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REVIEW

Revisiting Global HPV Vaccination Behavior and Its Determinants: A Comprehensive Review

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Purpose: Human papillomavirus (HPV) infection and the resulting penile, anal, oropharyngeal and cervical cancer impact the health and welfare of men and women. The HPV vaccine has emerged as the most effective method to combat HPV. This study comprehensively analyzes the key influencing factors of global HPV vaccination behavior.

Methods: This systematic review synthesizes evidence on global HPV vaccination behaviors and determinants. We searched three major databases PubMed, Web of Science and Scopus for peer-reviewed literature published between 2018 and 2023. Studies from diverse geographical regions and population subgroups were analyzed using thematic synthesis and narrative approaches.

Results: In the published literature, men and men who have sex with men (MSM) were under-represented groups. Both subjective and objective determinants influenced HPV vaccination behavior, including parental attitudes, knowledge of health professionals and gendered views about HPV risks. In the studies reviewed, HPV vaccination rates were low globally, with few countries achieving vaccination rates above 70%.

Conclusion: Key HPV vaccination determinants included education level, parental attitudes, knowledge and awareness of HPV and its vaccine and acceptance of the HPV vaccine. Based on the literature survey, we provide recommendations for governments and health institutions to improve gender-specific HPV vaccination rates, including MSM.

Keywords: human papillomavirus, HPV vaccine, vaccination behavior, determinants, gender

Introduction

Human papillomavirus (HPV) infection is a prevalent sexually transmitted disease and a leading cause of cancers, including anal cancer, cervical cancer and penile cancer. Since its introduction in the early 2000s, HPV vaccination has emerged as a pivotal public health intervention. The first HPV vaccine, Gardasil, was approved by the US Food and Drug Administration (FDA) in 2006, targeting HPV types 6, 11, 16, and 18, which are responsible for a significant proportion of cervical cancers and genital warts. This was followed by the approval of Cervarix in the same year, which focuses on HPV types 16 and 18. The vaccines have been a breakthrough in preventive healthcare, yet disparities in vaccination rates persist between genders.[1] While both vaccines have been approved for use in males and females, initial campaigns predominantly targeted females, leading to lower vaccination rates among males. This gender disparity highlights the need for comprehensive strategies that promote equitable access and awareness of HPV vaccination for all genders.[2]

A review of studies on the efficacy and population effects of HPV vaccination strongly supports its role in reducing the incidence of HPV infection and related cancers.[3] Although the HPV vaccine has been rolled out in many countries, our comprehensive analysis of 56 HPV articles found that HPV vaccination rates remain low worldwide. Covering diverse countries, including the United States, China and Turkey, our literature review reveals not only suboptimal

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vaccination rates, even in the US, where rates are relatively high, but also significant differences across countries. US studies found that adult female vaccination rates ranged from only 9.1% to 72%, while in China, vaccination rates were as low as 2.64%.

The HPV vaccination rates of men are lower than that of women, with a Scottish study reporting that HPV anogenital-related diseases were disproportionately higher in men who have sex with men (MSM), who were up to twenty times more likely than heterosexual men to develop anal cancer.[4] These significant differences in the HPV vaccine acceptance across countries and genders suggest that factors such as gay rights, cultural background, education level, and access to medical resources may explain cross-country variations in vaccination. The low, but diverse, HPV vaccination rates suggests that the public's awareness and acceptance of HPV vaccine requires improvement.

This paper explores the behavioral determinants influencing HPV vaccination rates, focusing not only on the barriers but also on the facilitators of vaccination uptake. By examining the nuances of vaccination behavior across different demographics and regions, this review seeks to provide a comprehensive understanding of the complexities surrounding HPV vaccination. This analysis is novel as it goes beyond merely summarizing the existing literature; it integrates behavioral theories and real-world data to offer actionable insights that can inform public health strategies and improve vaccination rates across diverse populations. We identify the influence of various related factors on HPV vaccination behavior, especially assessing the effect of existing cancer screening, prevention measures and gender-related differences in HPV vaccination information.[5] Our literature review focus on HPV vaccination rates in different countries and the factors influencing vaccination behavior, including sex behavior, parental attitudes and HPV medical knowledge.

Materials and Methods

The scope of the literature review addressed two key research questions: HPV vaccination rates and factors influencing HPV vaccination, especially MSM. Our literature review did not require ethics approval.

Search Strategies and Data Sources

Table 1 sets out the algorithms in the keyword search to identify all potentially relevant literature using PubMed, Web of Science, and x-mol electronic databases between 2018 and 2023.

Inclusion and Exclusion Criteria

In terms of study design, subjects and scope, we required that the included articles had conducted a comprehensive population-wide analysis of HPV vaccination behavior, with a particular focus on attitudes that influence HPV vaccination. We limited our selection to original research articles published in English from December 2018 to November 27, 2023. Excluded from the search were duplicate records, non-original (secondary) studies, research on topics not directly related to HPV vaccination and studies with ambiguous findings.

