

REVIEW

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Evidence of Knowledge, Attitude, and Practice Regarding Human Papilloma Virus Vaccination at the Community Level in India: A Systematic Review and Meta-Analysis

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Abstract

Background: Effective vaccines for the prevention of cervical cancers are available in India. The existing knowledge and attitude regarding the Human Papillomavirus (HPV) vaccine varies widely among available studies. Our study aimed to estimate pooled prevalence related to knowledge, attitude, and practice of HPV vaccination in India. **Methodology:** We conducted systematic searches in PUBMED, EMBASE, CINHAL, PROQUEST, and Cochrane Library databases using database-specific search strategies. The random effects model was used for estimating the pooled proportion of knowledge, attitude, and practice. The outlier studies were identified using the Baujat test. Egger's regression test and funnel plots were used to identify publication bias. **Results:** Database-specific search strategies yielded 2,377 records from five databases. We identified 48 studies for full-text retrieval after screening titles and abstracts. Finally, 27 studies were included in the meta-analysis. The pooled prevalence of knowledge regarding HPV vaccines in India was 0.22 (CI;0.14-0.31, I² =99.5%). The pooled prevalence of positive attitudes towards the uptake of HPV vaccines in India was 0.45 (CI;0.33-0.57, I² =100%). The pooled prevalence of coverage of HPV vaccines in India was 0.04 (CI;0.02-0.07, I² =96%). Significant publication bias was present for the studies' reported knowledge and coverage. **Conclusion:** The knowledge, attitude, and coverage of the HPV vaccine were low in India. It suggests effective strategies to improve knowledge and attitudes towards HPV vaccination in India.

Keywords: Cervical cancer- knowledge- practice- Human Papilloma virus- HPV vaccine

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Introduction

Cervical cancer is the fourth most common type of cancer among women worldwide and in India [1]. It contributes to 8.7% of all cancer-related deaths among women in India, accounting for an age-standardized mortality rate of 9.2 per one lakh population [1, 2]. Different strategies such as screening and vaccination are currently available to prevent cervical cancer. These strategies were found to be cost-effective in reducing morbidity and mortality related to cervical cancer [3]. The effectiveness of Human papillomavirus (HPV) vaccines against cervical cancer is as high as 90 percent [4]. Currently, bivalent, quadrivalent, and nonvalent HPV vaccines are approved worldwide, including in India. HPV vaccines are not included in the National Immunization Schedule (NIS) in India, but states like Sikkim and Punjab have included it in their immunization schedule [5]. The vaccines are provided to adolescents mainly through school health programs. The vaccines

are also available in open markets in all states and can be purchased by anyone. knowledge regarding the vaccine and a positive attitude towards vaccination is crucial to improve the uptake of vaccines at the community level. This aspect becomes even more contextual when India is planning to include the HPV vaccine in the NIS in the near future. The country-level evidence regarding the knowledge of HPV and attitude towards the vaccine is required. It will help in improving the intake of HPV vaccination. The country-level data regarding vaccine coverage is required to understand the acceptance of the vaccine at the community level before its inclusion in the NIS. This will also help in policy formulation regarding the implementation of the vaccination program [6]. The knowledge regarding the HPV vaccine varies very widely in different studies from 0% to 60% [7, 8]. Similarly, the attitude towards the vaccine and the coverage of the HPV vaccine had a very wide range reported in different studies. This study aims to systematically synthesize the evidence on knowledge, attitude, and practice related to the HPV

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vaccine at the community level in India. This study will also estimate the pooled prevalence of knowledge, attitude, and practice regarding the HPV vaccine at the community level in India.

Materials and Methods

Protocol and registration

We registered this systematic review and meta-analysis protocol in PROSPERO (CRD42023440329). As of our knowledge, no similar systematic review was either registered in PROSPERO or published in the public domain. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines 2020. We obtained ethical approval from the Institutional Ethics Committee (IEC) of All India Institute of Medical Sciences (AIIMS), Bhubaneswar (IEC reference number: T/IM-NF/CM&FM/23/28).

