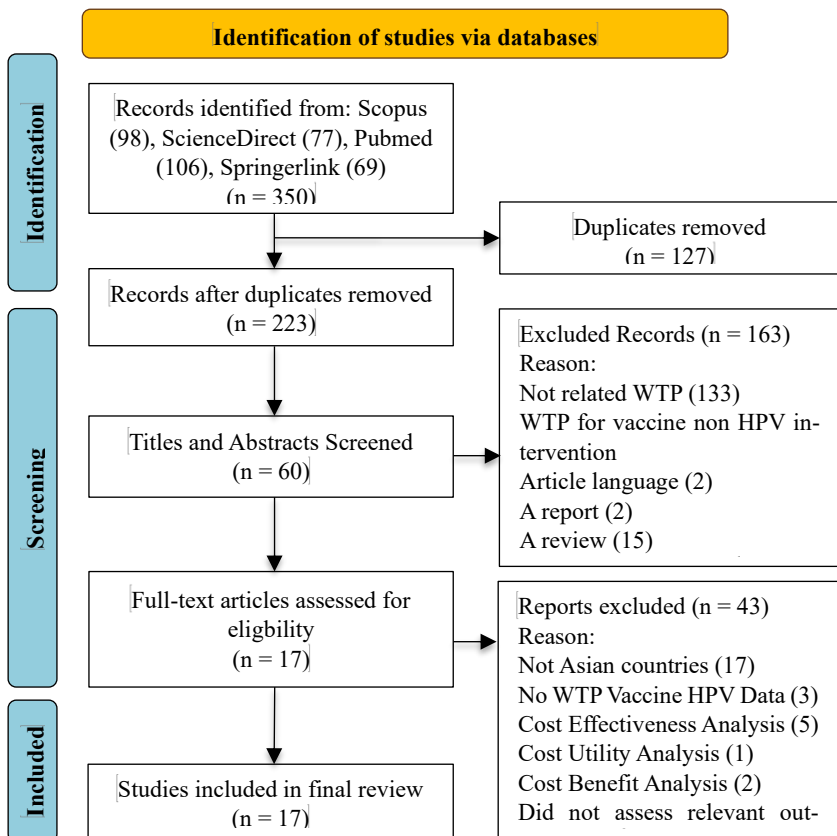


Fig. 1. PRISMA flowchart of study selection

Table 1. Characteristics of include studies.

No	Author, year, country	Time of study	Study Setting	Data collection method	Respondent (n)	Vaccination target	Method used to collect WTP value
1	Zhou et al (2024a) [19] china	January-august 2022	School setting	Cross sectional (online survey)	Mother: (n = 2.906), father: (n = 998)	Themselves & their Children	Contingent valuation method (a two-boundary dichotomous)
2	Zhou et al (2024b) [20] china	January-july 2022	School setting	Cross sectional (online survey)	Mother: (n = 1.798), father: (n = 695)	Themselves & their Children	Contingent valuation method
3	Zhou et al (2022) [21] china	November 2020 - march 2021	College setting	Cross sectional (online form)	Female student: (n = 475), male student: (n = 334)	Themselves	Contingent valuation method
4	Wong et al (2018) [31] hongkong	Juni 2014 - mei 2015	Health care setting	Cross sectional (online survey)	Mothers in pmh: (n = 181), mothers in qmh: (n = 301)	Their Children	Discrete choice experiment
5	Tran et al (2018) [16] vietnam	March-april 2016	Health care setting	Cross sectional (face-to-face interviews)	Female vaccination service users: (n = 256), male vaccination service users: (n = 92)	Themselves	Open-ended questions with double bounded dichotomous choice questions
6	Sargazi et al (2021) [22] iran	October-november 2019	Health care setting	Cross sectional (face-to-face interviews)	Mother: (n = 306)	Their Children	Discrete choice experiment
7	Rajiah et al (2017) [23] malaysia	2014	College setting	Cross sectional (self administered questionnaire)	Female student: (n = 94), male student: (n = 48)	Themselves	Contingent valuation method (opened-ended questions)
8	Nguyen et al (2022) [9] vietnam	December 2020	School setting	Cross sectional (interviewed based on a structured questionnaire)	Mother: (n = 472), father: (n = 313)	Their Children	Bidding game method
9	Ngorsuraches et al (2015) [24] thailand	Januari 2014	Public area setting	Cross sectional (self-administered questionnaire)	Mother: (n = 164), father: (n = 150)	Their Children	Discrete choice experiment