Data Extraction, Quality Assessment and Data Analysis

In step 1, an exhaustive search across the electronic databases yielded 456 articles, comprising 251 from PubMed, 143 from the Web of Science and 64 from X-mol. All selected studies were exported to an Excel spreadsheet, where 110 duplicate entries, unrelated topics and undefined outcomes were removed.

Table 1 Search Algorithms

Search	Keywords
#1	HPV vaccination rates
#2	HPV vaccination behavior
#3	2018 OR 2019 OR 2020 OR 2021 OR 2022 OR 2023
#4	#1 AND #2 AND #3

Step 2 involved 332 articles, with information on publication year, title, research methodology, subjects, vaccination rates, country, and factors influencing HPV vaccination intentions recorded in an Excel table.

In step 3, the researchers collaboratively categorized similar factors and causes and resolved any discrepancies. After further evaluation, Table 2 included 49 articles to comprehensively study HPV vaccination behavior, and Table 3 included 7 articles to specifically study HPV vaccination behavior in MSM, with only factors with a p-value less than 0.05 retained for analysis. The identified literature was downloaded to Zotero [www.zotero.org] [Last accessed: April 15, 2024], a reference management software to manage bibliographic data as shown in Figure 1.

Table 2 Characteristics of Literature

Topic	Research Method	Research Object	Country	Vaccination Rate
Yacouti A et al (2022)[6]	A structured interviewer-administered questionnaire	Participants in six Moroccan universities	Morocco	< 1.00%
Btoush R et al (2019)[7]	A qualitative study	Latina mothers of HPV vaccine-eligible children	The United States	41.00%
El T et al (2018)[8]	Interviews	College women, aged 18–26 years	The United States	/
Alsulami FT et al (2023)[9]	A quantitative cross-sectional survey	All NSU students.	The United States	63.00%
Villavicencio A et al (2023)[10]	Questionnaires	100 HIV-negative, cisgender, sexually active women aged 18–45 years	The United States	16.00%
Xu MA et al (2023)[11]	Review	Adolescents	The United States	55.00%
Amboree TL et al (2022)[12]	Data used for this study were obtained from the 2019 Center for Disease Control and Prevention's National HIV Behavioral Surveillance (NHBS) system in Houston, Texas.	Individuals 18–60 years of age	The United States	11.50%
JA, JD (2022)[13]	The survey consisted of 32 multiple choice questions and one opened ended question	National Survey of School Health	The United States	71.50%
Shah SFA et al (2021)[14]	A cross-sectional survey	Students attending a rural state university	The United States	38.00%
Leidner AJ et al (2020)[15]	Data collected in the National Center for Health Statistics' National Health and Nutrition Examination Survey from 2007 to 2014	Young, adult female	The United States	23.00%
Daniel CL et al (2021)[16]	An online survey	All medical students at an Alabama university	The United States	32.10%
Santa Maria D et al (2021)[17]	A randomized attention-controlled trial	Parents and their 11–14 year old youth	The United States	55.70%
Bradley-Ewing A et al (2022)[18]	Practices were randomly assigned	Aged 18 or older, English speaking, and presented to one of the four practices with a child aged 9–17 who had not completed the HPV vaccine series	The United States	72.00%
Koskan A et al (2021)[19]	A 40-item cross-sectional survey	Community pharmacists' and pharmacy interns'	The United States	59.30%
Oliveira MSF de et al (2020)[20]	A cross-sectional study	Adolescents aged 10 to 19 years.	The United States	46.10%

(*Continued*)

Table 2 (Continued).