Search Strategy

We prepared database-specific search strategies for MEDLINE/PubMed, ProQuest, EMBASE, CINAHL, and Cochrane databases. The search strategy was formulated to find articles on knowledge, attitude, and practice regarding HPV vaccination in India, published till 30th June 2023 since inception. The search strategy was restricted to the studies published in the English language. The PEO scheme was used to formulate search strategies. Key elements that we used in our search were the 'P' (Indian population), the 'E' (HPV vaccine), and the 'O' (knowledge/attitude/practice). The search strategies and number of articles specific to individual databases were reported in the supplementary table (Supplementary Table 1).

Study selection criteria

We included studies that reported knowledge regarding the HPV vaccine in India. We also included studies that reported attitudes towards the HPV vaccine in India with acceptance of the HPV vaccine in India. We used the following inclusion criteria for identifying eligible studies.

- Studies with female or male participants aged from 5 years to 75 years; and
- Participants residing in India; and
- Studies with participants either selected from the community or the patients attending any healthcare facility; and
- Studies published in the English language; and
- The full text of the articles was retrievable; and
- Studies reported knowledge of any type of HPV vaccine; or
- Studies reported any type of attitude towards intake of HPV vaccine; or
- Studies reported acceptance/ intake of any type of HPV vaccine.

We excluded studies using the following criteria-

- Participants working in a healthcare setting; or
- Participants who were students of M.B.B.S./ B.D.S./ any Bachelor's or master's degree related to health or allied sciences.

- Participants work as any type of healthcare worker.

We included only observational studies for the systematic review and meta-analysis. We excluded review articles, letters to the editor, commentaries, viewpoints, case series, case reports, and conference abstracts from this meta-analysis.

Steps for selection

Two reviewers independently screened the titles and then abstracts of identified records for inclusion in the review. The full text of all records passing the title and abstract screening was retrieved. Two reviewers independently confirmed final eligibility. Any kind of disagreements in the title abstract screening and full-text review were resolved by a third senior researcher. Figure 1 presents the PRISMA flow chart. (Supporting information: Figure 1)

Quality assessment

We used the 11-item checklist formulated by the United States (US) Agency for Healthcare Quality and Research (AHRQ) for the quality assessment of the cross-sectional studies [9]. A score of zero to three indicates low quality, four to seven indicates medium quality, and eight to 11 indicates high quality [9]. This tool assessed the risk of bias based on the sampling strategy and data collection method. The risk of bias in individual studies was mentioned in the table (Table 1).

Data extraction

Two reviewers extracted study details about the author, publication year, study place, study participants, variables assessed, main findings, and risk of bias. Data extraction was performed in Microsoft Office Excel using a standardized data extraction form.

Statistical procedure

We conducted the meta-analysis using R software version 4.3.1 [10]. The proportions of knowledge, attitude, and practice were estimated separately. We used the inverse variance method without any transformation to find out the pooled prevalence. We used the inconsistency index (I^2) to report statistical heterogeneity. The I^2 values of 25%, 50%, and 75% are regarded as low, moderate, and high heterogeneity, respectively. The Baujat test was performed to identify outlier studies, followed by sensitivity analysis by removing the outlier studies. We performed Egger's regression test to identify publication bias. A funnel plot was also drawn for individual outcomes.

Results

We identified 2,377 records from five databases. We screened 1,857 records for eligibility by title and abstract after the removal of duplicates. We identified 48 records for full-text retrieval. Full-text screening identified 27 studies eligible for inclusion in the meta-analysis (Figure 1). A total of 27 studies conducted between 2012-22 with a total sample size of 14,399 were included in the meta-analysis. There were 23 studies of knowledge regarding HPV vaccination in India [7, 8, 11-29]. Eleven

