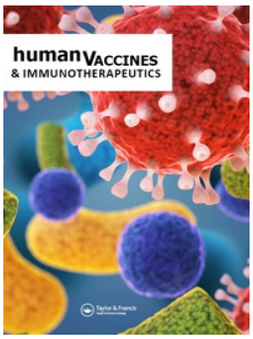

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REVIEW

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Acceptance and the willingness to pay for human papilloma virus (HPV) vaccine: A systematic review

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ABSTRACT

Human papillomavirus (HPV) is a major global health concern due to its link to cervical and other cancers. Although HPV vaccination is highly effective, acceptance and willingness to pay (WTP) differ widely across populations. This review summarizes global evidence from 2015–2025. A systematic search of PubMed, Scopus, CENTRAL, Web of Science, and Google Scholar was conducted in 2025 following PRISMA guidelines. Studies reporting data on knowledge, acceptance, attitudes, and WTP across any population were included. Quality assessment used ISPOR checklists, and data were synthesized in Excel 2019. Thirty-five studies met inclusion criteria, with China and Nigeria contributing most. WTP ranged from 52.68% in lower-middle-income countries to 65.38% in low-income countries. Mean WTP was highest in upper-middle-income settings. Knowledge, positive attitudes, socioeconomic status, and trust increased WTP, while cost remained the primary barrier. Improving affordability, awareness, and policy support is essential to enhance global HPV.

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Human papillomavirus; vaccines; vaccine acceptance; willingness to pay; systematic review

Introduction

Human papillomavirus (HPV) is a diverse group of over 200 related viruses, classified into several genera, of which the Alpha genus includes the types responsible for most clinically significant infections. High-risk HPV types, particularly HPV-16 and HPV-18, are etiologically linked to approximately 70% of cervical cancer cases worldwide, as well as a substantial proportion of other anogenital and oropharyngeal cancers. These viruses are primarily transmitted through sexual contact and often cause persistent infections that may progress to malignancy if left untreated.[1,2]

Globally, HPV-associated diseases impose an enormous economic burden on health systems and societies. Recent estimates from high-income countries report that the annual direct medical costs of managing HPV-related diseases exceed $9 billion in the United States alone. The major cost components include screening, diagnosis, treatment of precancerous lesions, and cancer care.[3] In middle- and low-income countries, this burden is exacerbated by limited access to effective screening and treatment modalities, resulting in higher mortality and larger population-level impacts,[4] For example, in Asia and parts of Africa, cervical cancer remains a leading cause of cancer-related death among women, a trend primarily attributable to HPV infection. This underscores the urgent need for cost-effective prevention strategies.[3,5,6]

Vaccination against HPV has emerged as a highly effective and safe intervention to prevent infection and its associated cancers. However, despite the availability of prophylactic vaccines since the mid-2000s, global vaccination coverage remains suboptimal, especially in low-resource settings where coverage rates can fall below 20%, compared to rates exceeding 80% in some high-income countries.[7,8]

HPV vaccination guidelines vary across countries and regions. The World Health Organization (WHO) recommends a 2-dose HPV vaccination schedule (6–12 months apart) for girls aged 9–14 y. For individuals

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aged 15 y and older, a 3-dose schedule is advised. Some countries have also extended recommendations to include boys to address the role of HPV in non-cervical cancers and to promote herd immunity. As of 2023, over 100 countries have included the HPV vaccine in their national immunization programs, though coverage rates vary substantially between high-income countries (over 80% in some settings) and low- and middle-income countries (often below 20%).[8]

Acceptance of the vaccine and willingness to pay (WTP) vary widely across populations and are shaped by a complex interplay of factors.[9] WTP, an economic concept measuring the maximum amount an individual or group is prepared to pay for a good or service, reflects the value individuals place on specific healthcare interventions, such as vaccines. Consequently, WTP can inform pricing strategies and policy decisions.[10] Among the influencing factors, knowledge about HPV and vaccine benefits consistently correlates with acceptance; populations with an adequate understanding of HPV's role in cancer and the preventive potential of vaccination demonstrate significantly higher uptake rates. Conversely, widespread misconceptions and insufficient awareness limit demand for vaccination.[7,11]

Attitudinal factors also contribute significantly. Safety concerns, fear of side effects, misinformation linking the vaccine to increased sexual activity among adolescents, and cultural or religious objections all reduce acceptance.[12] In contrast, positive attitudes, often fostered by healthcare provider recommendations and social support, enhance vaccine uptake. Furthermore, socioeconomic status critically affects both acceptance and WTP. Higher income, better education, and urban residence correlate with increased willingness to vaccinate, while economic constraints frequently hinder vaccination in resource-limited regions.[13,14]

Beyond individual factors, systemic and policy-level barriers also influence HPV vaccine uptake. Inclusion in national immunization schedules, the availability of school-based vaccination programs, and public health campaigns positively impact coverage.[15] In many low-income countries, however, a lack of organized programs, vaccine stock-outs, and out-of-pocket costs remain substantial barriers. The social stigma tied to sexually transmitted infections further deters vaccine acceptance, especially among adolescents and young women. Thus, addressing structural, informational, financial, and cultural dimensions is essential for improving HPV vaccine coverage and equity.[16]

This systematic review synthesizes and critically evaluates the literature from the past decade to provide a comprehensive understanding of acceptance and willingness to pay for HPV vaccination globally. Through this synthesis, it identifies gaps, regional disparities, and key determinants of vaccine uptake. With an emphasis on populations in developing and low-resource contexts – where the burden of HPV-related disease is highest and vaccine coverage is lowest – this review aims to provide actionable insights for policymakers, healthcare practitioners, and researchers. Ultimately, by addressing both economic and psychosocial barriers, more effective strategies for increasing HPV vaccine acceptance and affordability can be developed, thereby advancing global efforts to reduce HPV-associated morbidity and mortality.