Topic	Research Method	Research Object	Country	Vaccination Rate
Edler M et al (2019)[21]	Semi-structured qualitative telephone interviews	Eligible cervical cancer survivors	The United States	9.10%
Si M et al (2021)[22]	A cross-sectional survey	Female freshmen in seven colleges in mainland China	China	2.64
Yi Y et al (2023)[23]	A web-based anonymous online questionnaire survey	Girls 9–14.	China	21.20%
Shao X et al (2023)[24]	Questionnaire	Respondents aged 18–45 years from 31 provinces in China's mainland	China	22.80%
Anonymous. (2021)[25]	Face-to-face questionnaires	College students in Guangzhou	China	3.09%
Liu Y et al (2020)[26]	Self-administered anonymous questionnaires	College students who were recruited from a random sample at Peking University	China	9.50%
Turhan E et al (2019)[27]	Descriptive and cross-sectional study	18-year-old and older women and men	Turkey	2.70%
Cinar İO et al (2019)[28]	Descriptive and cross-sectional study	Total of 1563 female and male university students	Turkey	1.50%
Agadayi E et al (2022)[29]	Snowball sampling and with an online questionnaire	Women between 18 and 65	Turkey	3.60%
Woldehawaryat EG et al (2023)[30]	A community-based cross-sectional study	Adolescents	Ethiopia	48.00%
Beyen MW et al (2022)[31]	An institution-based cross-sectional quantitative	Adolescent school girls	Ethiopia	44.40%
Biselli-Monteiro M et al (2020)[32]	Questionnaire	Freshman and /senior undergraduate students aged ≥ 18 years of the courses of medicine, nursing, speech therapy, pharmacy and physical education of Unicamp	Portugal	Women: 26% men: 8%
Wang H et al (2022)[33]	An anonymous questionnaire	Chinese female college students	China	1.30%
Kisaakye E et al (2018)[34]	An interviewer-administered questionnaire	Female adolescents	Uganda	17.61%
Di Giuseppe G et al (2023)[35]	A self-administered questionnaire	Students on randomly selected days during their courses.	Italy	39.1%
Mascaro V et al (2019)[36]	A self-administered questionnaire	18–30 year-old students attending medical and healthcare professions schools.	Italy	40.50%
Patel I et al (2021)[37]	A cross-sectional survey was conducted, using predesigned and validated questionnaire.	Students	India	8.00%
Mn S et al (2020)[38]	A pre-post structured-educational intervention study	Parents of female primary school students grades 5th and 6th	India	4.40%
Sauvageau C et al (2021)[39]	A computer-assisted questionnaire	Women aged 17–29 years	Canada	67.90%
Steben M et al (2019)[40]	A 16-item questionnaire	Unvaccinated women (n = 802) and vaccinated women (n = 250) 18 to 45 years old, as well as 18- to 26-year-old men (n = 200)	Canada	74.00%
Sidiropoulou M et al (2022)[41]	A cross-sectional online survey	Young Greek adults (n = 883) residing in Greece, aged 17 to more than 35 years	Greece	52.30%
Xenaki D et al (2020)[42]	A thirty-one-item questionnaire	Both men and women	Greece	25.20%
Aj L et al (2022)[43]	Cross-sectional in-person surveys	Health workers, school personnel, community leaders, and council leaders in 18 council areas across six regions	Tanzania	79.00%

(*Continued*)

Table 2 (Continued).

Topic	Research Method	Research Object	Country	Vaccination Rate
Soudeyns C et al (2020)[44]	A questionnaire	Women 18–43 years	Luxembourg	71.80%
Jeannot et al (2019)[45]	The web questionnaire	Undergraduate women and men (nursing and midwifery courses) attending three Schools of Health Sciences located in Switzerland.	Switzerland	72.60%
Iova CF et al (2023)[46]	An anonymized questionnaire	Teenage girls in the 18–19 age group, recruited from 15 high schools in Bihor County	Romania	5.51%
Sallam M et al (2021)[47]	A self-administered online questionnaire	Female university students	Jordan	3.60%
Cordoba-Sanchez V et al (2019)[48]	Qualitative research	Girls and their parents	Colombia	5.00%
Lavé Llavall A et al (2021)[49]	Qualitative research	Nurses and teachers	Peru	6.40%
Guo Q et al (2022)[50]	An online questionnaire	Daughters' age, 9–12 and 13–14, based on the primary schools and middle schools.	China	Mothers: 18.6% Daughters: 4.5%
Gauna F et al (2023)[51]	A random cross-sectional telephone survey	All households with at least one French-speaking individual aged 15–75 years were eligible.	French	35.20%
Sun L et al (2022)[52]	N online self-administrated questionnaire	Female freshmen over 18 years old who had not been vaccinated against HPV with no contraindications to vaccination Shanxi University of Finance and Economics	China	3.73%
Bitariho GK et al (2023)[53]	A structured questionnaire	Adolescent girls aged 10–14 years	Uganda	8.60%
Zhang X et al (2022)[54]	A web-based cluster randomized controlled trial	Female freshmen were recruited from two universities	China	2.20%

Table 3 Factors Influencing HPV Vaccination Rates Among Men Who Have Sex with Men

Article	Vaccination Rate	Influencing Factor	Suggestion
Koskan A et al (2022)[2]	16.40%	Positive correlation: HPV knowledge and HPV perceived benefits Negative correlation: HPV knowledge with HPV knowledge acquisition ability and perceived barriers.[2]	It is important to raise awareness of HPV in the male population, and clinicians and health educators should establish a safe and private environment for male patients.[2]
Grewal R et al (2021)[48]	26.00%	Age, men taking PrEP, ethnicity.[48]	Non-stigmatizing patient-provider conversations around HPV and HPV vaccination include exploring cost coverage options for older men and bundling vaccination with other sexual health services.[48]
Loretan C et al (2023)[49]	37.6%/3407	Age, region, urbanicity, household income, having any health insurance, having seen a HCP in the past 12 months, having disclosed sexual identity to their HCP, and having been diagnosed with gonorrhea or chlamydia in the past 12 months.[49]	Future HPV research should explore barriers to and promoters of HPV vaccination, including disclosure of gender identity to HCP, especially in rural areas.[49]

(*Continued*)

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Table 3 (Continued).