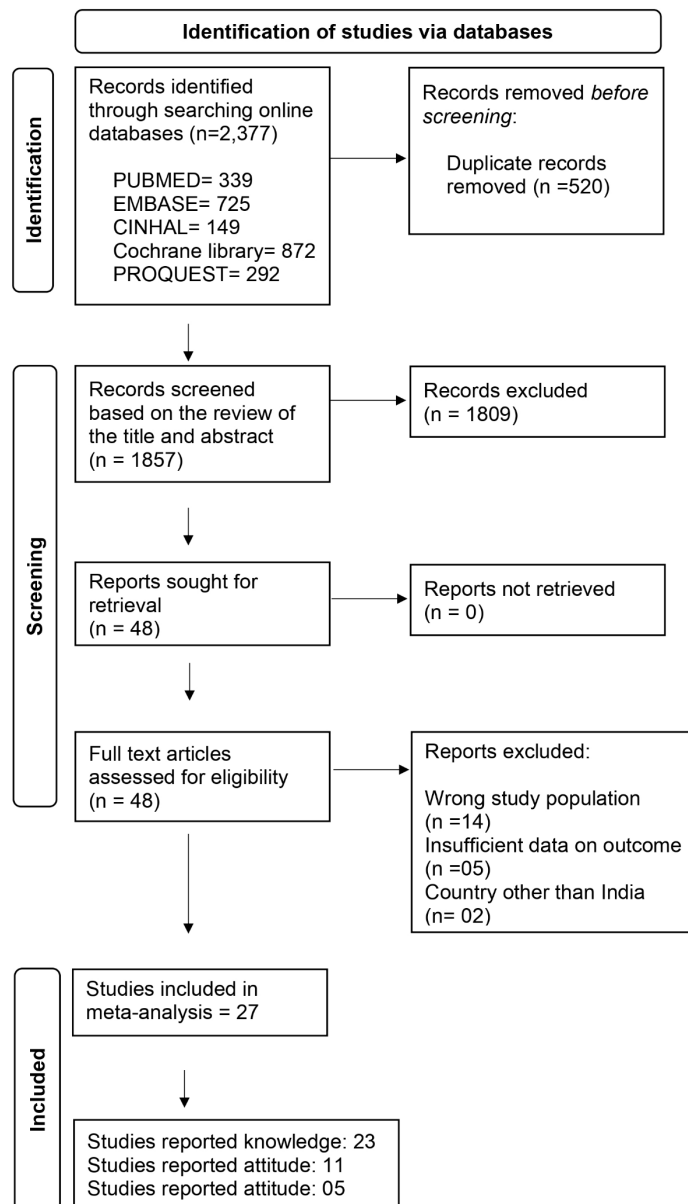


Figure 1. PRISMA Flow Diagram Showing the Selection Procedure of Studies

studies reported attitudes towards HPV [8, 13, 15, 18, 26, 28, 30-34]. The practice related to HPV vaccination was reported in five studies [8, 17, 26, 28, 29].

Meta-analysis finding

Knowledge regarding the HPV vaccine

The pooled prevalence of knowledge regarding HPV vaccines in India was 0.22 (CI;0.14-0.31) (Figure 2). The heterogeneity among studies was statistically significant ($I^2= 99.5\%$, $p<0.001$). The Baujat test identified the study conducted by Shah (2022) [34] as an outlier, but the removal of this study didn't change the pooled estimate and heterogeneity significantly. Egger's test reported a significant publication bias ($p<0.001$) among the studies, which was further supported by an asymmetric funnel plot (Supplementary Figure 1). The trim and fill method identified two studies attributed to the publication bias.

Attitude towards HPV vaccine

The pooled prevalence of positive attitudes towards

uptake of HPV vaccines in India was 0.45 (CI;0.33-0.57) (Figure 3). The heterogeneity among studies was statistically significant ($I^2= 100\%$, $p<0.001$). The Baujat test identified the study conducted by (Hussain, 2014) [13] as an outlier, but removing this study didn't change the pooled estimate and heterogeneity significantly. Egger's test reported no publication bias ($p=0.696$) among the studies supported by an almost symmetrical funnel plot (Supplementary Figure 2).