Methods

This systematic review aimed to assess the characteristics, levels, and factors influencing preferences and willingness to pay (WTP) for the HPV vaccine. The study was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[17]

Study selection and screening

A systematic literature search was conducted across multiple electronic databases, including PubMed, Scopus, the Cochrane Central Register of Controlled Trials (CENTRAL), and Google Scholar, to identify relevant studies on WTP and preferences for the HPV vaccine (see Appendix). The search strategy for PubMed combined Medical Subject Headings (MeSH) terms and keywords using Boolean operators, as detailed in Table 1.

The search was conducted from January 1, 2015, to September 15, 2025. The year 2015 was selected as the starting point to capture recent developments in HPV vaccine availability and implementation, including the introduction of the 9-valent vaccine. Two reviewers independently screened titles and abstracts to exclude irrelevant records. Full texts of potentially eligible studies were then retrieved and assessed for final

Table 1. Search strategy for PubMed combined MeSH terms.

("HPV"[Mesh] OR "Human Papilloma Virus"[Mesh] OR "Human Papillomavirus"[Mesh] OR "HPV"[tiab] OR "Human Papilloma Virus"[tiab] OR "Human Papillomavirus"[tiab] OR (human[tiab] AND papillomavirus[tiab]))AND("vaccine"[Mesh] OR "vaccination"[Mesh] OR "immunization"[Mesh] OR "vaccine"[tiab] OR "vaccination"[tiab] OR "immunization"[tiab] OR "inoculation"[tiab])AND("WTP"[tiab] OR "willingness-to-pay"[tiab] OR WTP[tiab] OR "payment intention"[tiab] OR "acceptance"[tiab] OR "uptake"[tiab] OR "willingness to accept"[tiab] OR "payment willingness"[tiab])AND
("Contingent Valuation Method"[tiab] OR "contingent valuation*"[tiab] OR "contingent evaluation"[tiab] OR "contingent-valuation"[tiab] OR CVM[tiab] OR "discrete choice"[tiab] OR DCE[tiab] OR "choice experiment"[tiab] OR "conjoint analysis"[tiab] OR "stated preference*"[tiab] OR "preference elicitation"[tiab] OR "dichotomous choice"[tiab] OR "iterative bidding"[tiab] OR "payment card*"[tiab] OR "open-ended"[tiab] OR "choice modeling"[tiab] OR "pair comparison"[tiab] OR "contingent rating"[tiab] OR "contingent ranking"[tiab] OR "payment scale*"[tiab] OR "Take-It-Or-Leave-It"[tiab] OR TIOLI[tiab])

inclusion. Any discrepancies between reviewers were resolved through discussion or consultation with a third reviewer. The review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the registration number CRD420251126257. Additionally, we manually searched the references of selected studies and review articles to identify any additional relevant publications.

Inclusion and exclusion criteria

Studies were included if they reported original data on knowledge, acceptance, attitudes, WTP, or preferences related to the HPV vaccine among any population group. Both quantitative and qualitative studies were considered for inclusion. Studies were excluded if they were reviews, editorials, conference abstracts, cost-effectiveness or economic evaluations unrelated to WTP, or if they were not published in English. Studies that did not focus specifically on HPV vaccine preferences or WTP were also excluded.

Critical appraisal of studies

The methodological quality of the included studies was assessed using a checklist provided by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Although the initial search protocol considered both quantitative and qualitative studies, all 35 studies that met the final eligibility criteria were quantitative. Therefore, the quality appraisal was conducted using the ISPOR checklist for quantitative studies.[10] Two reviewers (F.K., Z.K.) independently appraised each study, and disagreements were resolved through consensus. The overall risk of bias was considered during the interpretation and synthesis of the findings.

Data extraction and synthesis

Data were extracted using two standardized forms: one to capture general study characteristics (author, year, country, study design, population, sample size, and sampling method) and another to extract key results related to WTP and associated factors. Extracted data included measures of WTP, preference attributes, and their relative importance. Excel 2019 software was utilized to manage and synthesize the extracted data.

Results

A total of 529 articles were identified through the database search. Following the removal of duplicates, 359 articles remained for title and abstract screening. This process resulted in 59 articles progressing to full-text review. Of these, 35 studies met the inclusion criteria and were included in the final analysis (Figure 1).

Study descriptions and methodologies

Table 2 summarizes the study characteristics including author/year, country, population, sample size, and type of sampling.