10	Lu et al (2022) [25] china	15 november-22 December 2021	Mainland-level setting	Cross sectional (national online survey)	Female health care workers: (n = 15.969)	Themselves	Double dichotomous choice bidding with contingent valuation method with
11	Li et al (2018) [32] hongkong	2018	Healthcare setting	Cross sectional (survey)	Mothers in pmh: (n = 181), mothers in qmh: (n = 301)	Their Children	Discrete choice experiment
12	Dinh thu et al (2018) [17] vietnam	2018	District-level setting	Cross sectional (interview in the participants' homes using a structured questionnaire)	Mothers in urban: (n = 320), mothers in rural: (n = 286)	Their Children	Contingent valuation method (opened-ended questions)
13	Ray et al (2024) [18] india	December 2018-February 2019	Healthcare setting	Cross sectional (survey)	Mother (319)	Their Children	Payment card
14	Maharajan et al (2015) [27] malaysia	June 2014-november 2014	College setting	Cross sectional (survey)	Female student: (n = 163), male student: (n = 139)	Themselves	Contingent valuation method
15	Frianto et al (2022) [28] indonesia	2022	District-level setting	Cross sectional (survey)	Parents in bandung: 51, parents in purwakarta: 127, parents in karawang: 108	Their Children	Contingent valuation method
16	Rajiah et al (2015) [29] malaysia	July-September 2014	College setting	Cross sectional (survey)	Female student: (n = 204), male student: (n = 69)	Themselves	Contingent valuation method
17	Lin et al (2020) [30] china	12 may-8 june 2019	Provincial-level setting	Cross sectional (online survey)	Mother: 2339	Their Children	Market price offered

3.3 Bias Risk in the Included Studies

The bias risk evaluation with the JBI tool (Table 2) reveals that most studies exhibit a low risk of bias. This is evidenced by the dominance of "Yes" responses across almost all evaluation criteria. However, some studies exhibit unclear or high risk of bias, particularly in areas such as exposure measurement, identification of confounding factors,

and strategies to deal with confounding factors, marked by "Unclear" and "No" responses. Overall, these findings suggest that while most studies possess strong and reliable methodologies, some limitations related to bias in design and reporting remain present in a few studies.

Table 2. Overview of the bias risk evaluation of the included studies (n=17)

Study ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Clear sampling criteria	1	1	3	1	1	1	1	3	1	1	1	1	1	1	1	1	1
Participants and setting	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Measurement of exposure	1	1	3	3	3	2	1	1	1	2	2	2	1	1	1	1	1
Objective and/or question	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
Identification of confounding factors	1	1	1	1	1	2	2	1	1	1	2	1	1	1	1	1	1
Strategies to deal with confounding factors	1	1	1	1	1	2	2	1	3	1	2	1	1	2	1	1	1
Measurement of outcome	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Appropriate statistical analysis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Score; 1: Yes, 2: No, 3: Unclear.
 Studi ID; 1: Zhou et al. 2024a, 2: Zhou et al. 2024b, 3: Zhou et al. 2022, 4: Wong et al. 2018, 5: Tran et al. 2018, 6: Sargazi et al. 2021, 7: Rajiah et al. 2017, 8: Nguyen et al. 2022, 9: Ngorsuraches et al. 2015, 10: Lu et al. 2022, 11: Li et al. 2018, 12: Dinh et al. 2018, 13: Ray et al. 2024, 14: Maharajan et al. 2015, 15: Frianto et al. 2022, 16: Rajiah et al. 2015, 17: Lin et al. 2020.