Practice related to the HPV vaccine

The pooled prevalence of coverage of HPV vaccines in India was 0.04 (CI;0.02-0.07) (Figure 4). The heterogeneity among studies was statistically significant ($I^2= 96\%$, $p<0.001$). The Baujat test identified the study conducted by (Rehman, 2022) [29] as an outlier, but removing this study didn't change the pooled estimate and heterogeneity significantly. Egger's test reported a significant publication bias among studies ($p=0.006$), supported by an asymmetric funnel plot (Supplementary

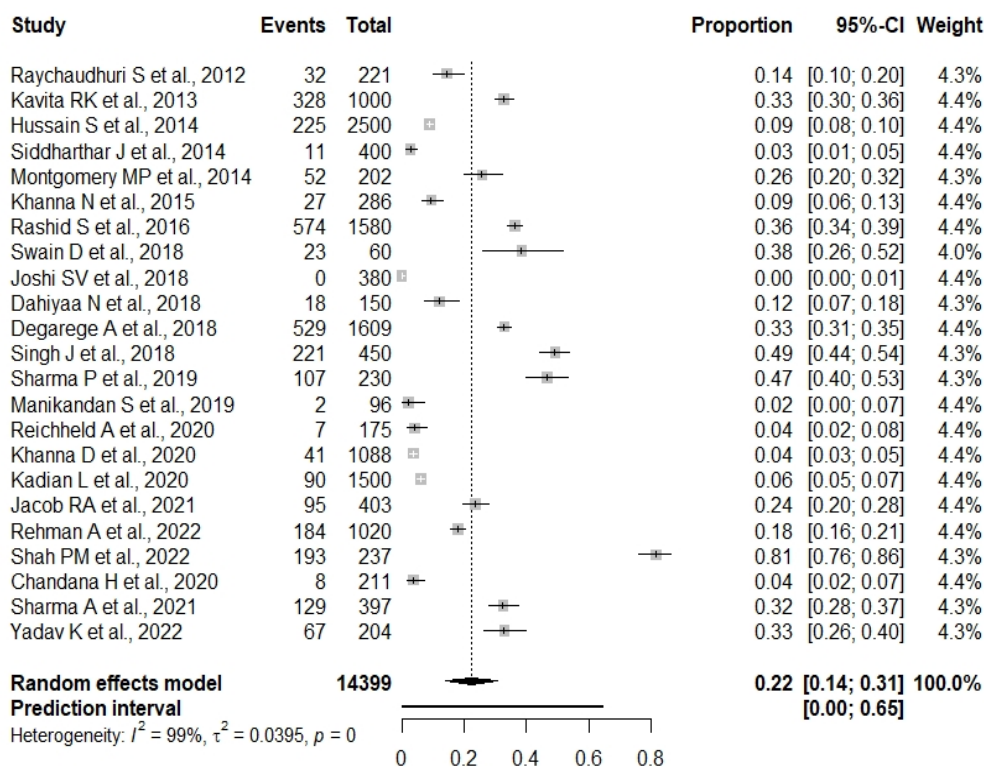


Figure 2. Forest Plot Showing the Pooled Prevalence of Knowledge Regarding HPV Vaccination in India (Using Random Effects Model)

Figure 3). The trim and fill method could not identify the studies responsible for the publication bias.

Discussion

This systematic review and meta-analysis estimated the pooled proportion of knowledge, positive attitude, and coverage of the HPV vaccination among the general population of India. We excluded the studies where the participants were either medical or nursing students or any

health care professionals. This meta-analysis was the first to find out the pooled proportion of knowledge, positive attitude, and acceptance of the HPV vaccination in India, as of our knowledge. These findings will help the relevant stakeholders and policymakers to formulate strategies to improve the knowledge regarding HPV vaccination. These strategies will ultimately lead to an improvement in positive attitudes toward HPV vaccination, leading to an improvement in acceptance of HPV vaccines. These will also help improve the overall uptake of HPV vaccines