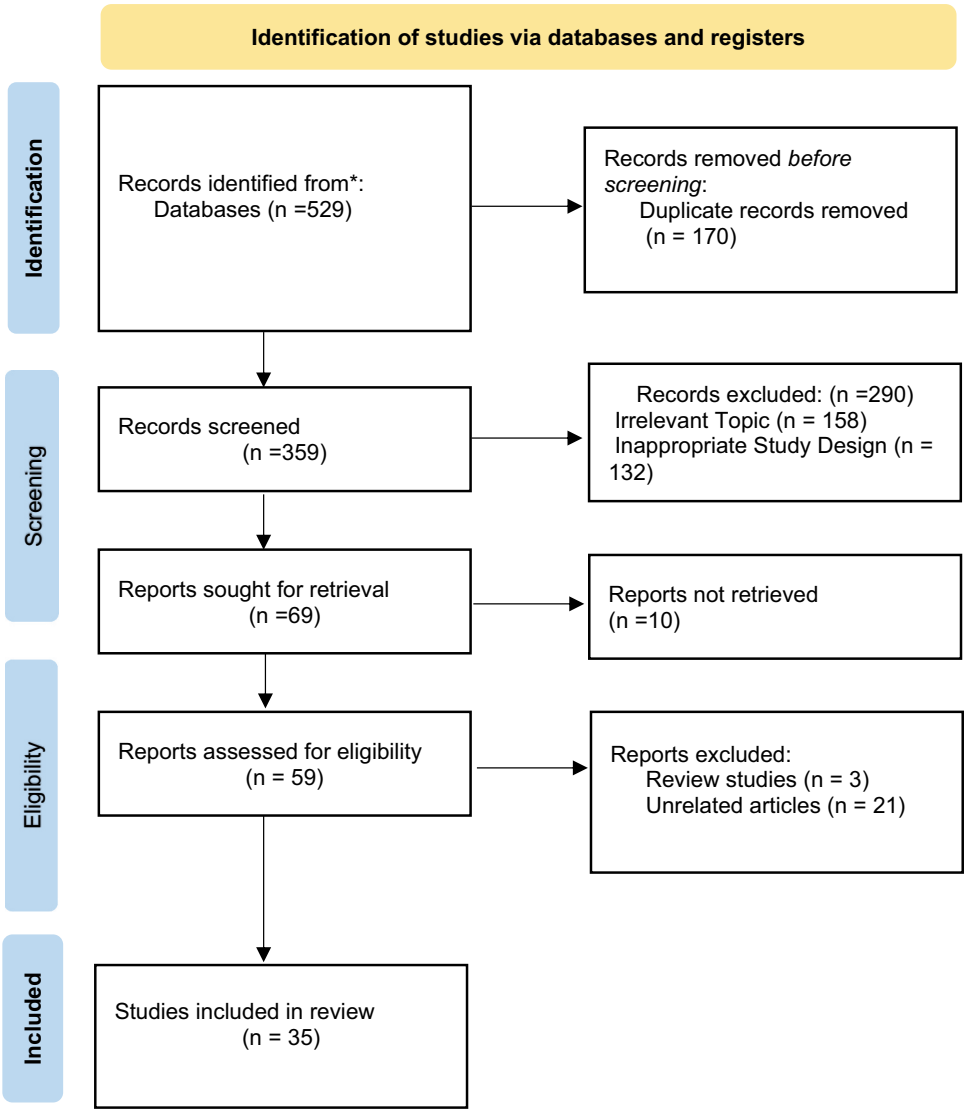

Figure 1. PRISMA (preferred reporting items for systematic reviews and meta-analysis) flow diagram.

The included studies were conducted across a diverse range of countries, highlighting the global interest in this research topic. China contributed the highest number of studies, with a total of 10 articles.[13,19,24,25,28,34,37,40,42,43] Nigeria followed with 5 studies,[22,23,29,33,48] while Vietnam accounted for 4 studies.[31,36,45,47] Other countries represented by multiple studies include Ethiopia,[38,44] Hong Kong,[19,46] Indonesia,[18,35] and France,[21,26] each with 2 studies. Additional countries with a single study include Saudi Arabia,[27] Poland,[30] Algeria,[32] Jordan,[41] Iran,[39] Malaysia,[52] Thailand,[51] Argentina,[49] and India.[20] This wide geographical distribution illustrates the broad applicability and relevance of the research across different populations and regions.

Sample sizes ranged widely, from as few as 180[49] participants to as many as 15,969.[34] Among the included studies, nine employed convenience sampling,[8,9,19,24,27,30,35,40,41] six used multistage sampling,[20,22,23,25,28,31] and five studies applied random sampling methods.[26,36,38,44,47] Stratified sampling was reported in three studies,[27,40] while cluster sampling,[24] quota sampling,[30] snowball sampling,[41] census,[32] four-staged sampling,[33] consecutive sampling,[39] and purposive selection[48] were each used in one study. Notably, six studies did not report or specify their sampling methods.[19,21,35,42,43,49]

Table 2. Summary of the characteristics of the 35 included studies.

Ref	Author, Year	Country	Study Design	Population	Sample Size	Type of sampling	2-valent	4-valent
[18]	Endarti et al. 2025	Indonesia	Cross-sectional study	Parents	410	Convenience sampling	✓	✓
[13]	Luo et al. 2025	China	Community-based longitudinal study	Parents	700	Convenience sampling	✓	✓
[19]	Zhang et al. 2025	Hong Kong, China	Cross-sectional study	Men	701	NR*	✓	✓
[20]	Krishna et al. 2025	India	Cross-sectional study	College-going students	801	Multistage sampling		
[21]	Dorleans et al. 2025	France	Cross-sectional study	Parents or legal tutors	389	NR		
[22]	Anyaka et. al. 2024	Nigeria	Cross-sectional study	Parents	509	Multistage sampling		
[23]	Akande et al. 2024	Nigeria	Cross-sectional study	Undergraduates	240	Multistage sampling	✓	✓
[24]	Zhao et al. 2024	China	Cross-sectional study	Guardians (primarily mothers)	4,933	Cluster sampling	✓	✓
[25]	Hu et al. 2024	China	Cross-sectional study	Female university students	1178	Multistage sampling		
[26]	Chyderiotis et al. 2024	France	Cross-sectional study	Parents (11–14 y)	1291	Random sampling		
[27]	Alrashidi et al. 2024	Saudi Arabia	Cross-sectional study	Women (18–65 y)	640	Stratified sampling		
[28]	Yang et.al 2024	China	Cross-sectional study	Female medical college students (18–26 y)	988	Multistage sampling	✓	✓
[29]	T. Akinsolu et al. 2023	Nigeria	Cross-sectional study	Women (HIV)> 18 y	1371	Convenience sampling	✓	
[30]	Jankowski et. al 2023	Poland	Cross-sectional study	Adults (18–83 y)	1056	Quota sampling		
[31]	Tran et al. 2023	Vietnam	Cross-sectional study	Women (15–49 y)	648	Multistage sampling		
[32]	Bencherit et al. 2022	Algeria	Cross-sectional study	University students	715	Census		
[33]	M. Balogun et al. 2022	Nigeria	Cross-sectional study	Parents, guardians of adolescents, adolescents, traditional healers, and religious leaders	700	Four-staged sampling		
[34]	Lu et al. 2022	China	Cross-sectional study	Female health care workers (18–45 y)	15969	Convenience sampling	✓	✓
[35]	Frianto et al. 2022	Indonesia	Cross-sectional study	Parents	286	NR		
[36]	Nguyen et al. 2022	Vietnam	Cross-sectional study	Parents	785	Random sampling		
[37]	Zhou et al. 2022	China	Cross-sectional study	Medical students	809	Convenience sampling	✓	✓
[38]	Mihretie et al. 2022	Ethiopia	Cross-sectional study	Parents	638	Random sampling		
[39]	Sargazi et.al 2021	Iran	Cross-sectional study	Mothers	306	Consecutive sampling	✓	✓
[40]	Wang et al. 2021	China	Cross-sectional study	Female undergraduate students	850	Convenience sampling/ Stratified sampling	✓	✓
[41]	Sallam et al. 2021	Jordan	Cross-sectional study	Female university students	836	Snowball sampling		
[42]	Lin et al. 2020	China	Cross-sectional study	Mothers	2,339	NR	✓	✓
[43]	Zhu et al. 2020	China	Cross-sectional study	Parents	995	NR		
[44]	Tarekegn et al. 2019	Ethiopia	Cross-sectional study	Female health professionals	392	Random sampling		
[45]	Tran et al. 2018	Vietnam	Cross-sectional study	Vaccination service users	492	Convenience sampling	✓	✓
[46]	Wong et al. 2018	Hong Kong	Cross-sectional study	Mothers	482	Stratified sampling		
[47]	Thu et al. 2017	Vietnam	Cross-sectional study	Married women/Mothers	606	Random sampling	✓	✓
[48]	Umeh et al. 2016	Nigeria	Cross-sectional study	Mothers	438	Purposive selection	✓	✓
[49]	Alder et al. 2015	Argentina	Cross-sectional study	Mothers	180	NR	✓	✓