3.4 Willingness to Pay for HPV Vaccine

Of the 17 studies incorporated in this review, nine used CVM to assess WTP, four used the DCE, one used double-bounded dichotomous-choice questions combined with open-ended questions, one adopted a payment card method, one used a bidding game, and one used the market price offered. There was variability in WTP values for the HPV vaccination among nations, with an average value of 741.66 USD. The study in Thailand had the highest WTP value at 790.20 USD, while the lowest WTP value was in Indonesia at 0.08 USD. Additionally, WTP was analyzed as a percentage of GDP per capita. The WTP percentage of GDP per capita for the HPV vaccine varied significantly between countries. The WTP percentage compared to GDP per capita in 2024 ranged from 0.21 % – 4.37% (USD 9.71 – USD 203.10) in lower-middle-income countries, 0.002-10.49% (USD 0.08 – USD 790.20) in upper-middle-income countries, and 0.49 % –0.52 % (USD 261.47 – USD 275.68) in high-income countries. The highest proportion was found in Thailand (5.19 % – 10.49 %), and the lowest proportion was found in Indonesia (0.002 % – 0.73 %) (Table 3).

The review also analyzed the comparison of WTP to the market price of HPV vaccines, with an average value of 75.38 %, close to the market price. The 17 studies analyzed were divided into eight countries. In China, WTP varied depending on the type of vaccine and population group. For girls, WTP was consistently lower than the market

price, while for boys, WTP for 2vHPV was very high, almost reaching 3 times the market price, while for 4vHPV, it was slightly higher than the market price, and 9vHPV was lower. Other studies have shown that WTP for imported vaccines tends to be higher compared to domestic vaccines, although still below the market price.

In contrast, WTP was consistently higher than market prices in Thailand and Malaysia. In Thailand, respondents were willing to pay up to 2 times the market price for 4vHPV, making it one of the countries with the highest willingness to pay. In Malaysia, WTP reached 3 times the market price, reflecting a high appreciation of the vaccine and significant payment capacity in the country. In Hong Kong, WTP was lower than the market price, with average values of only 36 % – 55.74 %. Vietnam showed considerable variation, but overall, WTP tends to be lower than the market price. For example, one study recorded a WTP of only 19.16 % – 23.59 % of the market price, while another study showed a value closer to the market price of 85.3 %. This is followed by India and Indonesia, which have WTPs that are far from the market price.

Table 3. Willingness to pay estimates and associated determinants across included studies.

No	Author, Year, Country	WTP (Currency)	WTP As % of Market Price	WTP (USD 2024)	WTP As % of GDP Per Capita	Determinants of WTP HPV vaccine
1	Zhou et al (2024a) [19] China	WTP for themselves 2050.61 CNY (mothers) and 1616.12 CNY (fathers). WTP for their sons was 2122.75 CNY (mothers) and 1695.40 CNY (fathers).	For their Son; 2vHPV (272.72), 4vHPV (106.06), 9vHPV (76.36), Domestic (68.18), Imported (48.95)	Parents: 223.02-282.98 USD Children: 233.96-292.94 USD	1.72-2.26	1. Type vaccine 2. Sex 3. Age 4. Household income 5. Knowledge 6. Awareness 7. Willingness to Accept
2	Zhou et al (2024b) [20] China	The median WTP was 2000 CNY (277 USD) for self, spouse, and daughter, with ranges of 1000–3500 CNY, 800–3000 CNY, and IQR 1000–3600 CNY, respectively.	For their daughter; 2vHPV (42.71), 4vHPV (16.61), 9vHPV (11.96), Domestic (10.67), Imported (7.67)	Parents: 110-483 USD Children: 138-498 USD	0.85-3.84	1. Type vaccine

3	Zhou et al (2022) [21] China	The average values (in RMB) are 3,252.43 ($\pm 2,064.71$, 2,216.61 ($\pm 1,190.62$), and 1,689.80 (± 926.13) for imported 9-valent, quadrivalent, and bivalent vaccinations, while domestic counterparts 910.63 (± 647.03), 1,861.69 ($\pm 1,147.80$), and 2,866.96 ($\pm 1,784.41$)	Imported 2vHPV (97.11), Imported 4vHPV (89.78), Imported 9vHPV (81.31), domestic 2vHPV (52.33), domestic 4vHPV (75.4), domestic 9vHPV (71.67)	Health students: 254.33-489.51 USD (for imported vaccine) and 137.06-431.50 USD (for domestic vaccine)	1.06-3.77	1. Sex 2. Education level 3. Type of family residence 4. Hours of exercise 5. Cognitive score
4	Wong et al (2018) [31] Hongkong	Mothers' WTP was HK\$1620 (US \$208)	36	Children: \$261.47 USD	0.49	1. Education level 2. Household income 3. Protection against cervical cancer 4. Protection duration 5. Side effects 6. Cost
5	Tran et al (2018) [16] Vietnam	WTP an average amount of US\$49.3 (1.119 million VND)	60.86	Vaccination service user: \$61.97 USD	1.33	1. Education level 2. Age 3. Employment 4. Household income 5. Believe that the HPV vaccine provides adequate protection 6. Source of hearing about HPV 7. Has a family member with a history of STI 8. Has undergone a reproductive health check-up
6	Sargazi et al (2021) [22] Iran	Mothers' WTP for bivalent and quadrivalent HPV vaccines was in US \$ 432 and US \$ 380	-	Children: \$442.68-503.25 USD	8.82-10.03	1. Protection against cervical cancer 2. Protection against genital warts 3. Protection duration 4. Serious side effects 5. Cost
7	Rajiah et al (2017) [23] Malaysia	The total mean of money WTP by students for HPV vaccine was RM 1304	153.41	Dental students: 414.73 USD	3.16	1. Knowledge