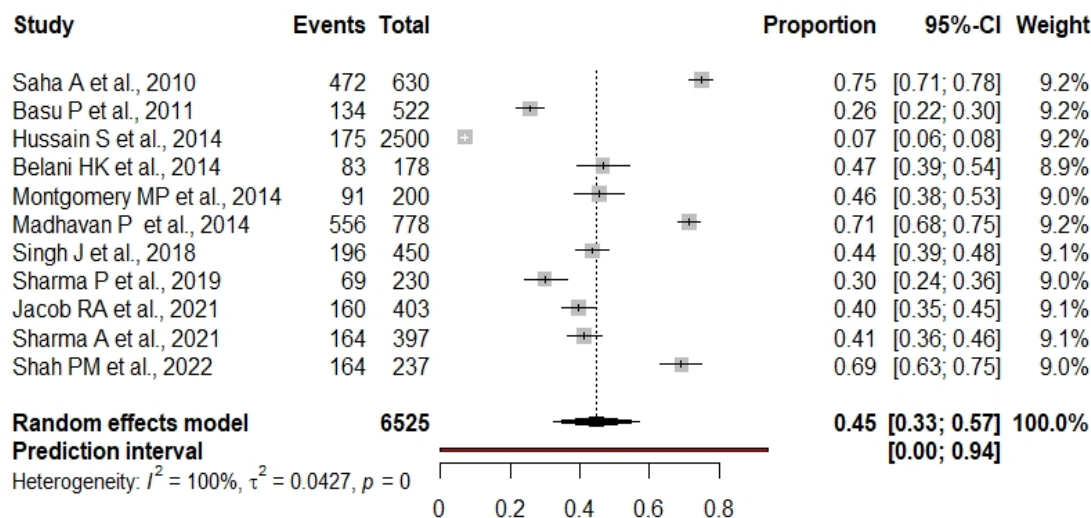


Figure 3. Forest Plot Showing the Positive Attitudes Regarding HPV Vaccination in India (Using Random Effects Model)

Table 1. Key Characteristics of the Studies Included in the Meta-Analysis (n=28)

Author	Year of publication	Study site	Type of study area (urban/ rural/ both)	Type of study participants	Age of the participants	Sampling strategy	Sample size	Knowledge present	Positive attitude	HPV vaccine received	Risk of Bias
Saha A et al.	2010	Four colleges of Kolkata	Urban	College students	17-24 years	Purposive sampling	630	-	472	-	Medium risk
Basu P et al.	2011	Two municipal wards of Kolkata	Urban	Parents	Not mentioned	Purposive sampling	522	-	134	-	Medium risk
Raychaudhuri S et al.	2012	Siliguri	Both	Married/unmarried women	15-49 years	Simple random sampling	221	32	-	-	Low risk
Kavita RK et al.	2013	Five cities in India	Urban	High school/college students	13-19 years	Simple random sampling	1000	328	-	-	Low risk
Hussain S et al.	2014	Noida and Delhi	Both	School students	12-22 years	Purposive sampling	2500	225	175	-	Medium risk
Siddharthar J et al.	2014	Puducherry	Rural	Patient attending a tertiary care hospital	18-60 years	Convenient sampling	400	11	-	-	Medium risk
Belani HK et al.	2014	Bangalore	Both	Patient attending a tertiary care hospital	18-45 years	Purposive sampling	178	-	83	-	Medium risk
Montgomery MP et al.	2014	Karnataka	Both	Patient attending a tertiary care hospital	18-44 years	Convenient sampling	202	52	91	-	Medium risk
Madhavan P et al.	2014	Karnataka, Mysore	Both	Parents of school students	Not mentioned	Multistage sampling (Proportional to probability sampling)	778	-	556	-	Low risk
Khanma N et al.	2015	Odisha	Both	Patient attending a tertiary care hospital and marketplace	18-49 years	Convenient sampling	286	27	-	-	Medium risk
Rashid S et al.	2016	Uttar Pradesh	Urban	College students	16-26 years	Convenient sampling	1580	574	-	116	Medium risk
Swain D et al.	2018	Odisha	Urban	College students	17-24 years	Simple random sampling	60	23	-	-	Low risk
Joshi SV et al.	2018	India	Both	Students	16-40 years	Convenient sampling	380	0	-	-	Medium risk
Dahiya N et al.	2018	New Delhi	Both	Participants of International Trade Fair	19-70 years	Convenient sampling	150	18	-	-	Medium risk
Degargre A et al.	2018	Mysore	Both	Parents of school going students	Not mentioned	Proportional to probability sampling	1609	529	-	-	Low risk
Singh J et al.	2018	New Delhi	Urban	Females attending different public place	16-65 years	Convenient sampling	450	221	196	-	Medium risk
Sharma P et al.	2019	New Delhi	Urban	College students	16-28 years	Convenient sampling	230	107	69	16	Medium risk
Manikandan S et al.	2019	Not mentioned	Both	College students	18-20 years	Multistage random sampling	96	2	-	-	Low risk
Reichheld A et al.	2020	Tamil Nadu, Vellore	Urban	Women	25-65 years	Convenient sampling	175	7	-	-	Medium risk
Khanma D et al.	2020	Uttar Pradesh	Both	Women attending a secondary health care	30-65 years	Convenient sampling	1088	41	-	-	Medium risk
Kadian L et al.	2020	Haryana	Both	Women	18-65 years	Purposive sampling	1500	90	-	-	Medium risk
Jacob RA et al.	2021	Karnataka, Mysuru	Both	Parents of school going students	Not mentioned	Purposive sampling	403	95	160	16	Medium risk
Rehman A et al.	2022	Delhi and Haryana	Urban	Women	15-49 years	Snowball sampling	1020	184	-	6	Medium risk
Shah PM et al.	2022	Mangalore, Karnataka	Urban	Women	18-45 years	Convenient sampling	237	193	164	-	Medium risk
Chandana H et al.	2020	Mysore, Karnataka	Urban	Women	18-60 years	Multistage systematic Random sampling	211	8	-	-	Low risk
Sharma A et al.	2021	Rajasthan	Rajasthan	School teachers	20-65 years	Convenient sampling	397	129	164	12	Medium risk
Yadav K et al.	2022	Uttar Pradesh	Rural	Males and females	18-65 years	Multistage random sampling	204	67	-	-	Low risk