Article	Vaccination Rate	Influencing Factor	Suggestion
Pollock KG et al (2019)[55]	49.8–55.5%	Existing sexual health services, MSM enrolled in services, HPV vaccination programs.[55]	Scaling up HPV vaccine implementation and outreach programs.[55]
McGrath L et al (2019)[56]	73.20%	MSM who reported a history of genital warts and multiple male partners.[56]	Regular educational training for clinicians is needed to provide HPV vaccine to eligible men who have sex with men, as well as targeted MSM programs combined with universal school vaccination programs.[56]
J K et al (2022)[57]	20.00%	Age, heard of HIV post-exposure prophylaxis, P6M testing for sexually transmitted infections.[57]	Additional interventions are needed.[57]
Gerend MA et al (2022)[55]	21.00%	Sexual identity, race/ethnicity, condomless anal sex, and HIV status.[55]	Future interventions should aim to clarify misconceptions, modify psychosocial beliefs, and address barriers and facilitators to HPV vaccine uptake specific to young MSM.[55]

Results

Analysis of HPV Vaccination Behavior by Country and Gender

Table 2 sets out the characteristics of the 49 included articles, where two were randomized trials, four employed qualitative interviews and the remaining 43 adopted questionnaires to investigate HPV vaccination behaviors.

From Table 2, the studies reveal a low vaccination rate across countries, with only 13 studies reporting vaccination rates above 50% and one study, on six Moroccan universities, revealing an alarmingly under 1% vaccination rate.[6] Twenty studies involved students, as college-aged women and men experienced high HPV prevalence, making them an important target group for interventions. The geographical distribution of the studies on HPV vaccination reflected significant diversity: 15 from the United States, 9 from China, 3 from Turkey, and 2 each from Ethiopia, Uganda, Italy, Greece, Canada, and India. Single studies were conducted in France, Romania, Tanzania, Morocco, Jordan, Luxembourg, Portugal, Switzerland, Colombia and Peru.

Among the 15 American articles, two studies used qualitative analysis methods and found that young women's HPV vaccination intention and vaccination rate were significantly influenced by HPV knowledge level, awareness of the vaccine and maternal motivation.[7,8] Thirteen quantitative studies reported that the HPV vaccine coverage rate ranged from 9.1% to 72%,[7,9–21] with the difference in HPV vaccine coverage rate affected by HPV knowledge level, awareness of the vaccine and maternal motivation,[7,8] but also medical knowledge and economic status. Two small sample size studies focused on specific demographics: 16% vaccination rates for 100 HIV-negative, cisgender, sexually active women aged 18–45 years in the Miami community and 38% vaccination rate for 258 students aged 18 to 26 years at Alabama State University.[10,14]

A small cross-sectional survey of 217 undergraduate and graduate men and women at Villanova University in Pennsylvania found 71.5% had at least one HPV vaccine dose, with no statistically significant differences between men and women in terms of sexual history, number of sexual partners, and history of sexually transmitted diseases/infections, although women were more likely than men to be screened for sexually transmitted diseases.[13] A cross-sectional study evaluating HPV vaccination behavior and its impact among 27 pharmacists and pharmacy trainees in Arizona, found that the vaccination rate in this group was only 59.3%, but significantly higher than those who lacked medical, pharmaceutical and other related knowledge.[19]

Among the nine studies conducted in China, all reported HPV vaccination rates below 25%, with most studies only surveying women. One cross-sectional survey among 3000 female freshmen across seven universities in mainland China