8	Nguyen et al (2022) [9] Vietnam	The average WTP value for complete HPV vaccine doses was 137.5 USD (3.053.005 VND), with a range from 9 USD to 188.3 USD (200.000 VND to 4.180.000 VND)	85.3	Children: 9.71-203.10 USD	0.21-4.37	1. Knowledge
9	Ngor-suraches et al (2015) [24] Thailand	WTP the bivalent and quadrivalent HPV vaccines at 10,479.9 and 21,189.9 Baht	4vHPV (211.99), 2vHPV (104.79)	Children: 390.80-790.20 USD	5.19-10.49	1. Sex 2. Cervical cancer risk 3. Genital warts risk 4. Common side effect 5. Cost
10	Lu et al (2022) [25] China	The reported median WTP amounted to 2000 CNY (IQR 1000-3200 CNY)	Domestic 2vHPV (55.04), Imported 2vHPV (53.08), Imported 4vHPV (58.02), Domestic 9vHPV (56.51), Imported 9vHPV (56.14)	Female health care workers: 168.80-540.17 USD	1.30-4.16	1. Age 2. Marital status 3. Monthly income 4. Numbers of children, 5. Local GDP 6. Local HDI 7. Hospital level 8. Vaccination behavior
11	Li et al (2018) [32] Hongkong	Mothers' WTP was HK\$1700	55.74	Children: 275.68 USD	0.52	1. Protection against cervical cancer 2. Protection duration 3. Adverse effects 4. Cost
12	Dinh Thu et al (2018) [17] Vietnam	Mothers' WTP ranges from \$23 to \$46 for three doses of HPV vaccine	19.16-23.59	Children: 28.91-57.83 USD	0.62-1.24	1. Perceptions on cost and condom use 2. Being or not being a farmer 3. Knowledge HPV or HPV vaccine 4. Experience of cervical cancer screening,
13	Ray et al (2024) [18] India	The mean highest WTP was 35 USD (INR 629), ranging between 55.60 and 197 USD (INR 100-3500)	23.97	Children: 36.03 USD	1.34	1. Monthly family income 2. Awareness of cervical cancer 3. Total children in the family 4. Occupation
14	Maharajan et al (2015) [27] Malaysia	The mean WTP was RM 1197.68	339.22	Medical students: 448.58 USD	3.41	1. Cost 2. Knowledge

15	Frianto et al (2022) [28] Indonesia	WTP in Bandung, Purwakarta, and Karawang was US\$ 1.38-20.69, US\$ 0.07-34.48, and US\$ 1.38-6.90	Bandung (2.65-22.99), Purwakarta (0.13-38.31), and Karawang (2.65-7.67)	Children: US\$ 0.08-36.48	0.002-0.73	1. Cost
16	Rajiah et al (2015) [29] Malaysia	WTP, an average amount of 108.66 USD	-	Health science students: 143.81 USD	1.09	1. Cost
17	Lin et al (2020) [30] China	WTP vaccine 2vHPV (RMB580 /pershot) 4vHPV (RMB798 /pershot) and 9vHPV (RMB1298 /pershot)	100	Adult women: 110.71-247.76 USD	0.85-1.90	1. Present working location 2. Marital status 3. Annual household income 4. Exposure of HPV vaccination information in the mass media 5. Perceived self-efficacy

3.5 Determinants of Willingness to Pay for HPV Vaccine

The studies included in this review suggest that factors influencing willingness to pay for HPV vaccine in Asian countries can be categorized as (10 personal factors, (2) behavioral factors, and (3) environmental factors.