(*Continued*)

Table 2. (Continued).

Ref	Author, Year	Country	Study Design	Population	Sample Size	Type of sampling	2-valent	4-valent
[50]	Maharajan et al. 2015	Malaysia	Cross-sectional study	Medical students	302	Convenience sampling	✓	✓
[51]	Ngorsuraches et al. 2015	Thailand	Cross-sectional study	Parents	314	Convenience sampling	✓	✓

*Not Report.

HPV vaccines and WTP methods calculations

In the reviewed systematic studies assessing willingness to pay (WTP) and preferences for the HPV vaccine, the predominant data collection tool was the questionnaire, used in 24 of the included articles. Interviews were less commonly employed, featuring in only two articles.[39,46] Additionally, eight articles gathered data via online survey questionnaires.[13,21,24–26,37,40,42] Among the studies that examined the use of HPV vaccines in different countries in this review, 16 studies mentioned the bivalent vaccine (bivalent), 15 studies mentioned the quadrivalent vaccine (4-valent), and 10 studies mentioned the non-valent vaccine (9-valent) (Table 2).

eight studies used the Contingent Valuation (CV) method for WTP calculation, which is a widely recognized approach that involves directly asking respondents their maximum WTP for a good or service. 11 studies applied the Discrete Choice Experiment (DCE) method, which estimates WTP based on respondents' preferences across different hypothetical scenarios involving trade-offs between attributes. Notably, 15 studies did not specify the WTP calculation method used (Table 3).

Factors affecting WTP or preference in the included studies

The review identified a diverse set of factors influencing WTP or preferences for the vaccination, spanning demographic, socio-economic, knowledge-related, and attitudinal domains (Table 4).

WTP for HPV vaccine in the included studies

Table 5 presents the proportion of respondents expressing willingness to pay for HPV vaccine by country income level included in the study. High-income countries demonstrated a combined average WTP of 64.75%, with individual study values ranging from 56.3% to 72.4%.[19,21,26,27,30,46] Upper-middle-income countries showed a similar average WTP of 63.86%, though with a broader range between 34.3% and 84.4%.[18,28,37,42,49] For lower-middle-income countries, the average WTP was lower at 52.68%, but the range was the widest, spanning from 16% to 91.6%.[20,22,23,29,31,32,36,39,41,45,47,48] Interestingly, low-income countries reported the highest average WTP at 65.38%, with values ranging from 44.8% to 85.9%.[38,44]

The average willingness to pay (WTP) for the HPV vaccine is summarized in Table 6. To ensure comparability across studies, all WTP values were standardized to 2023 US dollars using the EPPI-Center Cost Converter.[56] This tool adjusts for both inflation and currency conversion across countries and years. Although this converter is primarily designed for health economic costs, it provides a reasonable method for standardizing hypothetical WTP values. It is important to acknowledge, however, that this standardization

Table 3. Type of WTP calculation methods in the included studies.

Method	Number [Ref]
CV*	12[18,23,29,34,36,37,44,45,47–50]
DCE**	10[21,24–26,33,39,40,43,46,51]
Other Direct Methods	11[13,19,20,22,28,30–32,35,38,41]
Total Studies Assessing WTP	33
Studies Not Assessing WTP	2[27,42]
Total Included Studies	35

*Contingent Valuation Method.
**Discrete Choice Experiment.

Table 4. Factors affecting WTP or preference in the included studies.

Studies	Factors Affecting WTP or Preferences
[23,27,34]	Marital Status
[28,38]	Family History
[23]	Having Children
[34]	Number of Children
[13,22,31,37,47,52]	Attitude
[30,32]	Female Gender
[28–32,35,36,38,42–44,48]	Education
[13,28,29,34,42,44,48,49,53,54]	Household Income
[30,32,42,48]	Urban/Rural Residence
[13,28,31,36–38,40,42,44,47,52]	Knowledge
[31]	Access to Information
[35]	Health Beliefs
[13,21,26,30,32–34,36,38,44,53]	Age
[25,27,43]	Vaccination Location
[42]	Knowing Someone with Cancer
[38]	Fear of HPV infection
[42]	Independent Decision-Making
[25,43]	Vaccine Effectiveness
[24,25,43]	Protection duration
[43]	Risk of Side-Effects
[21,24,26]	Safety
[38,49]	Employment
[28,49]	Awareness of Cervical Cancer
[33,48]	Religion
[48]	Previous HPV Infection
[25,43,47]	Cost
[47]	Condom Use

Table 5. Proportion of respondents expressing willingness to pay for HPV vaccine by country income level.