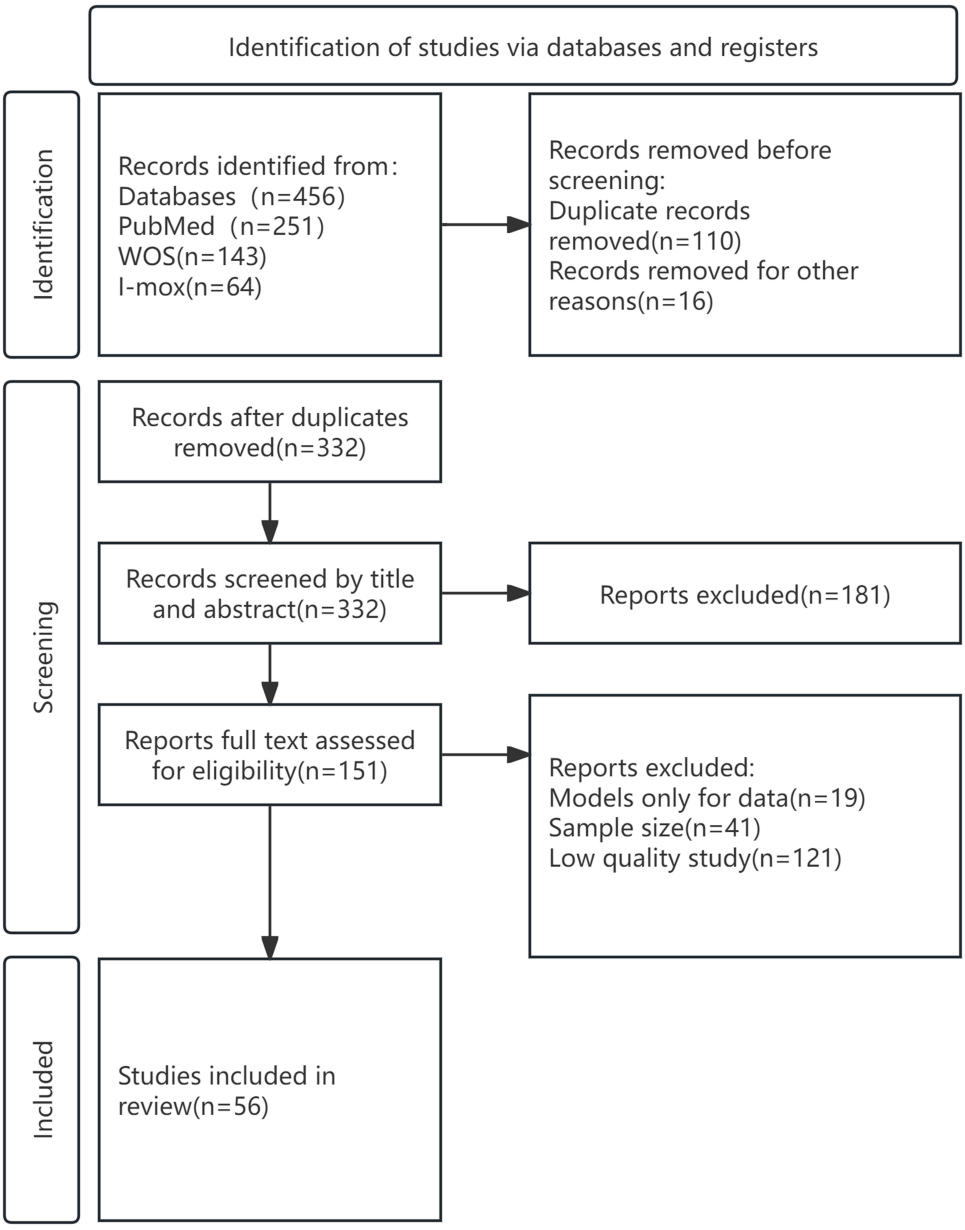

Figure 1 Document inclusion and exclusion flow chart.

revealed a vaccination rate of only 2.64%.[22] Two Chinese studies across various provinces and cities estimated vaccination rates among specific age groups: 21.2% vaccination rate in girls aged 9–14 years and 22.8% in women aged 18–45 years.[23,24] A survey of college students in Guangzhou reported low HPV vaccine coverage without breaking down gender differences among male and female students.[25] A survey of college students in Beijing reported a 9% vaccination rate was reported for female students, but collected no data on men.[26]

Three Turkish studies reported low vaccination rates, with two studies employing descriptive and cross-sectional methods to examine rates among men and women aged 18 and over with a 2.7% vaccination rate and 1.5% vaccination rate among male and female university students.[27,28] These studies reported only aggregated vaccination rates for men and women and did not give separate vaccination rate data for men and women.[27] Using snowball sampling, the third Turkish study explored the differences in HPV knowledge and attitudes between vaccinated and unvaccinated Turkish women, with a vaccination rate of 3.6% among 856 respondents.[29]

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We only identified two studies each from Ethiopia, Uganda, Italy, Greece, Canada, and India, and one study from France, Romania, Tanzania, Morocco, Jordan, Luxembourg, Portugal, and Switzerland, indicating the paucity HPV research in these countries. In Ethiopia, a community-based cross-sectional survey revealed a vaccination rate of 48% among 1825 participants,[30] while another investigation among young students found a vaccination rate of 44.4%, suggesting consistency in Ethiopian HPV vaccination rates.[31] A study in Portugal analyzed the impact of gender and undergraduate courses on HPV vaccination by surveying public university students, reporting a 26% vaccination rate for women, and 8% for men.[32]

Comparable vaccination rates were also reported in Uganda,[33,34] Italy,[35,36] India,[37,38] and Canada.[39,40] In an Italian study, it was reported that only 32.2% of 12-year-old boys and 26.7% of 12-year-old girls had completed the vaccination series by 2021.[35] In Greece, one study targeting young adult females reported a 52.3% vaccination rate,[41] but another study using a mixed-gender questionnaire reported a rate of only 25.2%, revealing a significant disparity in HPV vaccination rates in Greece.[42]

Single studies from Tanzania,[43] Luxembourg,[44] and Switzerland[45] reported high vaccination rates, ranging from 71.8% to 79%.[43–45] An observational cohort study at the University of Campinas in Portugal among first-year and fourth-year undergraduates in various health-related fields reported an initial female vaccination rate of 26% and male rate of 8% that subsequently increased to 52% for females and 27% for males, highlighting a positive trend over time.[32] Romania, Morocco, Jordan, Colombia and Peru reported exceedingly low vaccination rates, ranging from less than 1% to 6.4%.[6,46–49] Notably, developed countries generally exhibited higher vaccination rates than developing nations, with nine of ten countries reported HPV coverage rates exceeding 50% were developed countries among reviewed studies.