Personal Factors. Several personal factors, such as age, sex, income, knowledge, education level, marital status, number of children, and perceived benefits and risks, have been identified across studies as key determinants of willingness to pay for the HPV vaccine.

Age. Some studies found age to be an influential factor in WTP for HPV vaccine in Asian countries. Parents aged ≤ 45 years were more willing to pay than those who were older [20], and these results are consistent with the findings of another study that showed younger women tended to have higher WTP for the HPV vaccine than older women [25]. The relationship between age and willingness to pay for the HPV vaccine was also demonstrated in another study, with individuals aged 20-29 years more likely to pay for the HPV vaccine than those aged ≤ 20 years, indicating that WTP may increase at certain ages before decreasing in older age groups [16].

Sex. Several studies have reported differences in WTP for the HPV vaccine by gender, showing that women are more likely to be willing to pay than men. Research has found that mothers are more willing to pay for the HPV vaccine than fathers [20,24], and this finding aligns with the results of other studies that show women have higher WTP than men [21].

Income. Several studies have shown that income is significantly associated with WTP for the HPV vaccine. Household income is related to parents' WTP [20,30], and mothers with higher household incomes tend to have greater WTP [31]. In addition, income influences not only the decision to pay but also the amount willing to pay [16,18]. Other studies have also shown a positive relationship between an individual's monthly income and WTP, with women with higher incomes more likely to pay for the HPV vaccine [25].

HPV Knowledge and Awareness. High levels of knowledge and awareness about the HPV vaccine are the main factors influencing HPV vaccine WTP, which is validated in the results of several studies. Studies showed that good knowledge and awareness of HPV and HPV vaccine significantly increased WTP [9,18,20,23,27], while improved cognitive scores on cervical cancer also had a positive impact on WTP [21]. In addition, mothers with a sufficient understanding of the HPV vaccine had 1.6 times higher WTP [17].

Education Level. Studies found that higher education levels were positively correlated with WTP [31]. However, another study reported that bachelor's degrees and above negatively impacted WTP [21]. This result is consistent with the findings of another study that showed that the higher the level of education, the lower the willingness to pay for the HPV vaccine [15].

Marital Status. Studies show that this factor influences WTP for the HPV vaccine. Unmarried women tend to have higher WTP than those who are married [25], and this result is consistent with the findings of other studies that show marital status to be a significant factor in WTP for the HPV vaccine [30].

Numbers of Children. WTP tends to be higher in families with fewer children [25], while each additional child in the family is associated with a significant decrease in willingness to pay [18].

Benefit and Risk Perception. Individual perceptions of the benefits and risks of the disease and the HPV vaccine are important factors that influence WTP. Studies show that protection against cervical cancer and genital warts is a major factor driving WTP, with individuals who realize these benefits more likely to pay more for the HPV vaccine. In addition, the duration of vaccine protection also has a significant effect on WTP, with individuals more willing to pay for vaccines with long-term or lifelong protection [22,31,32]. The effectiveness of the HPV vaccine in preventing HPV infection is a major factor in increasing the WTP value, with individuals who have confidence in the vaccine's efficacy are more willing to pay [9]. In addition, perceived self-efficacy in accessing the vaccine was also found to influence intention and WTP [30]. On the other hand, the perceived risk of HPV and the HPV vaccine also determines the level of WTP [24]. However, concerns over vaccine side effects are a major barrier in WTP decisions, with some individuals declining vaccination for this reason [22,24,31,32].

Behavioral Factors. Behavioral factors, including previous vaccination experiences and individual acceptance of the HPV vaccine, were highlighted as significant contributors to willingness to pay. A study conducted in China on willingness to pay for the HPV vaccine among women showed that respondents with more positive vaccination behavior tended to be willing to pay more for the HPV vaccine [25]. In addition, individual acceptance of the HPV vaccine is also a factor that significantly influences willingness to pay [20].

Enviromental Factors. In addition to personal and behavioral influences, environmental factors such as information exposure, vaccine costs, healthcare experiences, occupation, and area of residence play crucial roles in shaping willingness to pay for the HPV vaccine.