Income level of countries*	Proportion of Respondents Expressing WTP (%)	References
High Income	64.75% [56.3%–72.4%]	[19,21,26,27,30,46]
Upper-middle-income	63.86% [34.3%–84.4%]	[18,28,37,42,49]
Lower-middle-income	52.68% [16%–91.6%]	[20,22,23,29,31,32,36,39,41,45,47,48]
Low Income	65.38% [44.8%–85.9%]	[38,44]

*Note: These values represent the proportion of respondents who indicated willingness to pay for the HPV vaccine at the price points presented in each study. The higher proportion in Low-Income Countries may reflect that the price points offered in surveys were more realistic and affordable for those settings.

Table 6. Mean WTP for HPV vaccine for high-, middle- and low-income countries in included studies.

Income level of countries	Mean WTP (US$)*	Median WTP (US$)	IQR (US$)	Range (US$)	Number of Studies
High Income[19,46]	84.18 [4.37–128]	66.28	4.37–128	4.37–128	2
Upper-middle-income[13,18,25,34,35,37,40,42,43,49–51]	628.70 [11.46–1587.78]	156.75	42.50–375.25	11.46–1587.78	12
Lower-middle-income[23,29,36,39,45,47,48]	112.81 [13–431.12]	85.50	38.50–142.50	13–431.12	7
Low Income[44]	48.16	48.16	48.16–48.16	48.16	1

*The WTP values were updated based on an "EPPI-Center Cost Converter" source.[55]

method may not fully capture the nuances of WTP, which is consumer-driven and tied to contemporary local income and perceptions.

Attributes and their levels to identifying preferences for HPV vaccine

Studies examining HPV vaccine preferences systematically evaluated a range of attributes to identify key drivers of individual decision-making. The attributes and their specific levels, as identified across the included studies, are detailed in Table 7. These attributes were not selected arbitrarily; they were typically chosen based on clinical significance, policy relevance, and findings from prior qualitative research highlighting key patient concerns. A synthesis of these studies reveals a clear pattern in the focus of preference research. The majority of attributes (57%) were related to the vaccine's clinical characteristics, such as effectiveness against cervical

Table 7. Attributes and levels identified in the studies.

Attributes		Levels	Included Studies
1- Vaccine-Related Attributes	Disease Protection	– Febrile Illness – Cancer – Genital Warts – Pregnancy Complications – Oral Warts	26,33
	Protective Effectiveness	– Normal:50%, 70% – Good (Cervical Cancer: 70%, Genital Warts: 90%) – Very Good: 90% (both) – Cervical Cancer: 50%, 70%, 90% – Genital Warts: 0, 90% – Cervical Cancer: 71%, 90%	13,24,25,33,39,40,43
	Safety	– Average – Good – Very Good – No Side Effects – Long Term Observation – No Scientific Confirmation – Surveillance Other Countries – More Benefits than Risks	24,26
	Indirect Protection	– Protects only Childs – Protects Other Elimination	26
	Optimal Age	– Age-independent – Better Immune Response – Before Sexual relations – All Ages – Before 14 y – Adolescents – Before Sexual Debut	26
	Side Effects (Mild)	– 1:50 – 1:30 – 1:10 – 1, 2, 6, 10, 14 in 100	13,40,43,51
	Side Effects (Severe)	– 1: 10,0000 – 1:10000 – 1:1000 – 1:750000 – 1:150000 – 1:30000	33,39,40
	Protection Duration (Years)	– 10, 20, 40 y – 6, 25 y – 5, 15 y – 15, 30, 45 y – 6, 25, 100 y – Lifetime	24,25,39,40,43
	Cancer Risk	– 0, 2, 4 in 1000 (cervical cancer) – 0, 50, 100 in 1000 (genital warts)	51
	Number of Doses Required	– 2 doses – 3 doses	33
	Vaccine Type	– 2-valent – 4-valent – 9-valent	24
	Location	– Domestic – Imported	13,24
2- Service-Related Attributes	Waiting Time	– 1, 4, 12, 24 weeks – Less than 3 months – Between 3 and 6 months – Between 6 and 9 months – Between 9 and 12 months	25,40
	Distance (Minute)	– Less than 5 minutes – Between 15 and 30 minutes – Between 30 and 60 minutes – More than 60 minutes	25,40
	Promoting Vaccination	– General Practitioners – School Health – Maternal Services – Ministry of Health – Regional Health Authority	
	Making an Appointment	– On Site – By Phone – By the Internet – Through School	40

(*Continued*)

Table 7. (Continued).

Attributes		Levels	Included Studies
	Location	– School based Services – Health Facility based services – Community based – Vaccination Centers	13,33,43
	Coverage	– Insufficient – Already 30% – 80% in France – 80% in other Countries	26
	Service Time for Vaccination	– Weekdays only – Weekdays and weekends	40
3- Cost-Related Attributes	Out-of-Pocket (OOP)	– 1000 CYN – 2000 CYN – 3000 CYN – 5000 CYN – 8000 CYN	25,40
	Cost	– 0, 100, 200, 300 CYN – 1000, 2000, 4000, 8000 CYN – 0, 5000, 10000 Baht – 900, 1800, 2700 CYN – 0, 95, 167 US$ – 0, 1200, 2400, 4000 CYN	13,39,40,43,51

cancer and other diseases, duration of protection, and safety profile. A significant portion (33%) concerned service delivery factors, including vaccination location convenience, waiting times, and appointment scheduling methods. Finally, cost-related attributes, such as out-of-pocket price, accounted for 9% of the attributes studied, reflecting the critical role of affordability in vaccine decision-making.