Besides the diversity in vaccination rates, our studies revealed a bias towards studying female vaccination rates and surveys of school and college-aged students. Of the 47 studies looking at HPV vaccination rates that did not include MSM, only 2% provided vaccination rates for men, which averaged 18.12% and 42.55% of studies exclusively focused on females. In the six studies involving both men and women, only one gave both male and female vaccination rates with the other five providing only aggregate male and female vaccination rates. In the 47 studies, 44.68% involved school and college students.

The Influence Factors on HPV Vaccination Behavior

The Influence of Parents' Ideas and Attitudes on HPV Vaccination Behavior

Parents significantly influence their children's behaviors, a principle that extends to health-related decisions, including HPV vaccination. Three studies examined parental influence and two additional studies addressed the maternal impact on HPV vaccination behavior among children.[7,17,20,23,55] A French telephonic survey of young women and their parents about hesitancy towards the HPV vaccine indicated that fathers and families with higher incomes were more inclined to support vaccination and vaccination resistance was predominantly observed among mothers and lower-income families, particularly those aged 25–45.[56]

Research from China highlighted that mothers who had received the HPV vaccine were more likely to support vaccinating their daughters, with attitudes, subjective norms, and perceived behavioral control positively influencing the vaccination decision.[55] The study identified a disparity between the willingness and actual vaccination practices among parents of girls aged 9–14 years old.[23] Organized educational interventions have been shown to positively alter parents' perceptions of HPV vaccination behavior.[38] Underscoring the significance of maternal knowledge, awareness, and acceptance on improving childhood HPV vaccination.[7,55]

The willingness to vaccinate was closely associated with specific attitudes towards the HPV vaccine, suggesting that educational efforts can modify these attitudes and, by extension, vaccination behaviors. Enhancing public trust in vaccines is essential for improving uptake.

The Influence of Medical Knowledge on Self-Inoculation Behavior

Three research articles examined the impact of medical knowledge on HPV vaccination decisions.[16,36,37] A study of medical students in Alabama highlighted the critical nature of proven vaccine effectiveness and health worker recommendations, such as those from physicians, in shaping HPV vaccination behavior.[16] A study of female medical students

and prospective medical students aged 18 to 25 at a rural university in western India showed that the overall understanding of HPV among the students was relatively low. At the same time, students expressed a willingness to HPV vaccinate when they had acquire sufficient knowledge.[37]

Similarly, another study underscored the trust people place in health care workers under various circumstances, including vaccination decisions, emphasizing the importance of equipping health care professionals with comprehensive vaccination knowledge.[24] Finally, research involving students aged 18–30 from Italian health care professional schools revealed a high social willingness for HPV vaccination, though this willingness did not directly correlate with vaccination behavior.[17,23,56] The study suggested that enhanced education regarding HPV and its association with cancers among medical students could improved HPV vaccination rates and, subsequently, better prevention of HPV and its related conditions.[36]

Influencing Factors of HPV Vaccination Behavior Among Key Populations

From Table 3, seven articles focused on HPV vaccination behaviors among MSM. A study of a community-recruited sample of gay, bisexual, and other MSM in the three largest cities in Canada underscored the influence of vaccine cost and HPV screening outcomes on vaccination behaviors, highlighting the necessity of enhancing HPV awareness within the male demographic.[57] A key finding was the importance of creating a confidential and secure environment for MSM to inquire about HPV vaccines and associated subjects.[2]

MSM US, Scotland, Australian and Canadian studies revealed that,[2,50–52,55,57,58] the average vaccination rate among MSM (16.4%–73.2%) was roughly equal to the female average (1.3%–74%). A US study reported age, health insurance coverage, communication with healthcare professionals, and history of gonorrhea and chlamydia diagnoses were the determinants of MSM vaccination behavior.[55] A Scottish study found that incorporating vaccination services into existing sexual health frameworks significantly boosted vaccination rates among MSM.[50] Conversely, an Australia study in Victoria reported difficulties in extending the analogous vaccine benefits to MSM that are afforded to heterosexual men, owing to disparities in vaccination behaviors.[51] A Canadian study comparing HPV vaccine uptake among gay, bisexual, and other MSM groups, indicated substantial gaps in vaccination coverage, necessitating expanded interventions to heighten awareness and underscore the significance of HPV vaccination in the MSM community.[58]

Existing Problems and Challenges

The articles in Table 2 show that public stigma towards HPV vaccination was a significant vaccination barrier. Two studies reported the reluctance of parents to discuss sexual health with their children, which can result in the omission of HPV vaccination discussions.[17,51] Such discussions are likely to be both more difficult and rarer for parents of MSM youths. A common misconception among many parents is the association of HPV with sexual promiscuity, fostering the belief that the absence of such behaviors negates the necessity for vaccination. This misconception significantly impedes HPV vaccination efforts.