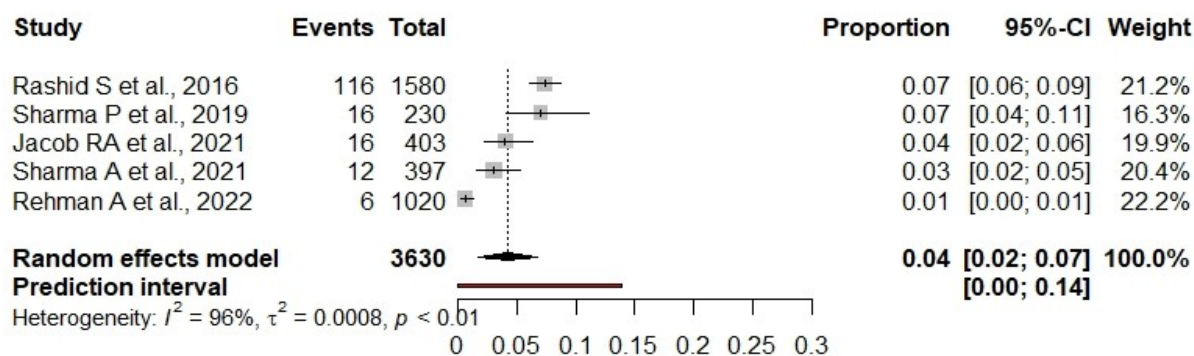


Figure 4. Forest Plot Showing the Pooled Prevalence of Coverage of HPV Vaccination in India (Using Random Effects Model)

after the introduction of the HPV vaccine in NIS.

The pooled proportion of knowledge regarding the availability of the HPV vaccine was 22%, with a 95% CI of 14%–31%. This proportion was very low compared to the systematic reviews and meta-analyses conducted in European countries and Ethiopia, which was around 50% [35]. However, it was higher than the proportion of knowledge from the studies conducted in China [36].