Information Exposure. The source and manner of obtaining information affect WTP for the HPV vaccine. Individuals who obtain information from health workers tend to have lower WTP [16]. In contrast, in a study conducted in China on willingness to pay for HPV vaccine among adult women, exposure to HPV vaccination information through mass media was found to be a significant factor that increased willingness to pay [30].

Cost of Payment. Several studies have shown that HPV vaccine cost is a major factor influencing WTP. Vaccine cost has a significant effect on willingness to pay, where higher prices tend to decrease willingness to pay [22,24,27,28,29,31,32]. In addition, the perceived cost of the vaccine also plays a role in determining WTP. Studies show that individuals who perceive vaccine prices to be affordable will have a higher WTP than those who perceive them to be expensive [17]. In contrast, parents are willing to pay more for higher-valence or internationally produced vaccines for their children [19-20].

Health Experience. The study showed that an individual's experience of reproductive health screening and family history of sexually transmitted infections (STIs) were associated with WTP for the HPV vaccine [16]. The results of this study are also consistent with other findings showing that women who had previously been screened for cervical cancer had a WTP 1.6 times greater than those who had not [17].

Occupation. Several studies have shown that occupation type and location influence WTP for the HPV vaccine. Occupation, in general, has a significant relationship with WTP [16-17]. A study conducted in China showed that health workers working in tertiary hospitals tended to have higher WTP [25], while those working in urban areas were more likely to pay than those working in rural areas [30]. However, another study showed that compared to housemakers, employees had lower WTP [18].

Area of Residence. The location of residence and the economic conditions of the region affect WTP for the HPV vaccine. Studies show that households in rural areas tend to have lower WTP than those in urban areas [21]. This result is consistent with other

studies that show that women living in cities with higher GDP and HDI are more likely to have greater WTP [25].

3.6 HPV Vaccination Programs in Asian Countries

As shown in Table 4, the 17 journals reviewed included eight countries where the status of HPV vaccination programs has evolved. At the time of the study, only Malaysia had incorporated HPV vaccination into its national immunization program. Meanwhile, China and Indonesia had pilot programs as well as HPV vaccination introduction programs. Five other countries, namely Hong Kong, Vietnam, Iran, Thailand, and India, have not yet incorporated HPV vaccination into their national immunization programs. Currently, significant developments have been made in the implementation of HPV vaccination. Malaysia continues to maintain its program as part of national immunization. In addition, Hong Kong, Thailand, and Indonesia have incorporated HPV vaccination into their national immunization programs. On the other hand, China, Vietnam, Iran, and India have yet to fully incorporate HPV vaccination into their national immunization programs, although China has run pilot programs in certain regions.

Table 4. Existing HPV vaccination program of included studies.

No	Author, Year, Country	Existing HPV Vaccine Program (at Study Time)	Current HPV Vaccine Program
1	Zhou et al, (2024b) [20] China	There is no HPV vaccination program for males in China.	As of now, the HPV vaccine has not been fully included in China's National Immunization Program (NIP). However, since 2020, there have been pilot programs in some regions to provide free or subsidized HPV vaccines to young females between 9 and 14 years, mostly in primary and middle schools.
2	Zhou et al, (2024a) [19] China	In China, pilot programs for HPV vaccination include the provision of domestic 2vHPV at no cost to girls in the first grade of middle school.	
3	Zhou et al, (2022) [21] China	There is no HPV vaccination program for adult women in China.	
4	Lu et al, (2022) [25] China	There are pilot HPV immunization programs in China that use strategies like government subsidies and basic medical insurance coverage.	
5	Lin et al (2020) [30] China	There is no HPV vaccination program for adult women in China.	
6	Wong et al, (2018) [31] Hongkong	There is no universally organized vaccination program in Hong Kong, whereas the HPV vaccination among teenage girls is largely opportunistic.	The HPV vaccination program has been included in the Hong Kong Childhood Immunization Programme (HKCIP). The program started in 2019 and targets girls in primary five and primary six schools.
7	Li et al, (2018) [32] Hongkong	HPV vaccination has not been included in the government immunization schedule in Hong Kong.	
8	Tran et al, (2018) [16] Vietnam		