Discussion

This systematic review provides a comprehensive synthesis of recent literature on acceptance and willingness to pay (WTP) for the HPV vaccine across diverse global populations. Our results elucidate critical demographic, socioeconomic, and psychosocial factors influencing HPV vaccine uptake and offer insights into the barriers and facilitators prevalent across different income settings.

A particularly compelling finding is that low-income countries (LICs) exhibited a slightly higher proportion of respondents expressing WTP (65.38%) compared to high-income countries (HICs) (64.75%). While seemingly counter-intuitive, this result likely reflects critical differences in study methodologies, perceived value, and economic context rather than a greater financial capacity to pay. The primary explanation lies in the nature of hypothetical WTP questions and the price points presented. Studies in LICs often use price points substantially lower and more aligned with local economic realities. Therefore, the high WTP proportion in LICs reflects a strong desire for the vaccine at an affordable price, rather than an ability to pay market rates. This high proportion is also driven by the greater perceived value and urgency of the vaccine in settings with the highest cervical cancer burden and limited access to screening and treatment. Here, vaccination may be seen as the only viable preventive strategy. However, this willingness stands in sharp contrast to the actual monetary value they can afford. As our analysis shows, the mean WTP amount in LICs was the lowest of all income groups at just $48.16. This finding does not contradict the central challenge of affordability; instead, it highlights a critical gap between high demand and the financial capacity to meet it. Translating this hypothetical willingness into actual uptake remains the paramount policy challenge.

Study descriptions and methodologies

The results of this review demonstrate considerable geographical diversity in HPV vaccine acceptance and WTP research. China contributed the largest proportion of studies, consistent with the rapid expansion of its vaccine market and growing academic focus on immunization economics.[34,37] Sub-Saharan Africa,

particularly Nigeria, was also well represented, reflecting increasing attention to HPV vaccination in regions with the highest cervical cancer burden.[29]

Differences in sampling strategies were notable. Convenience sampling was common, especially in resource-constrained settings, but such approaches may reduce representativeness. In contrast, large-scale stratified surveys in China[24,34] provided more robust population-level estimates. Sample sizes varied markedly, ranging from fewer than 200 to over 15,000 respondents, suggesting unequal rigor across studies. Large samples tend to produce more stable estimates, while smaller samples may be affected by bias. Future studies should prioritize probability sampling to strengthen external validity.

HPV vaccines and WTP methods calculations

Most studies relied on questionnaires, either paper-based or online, to collect WTP data. This is consistent with vaccine economics research more broadly, where structured surveys remain the dominant tool.[36] The increased use of online surveys after the COVID-19 pandemic broadened geographical reach but may have introduced selection bias. While online platforms facilitated data collection during pandemic restrictions, they likely excluded populations with limited internet access, particularly in low-income settings. This digital divide may affect the generalizability of findings, as those with internet access may differ systematically in socioeconomic status, education, and health literacy from those without access. Future research should employ mixed-method approaches that combine online surveys with traditional data collection methods to ensure representation of diverse population segments.

Regarding vaccine types, studies examined bivalent, quadrivalent, and nonvalent vaccines, reflecting availability in local markets. The growing focus on nonvalent vaccines aligns with economic modeling that demonstrates their superior cost-effectiveness in preventing HPV-related cancers compared with lower-valency products.[57,58]

For WTP estimation, contingent valuation (CV) and discrete choice experiments (DCE) were most frequently employed. CV provides direct monetary values but is vulnerable to hypothetical bias, whereas DCE better captures trade-offs among vaccine attributes but requires complex design.[59] The fact that almost half of the studies did not specify their valuation method limits comparability and undermines methodological transparency. Combining CV and DCE approaches, as recommended in health economics literature, could strengthen future studies. A sequential mixed-methods approach, where CV questions follow DCE tasks, could leverage the strengths of both methods and has been successfully applied in other health economic evaluations to enhance the validity of WTP estimates.[10,60]

Factors affecting WTP or preference

Several consistent predictors of WTP were identified. Education and income were strongly associated with higher willingness, consistent with broader evidence linking socioeconomic status to preventive health behaviors.[36] Beyond these socioeconomic factors, a crucial determinant was the level of knowledge and awareness regarding HPV transmission, its causal link to cervical cancer, and the preventive benefits of the vaccine (Figure 2).

Cultural and religious influences were particularly evident in African and Middle Eastern studies, where attitudes of community leaders strongly shaped parental decisions.[61] Attitudinal factors – including perceived susceptibility, perceived benefits, and fear of cancer – also influenced preferences, consistent with the Health Belief Model. Younger populations valued vaccine efficacy and protection duration more than cost, reflecting long-term perspectives on health investment.[37,42]

Several strategies have been implemented globally to improve HPV vaccine acceptance and uptake. School-based vaccination programs have proven effective in achieving high coverage rates in many high-income countries, with Australia reporting over 80% coverage through school delivery.[62] Public health campaigns featuring celebrity endorsements and educational messages have increased awareness and acceptance in some settings. Provider recommendation remains one of the strongest predictors of vaccine acceptance, highlighting the importance of healthcare professional education.[63] In low-resource settings, integration with other health services, such as maternal and child health programs, has improved access and acceptance.[64] Financial strategies,