Regarding attitude, the pooled estimate of positive attitude towards the HPV vaccine was found to be 45% with a 95% CI of 33%–57%. This finding was consistent with research findings in the United States, and Ethiopia; those reported a positive attitude in the range of 45%–50% [37–39]. However, the estimate was lower compared to findings from European countries [35].

Meanwhile, this pooled prevalence of knowledge was lower than the estimate from the study conducted in Hungary [40]. The difference can be attributed to the differential burden related to cervical cancer and public health policy related to HPV vaccination. Similarly, our study's knowledge proportion was lower than in other studies conducted in different parts of the world. It has been noticed that the rolling out of HPV vaccination through their national immunization schedule is associated with good knowledge.

In this study, the overall pooled proportion of HPV vaccine uptake was 4% with a 95% CI of 2%–7%. Obviously, the uptake of the vaccine was lower compared to the countries where it was rolled out through the government health system [39, 41, 42]. But, it was similar to the pooled estimate available from the less developed region [43]. The pooled estimates related to knowledge, attitude, and practice may be improved after its inception in NIS. Vaccination against HPV is usually recommended for adolescents. Vaccine delivery through schools was found to be one of the effective strategies for vaccine delivery in Haryana and Sikkim. We are expecting the HPV vaccination will be rolled throughout the country in upcoming years.

The results of the study should be considered with the following limitations. Firstly, using different tools to assess knowledge regarding HPV vaccination in different studies may lead to miscalculation of pooled estimates. However, as we have taken the dichotomous outcomes instead of knowledge scores, the pooling of individual study results can be considered. The need for studies

from some states in India might hamper generalization. In addition, there was heterogeneity across studies, which might affect the pooled estimate of knowledge, a positive attitude, and coverage. Different age groups of participants in different studies and different types of populations can be attributed to the heterogeneity. Also, the different sample sizes and different methods of data collection were responsible for the heterogeneity. However, the identification and elimination of the outlier study was not able to change the heterogeneity and pooled estimate significantly.

In conclusion, in India, the pooled proportions of knowledge, a positive attitude, and HPV vaccination coverage were low in the general population. The low level of knowledge can be attributed to the very low coverage of the vaccine, even after its availability in open markets. Different strategies like health education through mass media channels concerning the HPV vaccination and cervical cancer may be implemented. The decision-makers in India may expand the HPV vaccination programs to cover all young females and develop efficient tactics for different groups of beneficiaries. Future studies using a mixed-method approach should be considered to examine how parents and the general public understand the HPV vaccination, how they perceive it, and how that affects how many people get the vaccine.

Author Contribution Statement

Dr. Debkumar Pal; Contribution towards the manuscript: Concepts, design, definition of intellectual content, literature search, data acquisition, data analysis, statistical analysis, manuscript preparation, manuscript editing. Dr. Bimal Kumar Sahoo; Contribution towards the manuscript: data acquisition and manuscript review. Dr. Manish Taywade; Contribution towards the manuscript: Concepts, design, manuscript editing, manuscript review, manuscript proofreading. Dr. Shampa Maji; Contribution towards the manuscript: Data analysis, statistical analysis, manuscript editing, manuscript review.

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The authors didn't receive any financial aid during any stage of this study. This study was approved by the Institutional Ethics Committee (IEC) of All India Institute

of Medical Sciences (AIIMS), Bhubaneswar (reference no: T/IM-NF/CM&FM/23/28). There is no such ethical issues in this study as it is a systematic review and meta-analysis. The data related to this research work is already available in Table 1 and the supplementary file. The data that support the findings of this study can be available on request from the corresponding author. The data are not publicly available due to privacy.

Conflict of interest

The authors declare NO conflicts of interests.

Appendix

1. Supplementary data (Table S1) related to the search strategies used for different databases and the number of records identified from respective databases

2. Supplementary data (Figure S1) related to the funnel plot showing publication bias for studies reported knowledge

3. Supplementary data (Figure S2) related to the funnel plot showing publication bias for studies reported attitude

4. Supplementary data (Figure S3) related to the funnel plot showing publication bias for studies reported coverage/acceptance.

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