9	Dinh Thu et al, (2018) [17] Vietnam	The HPV vaccine has not been included in the national immunization program in Vietnam.	The HPV vaccine has not yet been included in Vietnam's National Expanded Program on Immunization (EPI).
10	Nguyen et al, (2022) [9] Vietnam		
11	Sargazi et al, (2021) [22] Iran	The HPV vaccine has not been included in the national immunization program in Iran.	As of now, the HPV vaccine has not yet been included in Iran's National Immunization Program.
12	Rajiah et al, (2017) [23] Malaysia	The Malaysian government implemented the National HPV (NHPV) immunization program, under which all 13-year-old girls from public or private schools can receive three doses of HPV vaccine free of charge.	
13	Maharajan et al (2015) [27] Malaysia	The Malaysian government was offering free vaccines not only to secondary school females but also to all those who were willing to be vaccinated.	The HPV vaccination program has been included in the national immunization program in Malaysia since 2010.
14	Rajiah et al (2015) [29] Malaysia	The Malaysian Ministry of Health introduced a free vaccination program for all 13-year-old girls studying in public or private schools.	
15	Ngorsuraches et al, (2015) [24] Thailand	The HPV vaccine has not been included in the national immunization program in Thailand.	Thailand has included the HPV vaccine in its National immunization program since 2014. The program targets 5th-grade girls aged 11-12.
16	Ray et al (2024) [18] India	The HPV vaccine has been introduced into immunization programs in several states in India.	The HPV vaccination has not yet been incorporated into India's National Immunization Program.
17	Frianto et al (2022) [28] Indonesia	There is an HPV immunization introduction program for girls in grades 5 and 6 of primary school.	The HPV vaccination program has been included in the national immunization program in Indonesia since 2023.

4 Discussion

In 2020, the WHO launched the global Cervical Cancer Elimination Initiative to accelerate the eradication of cervical cancer [33], aiming to reduce the incidence to below the threshold of 4 cases per 100,000 women per year in every country, thereby narrowing international disparities related to this disease. The initiative's 90–70–90 targets are to be accomplished by 2030, necessitating that 90 % of girls are vaccinated prior to age 15, 70 % of women undergo high-performance screenings at least twice before age 45, and 90 % of women diagnosed with precancerous conditions or cervical cancer receive treatment [4]. According to WHO data, as of 2023, global Human Papillomavirus (HPV) vaccination coverage remains low, ranging from 5 % – 27 % globally, with higher coverage in high-income countries than in low-income countries due to differences in access and program implementation [34]. 143 WHO member states have incorporated HPV vaccines in their national immunization programs by the end of 2023, including 13 countries that have newly introduced the vaccine. However, their immunization coverage remains very low [8].

To support achieving HPV vaccine immunization coverage, it is crucial to understand public acceptability and WTP for the HPV vaccination. This review aims to identify WTP for HPV vaccines and the determinants affecting it, focusing on studies conducted in Asia. Findings indicate inconsistent results regarding WTP for HPV vaccines across Asian countries. Moreover, no systematic review has yet explored WTP for HPV vaccines and its determinants in Asia. Therefore, the findings from this systematic review will assist policymakers in designing effective strategies to enhance WTP for HPV vaccines in Asia.

Most reviewed studies were conducted in East and Southeast Asia, with others in West Asia. These regions align with the GLOBOCAN 2020 Data Report, which noted that Asia accounted for more than half of the total cervical cancer deaths globally in 2020. The region is estimated to have contributed about 58% of total deaths, with most cases concentrated in low- and middle-income countries. Additionally, more than 58% of all global cervical cancer cases occur in Asia [4]. Other studies indicate HPV-induced cervical cancer as the most often diagnosed malignancy and the primary cause of cancer-related fatalities in Asia [5].

The WTP values obtained from this systematic review vary significantly based on geographic and economic status. Most reviewed studies show that WTP for HPV vaccines is far lower than their market price. The cost of HPV vaccines is one of the main factors driving low WTP values [17,22,24,27,28,29,31]. This review also reveals that parents tend to have a higher WTP for their daughters than for themselves or their sons. Parents are willing to pay more for HPV vaccines for their children [19]. Other research has documented that the public perceives HPV vaccination as exclusively for females, with males not seen as needing it [16].