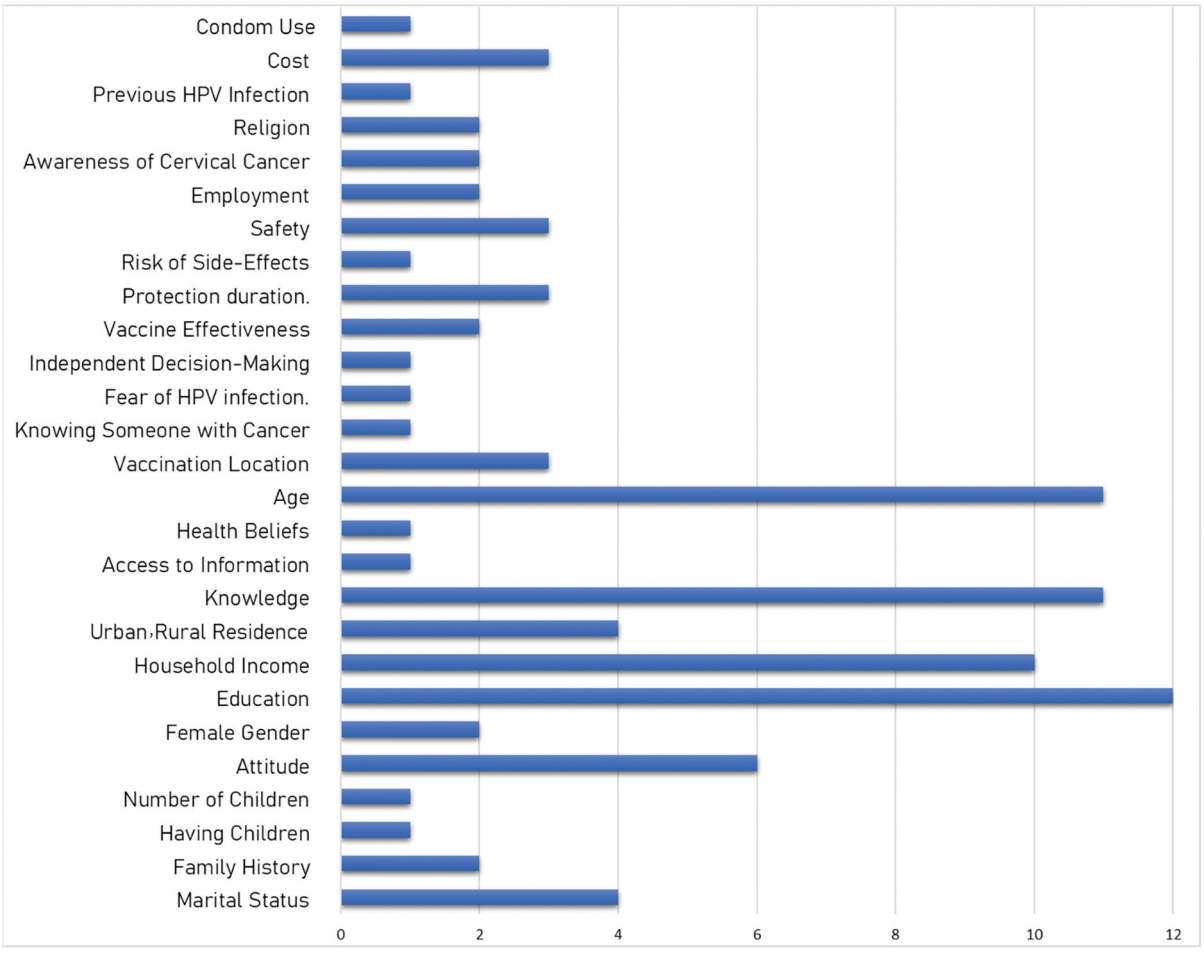

Figure 2. Factors affecting on WTP and preferences in the included studies. The vertical axis shows the number of studies, and the horizontal axis displays the different factors affecting WTP or preferences.

including tiered pricing, subsidies, and inclusion in national insurance schemes, have addressed affordability barriers in many countries.[65] These approaches, combined with culturally appropriate education and community engagement, offer promising pathways to increase equitable HPV vaccine access worldwide.

WTP for HPV vaccine across income levels

Marked differences in absolute WTP were observed across income levels, revealing a complex landscape of affordability. Although LICs reported the highest relative WTP (as a percentage of income), their absolute amounts were far below market prices, highlighting affordability barriers.[36] In HICs, mean WTP remained substantially below the actual price of the 9-valent vaccine, suggesting that without subsidies or insurance, coverage may remain suboptimal.[66] In upper-middle-income countries, extremely high mean WTP estimates in some Chinese studies may reflect hypothetical overstatement rather than real purchasing power.[34]

The variation in WTP across countries of different income levels shows considerable heterogeneity. While the mean WTP in Upper-Middle-Income Countries (UMICs) appears substantially higher at $628.70, this is largely driven by outliers, with the median being $156.75.[13,18,25,34,35,37,40,42,43,49–51] The interquartile range (IQR) of $42.50–$375.25 indicates significant variation within this group. In contrast, HICs show a more consistent but lower range of WTP values (median $66.28), based on only two studies.[19,46] The unusually high mean in UMICs appears to be influenced by several Chinese studies that reported substantially higher WTP values, possibly reflecting hypothetical bias in survey responses or cultural factors influencing stated preferences.

Finally, the low-income group had the lowest mean WTP at US$48.16, derived from a single study,[44] which limits generalizability

These findings underscore the central role of financing. Even modest co-payments have been shown to significantly reduce vaccine uptake in LMICs.[66] Subsidization, insurance inclusion, or integration into national immunization programs will therefore be essential to achieve widespread coverage.

Attributes and their levels in identifying preferences

The attributes most frequently examined were vaccine-related (e.g., efficacy, safety, duration of protection), followed by service delivery factors (e.g., waiting time, location) and cost. Effectiveness and long-term protection consistently ranked highest among preferences, reflecting a public emphasis on clinical outcomes. This aligns with longitudinal evidence that HPV vaccines provide durable protection beyond 12 y.[67]

Service delivery characteristics, although less frequently studied, also emerged as important. A recent DCE study in China found that travel distance and convenience were nearly as influential as cost in shaping preferences.[24] Concerns about safety and side effects remain strong determinants globally, consistent with surveys showing that safety fears are among the most common reasons for HPV vaccine hesitancy.[68]

Overall, these results suggest that maximizing HPV vaccine uptake requires balancing biomedical attributes with system-level facilitators, such as accessibility and affordability.