Several studies highlighted a critical issue of disparity between HPV vaccination intentions and actual vaccination behavior.[23,24,33] While overall vaccination rates remain modest, our literature review shows that the intention to vaccinate was comparatively high among young women and family members of cervical cancer patients. Vaccination intentions were frequently influenced by subjective factors, but actual vaccination behavior was dictated by objective realities. For instance, the scarcity of both imported and domestic HPV vaccines in China exacerbated the discrepancy between the intent to vaccinate and the actual vaccination rates.[33] This mismatch is further complicated by various factors, including the duration of vaccine availability, vaccine costs and perceptions regarding different vaccine types.

Importantly, we found that there was a lack of attention to men and especially MSM in the existing studies. Although the HPV virus is a sexually transmitted disease, most articles either focused on women or aggregated men and women together, rather than analyzing separately the different factors affecting the HPV vaccination behavior of men and women from the perspective of gender and MSM.

Discussion

Significance of Studying HPV Vaccination Behavior

HPV represents a prevalent sexually transmitted virus and a primary cause of anal and cervical cancer, genital warts and other related sexually transmitted diseases.[1] HPV vaccinations have increased globally, playing a crucial role in the routine national immunization programs of many countries. Our review of the existing literature on HPV vaccination rates and vaccination behavior shows that HPV vaccination rates remain suboptimal, for both men and women, with anal and cervical cancer and other sexually transmitted diseases remaining unnecessarily high. One implication of the data on parental influence, especially mothers, on HPV vaccinations of children is its gendered bias, focusing on girls at the expense of boys. Young MSM are reluctant to reveal their sexuality for their parents, with parental encouragement to receive the HPV vaccine low.

The highest documented vaccination rate came from Tanzania, where it reached 79%.[43] This success is attributed to the implementation of a widely recognized and accepted national HPV vaccination program. The expertise of doctors also played a key role in Tanzania's increasing vaccination rates, confirming the key role of continued technical support in achieving high vaccination rates. Among young women surveyed at the University of Morocco, the vaccination rate was less than one percent, largely because they were poorly informed about HPV and its vaccine, which highlights the importance of education and advocacy in increasing vaccination rates.

The diversity in HPV vaccination rates between different countries was significantly related to country cultural differences and different medical systems between countries and within regions. Given cross-country differences in HPV vaccination rates, the studies showed that HPV vaccination rates were influenced by sexual behavior, parental attitudes and medical knowledge.

School HPV vaccination rates and national HPV vaccination campaigns played a crucial role in increasing overall vaccination rates and promoting equal access to vaccination for all genders and sexual orientations. By integrating HPV vaccination programs into school health initiatives and national campaigns, vaccine awareness is raised and vaccination acceptance enhanced, ultimately leading to improve vaccination rates. School-based programs offer a convenient and accessible platform to reach large numbers of adolescents, increasing the likelihood of vaccination and capturing MSM youths without identifying and stigmatizing this cohort as a specific group.[52]

Similarly, national campaigns capture all genders and sexual orientations, leading to a comprehensive approach to public health. Of course, despite school-based and national campaigns, there are still barriers to HPV vaccination due to lack of vaccine awareness or vaccination hesitancy among parents, limited healthcare infrastructure in some regions, cost concerns, and misinformation campaigns that may impede the effectiveness of HPV vaccination initiatives. These barriers can differentially impact girls and heterosexual men and marginalized populations such as MSM youth, resulting in disparities in vaccination rates and access to preventive health services.

To tackle these challenges, HPV vaccination campaigns must implement targeted strategies that focus on education, parental and community engagement, and addressing specific barriers encountered by different population groups, including MSM youth. By customizing interventions to meet the needs of diverse communities and ensuring equitable access to vaccinations,[53] these programs can reduce HPV-related cancers and advance overall public health outcomes.

Limitations of Existing Studies on HPV Vaccination Behavior

Our literature reviewed exhibited some limitations. First, there were relatively few studies of MSM, a high-risk group.[2,50–52,55,57,58] To address this gap, future research should prioritize the inclusion of MSM in study designs to better understand their specific vaccination behaviors and barriers. This could involve targeted outreach and recruitment strategies in community organizations or healthcare settings that serve this population.

Further, the reliance on self-reported surveys in many studies can introduce recall bias, potentially skewing the results. Researchers should explore alternative methods of data collection, such as using electronic health records (EHR) or conducting qualitative interviews, to obtain more accurate and comprehensive data. Incorporating mixed-methods approaches can provide a deeper understanding of the factors influencing HPV vaccination behavior. For example, a study in the United States used an English-language questionnaire, necessitating proficiency in English among the

participants, which limited access to participants with English as a second language.[7–21] The selection of participants from a single university narrows the generalizability of the outcomes to non-university, older and lower socio-economic status women.[6,14,16,25,26,28,32,35,37,45,47,54] The utilization of self-reported surveys in various studies may induce recall bias,[8,12,27,29–31,33,35,40,41,46,55,59] potentially leading to the overestimation or underestimation of the strength of perceived correlations.[9]

Lastly, it is crucial to ensure that study materials, including questionnaires, are accessible to a broader audience. Researchers should consider providing translations or using simplified language to accommodate participants with different language proficiencies. Ensuring that diverse populations, including non-English speakers and individuals from lower socioeconomic backgrounds, are represented in the research will lead to more inclusive and applicable findings.