Most of the studies reviewed showed that at the time of the study, many countries in Asia had not yet incorporated HPV vaccination into their national immunization programs. Of the eight countries, only Malaysia had adopted HPV vaccination nationally, while other countries, such as China and Indonesia, were still in the pilot or introduction stage of HPV vaccination programs [19,23,35]. Five other countries, namely Hong Kong, Vietnam, Iran, Thailand, and India, have not yet incorporated HPV vaccination into their national immunization programs. However, recent developments indicate a significant increase in the implementation of HPV vaccination in some Asian countries. Malaysia continues to maintain its vaccine program as part of the national immunization. In addition, Hong Kong, Thailand, and Indonesia have now incorporated HPV vaccination into their national immunization programs [35-37]. On the other hand, China, Vietnam, Iran, and India have yet to adopt HPV vaccination into their national immunization programs fully, although China has run pilot programs in certain areas.

These findings are also corroborated by several studies showing factors that influence HPV vaccine acceptance in individual countries. For example, Malaysia has a national immunization program that has been running since 2010, with vaccination coverage of more than 80 % [38]. In addition, this study also showed that Malaysia has a WTP value 1.5 times higher than the market price [14]. Students who are in a relationship (committed and dating) have a great interest in being vaccinated and are willing to pay for the HPV vaccine [39], while in married adult women, the vaccination decision is influenced by their partner [40]. In China, although the HPV immunization program

is still limited to a few pilot areas with free provision of the 2vHPV vaccine to first-year junior high school students, vaccine acceptance rates are still very low. One study estimated that HPV vaccine acceptance among Chinese women, particularly in primary and junior high schools, was only 2.24 % [26]. This factor is one of the reasons for the low HPV vaccination coverage in the country, even though the government has started to implement a pilot program.

Determinants affecting WTP for HPV vaccine in Asian countries have been 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 increase WTP among the public in Asian countries. This review demonstrates that gender, age, income, knowledge, and awareness consistently correlate with higher WTP for HPV vaccines [16,20,25,31]. Increased knowledge significantly enhances HPV vaccine purchases and demand, particularly for imported vaccines [21]. Several studies have shown that imported HPV vaccines are far more preferred than domestic vaccines despite being much more expensive [19,20,21,25].

Higher vaccine valency is also associated with increased WTP, while vaccine acceptance positively correlates with increased WTP [19-20]. Factors such as residence type and education level negatively impact WTP, with families living in rural areas tending to have lower WTP [21]. Conversely, marital status and the number of children correlate with lower WTP, potentially due to limited financial capacity [25]. Other factors, such as health experience, health behavior, and psychological or perceptual factors regarding cervical cancer and HPV vaccines, significantly affect WTP [16,17,21,22,24,25,31,32].

The findings of this systematic review align with other systematic reviews examining the relationship between knowledge, acceptance, and WTP for HPV vaccines and evaluating the factors influencing WTP in low-, middle-, and high-income countries [5]. Another study indicates that the degree of acceptability and willingness to pay for the vaccine among parents may be influenced by variables such as socioeconomic background, perceived risk of HPV, and awareness about cervical cancer [11]. These studies highlight the critical role of health education in increasing WTP [11]. Studies focusing on identifying the determinants of WTP for the HPV vaccine indicate that sociodemographic factors, knowledge, health experiences, and vaccine costs are associated with WTP. People with sufficient knowledge about HPV and the HPV vaccine have a WTP that is 1.6 times higher. Women who have previously undergone cervical cancer screening have a WTP that is 1.6 times higher compared to those who have not been screened. Individuals who perceive the cost of the HPV vaccine as relatively affordable have a WTP that is 7.5 times higher compared to those who consider the vaccine cost expensive or very expensive [17].

This systematic review had several limitations. First, the search was restricted to specific databases and English-language publications, which may have led to the omission of relevant studies published in other languages or indexed elsewhere. Second, the review only included studies conducted in Asian countries, limiting the generalizability of the findings to other regions outside Asia.

5 Conclusion

This study showed that WTP for HPV vaccines in Asia varied from low to moderate. Most studies reported that WTP remained below the market price of the vaccine, especially in low- and middle-income countries. Therefore, intervention strategies that consider factors that influence WTP, such as price subsidies, HPV vaccine promotion campaigns, and policy support, are needed to increase the acceptance and accessibility of HPV vaccines in Asia.

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