This review must be interpreted in the context of several limitations. First, the search was limited to studies published between 2015 and 2025, potentially excluding earlier foundational work. Second, although multiple databases were searched, it is possible that relevant studies indexed outside major databases were missed. Third, heterogeneity in study design, sampling methods, and WTP elicitation techniques limited direct comparability across studies. Nearly half of the included studies did not specify their WTP methodology, which weakens the ability to draw firm methodological conclusions. Finally, the predominance of cross-sectional designs prevents causal inferences regarding factors influencing WTP.

A specific methodological limitation relates to the standardization of WTP values. We used the EPPI-Center Cost Converter, which is primarily designed for adjusting actual health economic costs rather than hypothetical consumer-driven price points. Future research might benefit from using Purchasing Power Parity (PPP) converters specific to the year of each original study, which may better account for local economic conditions when comparing WTP across countries.

The findings of this review translate directly into actionable strategies for policymakers and health practitioners. To bridge the gap between high willingness and low actual uptake, a multi-pronged approach is essential. Evidence-based strategies that have proven effective include implementing school-based vaccination programs to achieve high coverage, launching targeted public health campaigns to increase awareness, and empowering healthcare providers to make strong recommendations. In low-resource settings, integrating vaccination with other health services, such as maternal and child health programs, can improve access. Critically, financial strategies – including tiered pricing, government subsidies, and inclusion in national insurance schemes – are imperative to overcome the pervasive barrier of affordability and move toward equitable vaccine access worldwide.

Conclusion

This systematic review reveals a fundamental paradox at the heart of global HPV vaccine efforts: while acceptance is high, the ability to pay is critically low, especially in low-income countries where the need is greatest. The key drivers of willingness to pay are consistently linked to socioeconomic status, knowledge, and the perceived clinical benefits of the vaccine. Our findings underscore that affordability is not merely an economic issue but a profound barrier to global health equity. Ultimately, increasing HPV vaccine coverage worldwide will require more than just scientific advancement; it demands a concerted commitment from policymakers and global health organizations to implement integrated financial, educational, and systemic strategies that translate high demand into universal, affordable access.

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Author contributions

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Availability of data and materials

The data that used and/or analyzed during the current study are available for request (E-mail: fereshte_k69@yahoo.com).

Ethics approval and consent to participate

The review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) database under the registration number CRD420251126257.

Abbreviations

WTP	Willingness to Pay
DCE	Discrete Choice Experiment
CV	Contingent Valuation
NR	Not Reported

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Appendix

Database	Date	Strategy	#
Scopus		TITLE-ABS-KEY ("HPV" OR "Human Papilloma Virus" OR "Human Papillomavirus" OR (human AND papillomavirus)) AND TITLE-ABS-KEY ("vaccine" OR "vaccination" OR "immunization" OR "inoculation")AND TITLE-ABS-KEY ("WTP" OR "willingness-to-pay" OR wtp OR "payment intention" OR "acceptance" OR "uptake" OR "willingness to accept" OR "payment willingness")AND TITLE-ABS-KEY ("Contingent Valuation Method" OR "contingent valuation*" OR "contingent evaluation" OR cvm OR "discrete choice" OR dce OR "choice experiment" OR "conjoint analysis" OR "stated preference*" OR "preference elicitation" OR "dichotomous choice" OR "iterative bidding" OR "payment card*" OR "open-ended" OR "choice modeling" OR "pair comparison" OR "contingent rating" OR "contingent ranking" OR "payment scale*" OR "Take-It-Or-Leave-It" OR tioli)	98
Pubmed		("HPV"[Mesh] OR "Human Papilloma Virus"[Mesh] OR "Human Papillomavirus"[Mesh] OR "HPV"[tiab] OR "Human Papilloma Virus"[tiab] OR "Human Papillomavirus"[tiab] OR (human[tiab] AND papillomavirus[tiab]))AND ("vaccine"[Mesh] OR "vaccination"[Mesh] OR "immunization"[Mesh] OR "vaccine"[tiab] OR "vaccination"[tiab] OR "immunization"[tiab] OR "inoculation"[tiab])AND("WTP"[tiab] OR "willingness-to-pay"[tiab] OR WTP[tiab] OR "payment intention"[tiab] OR "acceptance"[tiab] OR "uptake"[tiab] OR "willingness to accept"[tiab] OR "payment willingness"[tiab])AND ("Contingent Valuation Method"[tiab] OR "contingent valuation*"[tiab] OR "contingent evaluation"[tiab] OR "contingent-valuation"[tiab] OR CVM[tiab] OR "discrete choice"[tiab] OR DCE[tiab] OR "choice experiment"[tiab] OR "conjoint analysis"[tiab] OR "stated preference*"[tiab] OR "preference elicitation"[tiab] OR "dichotomous choice"[tiab] OR "iterative bidding"[tiab] OR "payment card*"[tiab] OR "open-ended"[tiab] OR "choice modeling"[tiab] OR "pair comparison"[tiab] OR "contingent rating"[tiab] OR "contingent ranking"[tiab] OR "payment scale*"[tiab] OR "Take-It-Or-Leave-It"[tiab] OR TIOLI[tiab])	145
Web of science		TS=("HPV" OR "Human Papilloma Virus" OR "Human Papillomavirus")AND TS= ("vaccine" OR "vaccination" OR "immunization" OR "inoculation")AND TS=("WTP" OR "willingness to pay" OR "willingness-to-pay" OR "payment intention" OR "acceptance" OR "uptake" OR "willingness to accept" OR "payment willingness") AND TS=("Contingent Valuation Method" OR "contingent valuation*" OR "contingent evaluation" OR CVM OR "discrete choice" OR DCE OR "choice experiment" OR "conjoint analysis" OR "stated preference*" OR "preference elicitation" OR "dichotomous choice" OR "iterative bidding" OR "payment card*" OR "open-ended" OR "choice modeling" OR "pair comparison" OR "contingent rating" OR "contingent ranking" OR "payment scale*" OR "Take-It-Or-Leave-It" OR TIOLI)	86