The Research Methods in HPV Vaccination Behavior Studies

More than 90% of the studies used questionnaires to investigate HPV vaccination behavior in a particular region or population. Questionnaire surveys have some defects in exploring vaccination intention and related concerns, and the reliability and validity of questionnaires should be reported. Only two studies used a qualitative approach, using in-depth interviews with cervical cancer patients and mothers of children eligible for HPV vaccination, to understand the factors influencing HPV vaccination behavior.[7,21] In addition, two randomized controlled trials investigated the effects of parents' sexual health education and online health education on HPV vaccination behavior, providing in depth conclusions about the vaccination decision.[17,60] Therefore, it is highly recommended that future research increase the number of RCTs, particularly targeting under-studied populations such as men and men who have sex with men (MSM). Developing and implementing tailored interventions focused on HPV education, increasing vaccine awareness, and enhancing sexual health education targeted to the specific needs of these groups will be essential.

In summary, expanding the methodological diversity of research on HPV vaccination behavior is critical. Future studies should prioritize qualitative approaches, increase the utilization of RCTs, and actively engage under-researched populations to effectively identify and address the factors influencing HPV vaccination behavior. Such initiatives will ultimately contribute to improving HPV vaccination rates across various demographic groups.

Recommendations for Future Studies of HPV Vaccination Behavior

One outcome from our literature survey is that HPV vaccination rates can be improved through structured educational interventions for parents, training of medical professionals about HPV and its vaccines, and targeted prevention education and intervention strategies, such as for MSM. Our first recommendation is to equally target male anal, penile and oral cancers with cervical cancer in cancer awareness campaigns, and the role of HPV vaccines as an effective intervention.

Second, information on HPV should cover male-related HPV diseases, especially as a protection against HPV diseases common among MSM, such as anal cancers. Our reviews underscored the pivotal role of augmented parental understanding and awareness in fostering greater acceptance of the HPV vaccine.[38]

Third, health authorities should design parent education programs to inform and motivate parents to equally support male and female HPV vaccination, including identifying specific disease outcomes for MSM. Such education campaigns should include parent-male children discussions about youth sexual orientation and safe sex practices. Public health education concerning the HPV vaccine can shape societal cognition and acceptance of HPV vaccinations, catalyzing an enhancement in vaccination behaviors and treatments. Public health campaigns should not only focus on the protection provided by the HPV vaccine, but HPV disease health awareness and treatment.

The literature survey also warns that online campaigns can elevate knowledge levels, but they frequently fall short of effecting behavioral change.[21] Internet campaigns should focus not only on education about HPV but changing vaccination behaviors from intention to vaccinate to vaccination. The literature survey also identified primary healthcare organizations as the key vehicle to equip the public with comprehensive information on HPV and the HVP vaccine for men and women.

HPV vaccination behaviors correlate with engagement in community outreach initiatives, vaccine accessibility, and the provision of exhaustive vaccine information.[34] Health authorities should identify gay and lesbian community organizations through which HPV vaccine information and HPV catch-up vaccinations can be promoted. Online and

offline education and training for medical professionals on HPV and the HPV vaccine can improve the HPV vaccination rates and effectively reach out to marginalized populations, such as MSM. Health authorities should ensure safe and private environments for male patients to seek sexual health advice, including HPV-related treatments and information about HPV vaccines and HPV-related cancers.[2]

Limitations of This Review

There are also some limitations in this study. Literature on HPV vaccination behavior from 2018 to 2023 was selected. The time span is limited, which may be affected by short-term internal and external environmental factors, with this study not reflecting long-term trends. The review was limited by the scope and number of articles. This review, for example, included very few South American studies, which has restricted the in-depth understanding of HPV vaccination barriers in this region. Future HPV vaccination research on vaccine behavior in Latin American countries needs to be strengthened.

Conclusion

Recent studies have shown that human papillomavirus vaccination rates have fallen short of ideal levels, with most countries failing to achieve universal coverage. HPV studies of both men and men who have sex with men remain underrepresented. Further, our literature survey found that while many individuals express an intention to vaccinate against HPV, this intention did not always translate into actual vaccination behavior.

Parental attitudes and medical knowledge have been shown to be key factors driving HPV vaccination rates. Educating parents and health professionals about the benefits of the HPV vaccine is crucial for increasing the HPV vaccination uptake, especially for men and MSM. Both parents and health professionals should be better informed through sexual health awareness campaigns about the risk of HPV-related penile cancer, genital warts, anal cancer and oropharyngeal cancer to men and MSM. Enhanced knowledge among parents, healthcare providers, and the broader community can foster support for school-based and national HPV vaccination initiatives.

We recommend that government health departments and healthcare organizations actively promote HPV vaccination campaigns targeting parents, school management, and gay and lesbian groups. Tailored outreach programs should aim to identify MSM and provide them with confidential access to HPV vaccinations and sexual health resources.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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