Communication strategies to improve human papillomavirus (HPV) immunisation uptake among adolescents in sub-Saharan Africa: a systematic review and meta-analysis

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ABSTRACT

Objectives Developing countries face the greatest cervical cancer disease burden and mortality with suboptimal immunisation uptake. This review explores the communication strategies adopted, successes, challenges and lessons learnt in sub-Saharan countries to enhance human papillomavirus (HPV) immunisation.

Design Systematic review and meta-analysis.

Data sources PubMed, Hinari, Cochrane Library, Trip database, CINAHL, Web of Science, Scopus and seven grey resources were searched through May 2022.

Eligibility criteria We included observational studies addressing communication strategies for HPV immunisation uptake.

Data extraction and synthesis Two independent reviewers used standardised methods to search, screen and code included studies. Data extraction and assessment of risk of bias were done in duplicate to enhance validity of the results. Meta-analysis was conducted using the random-effects model. Findings were summarised and synthesised qualitatively.

Results Communication intervention to facilitate decision-making achieved uptake rate of 100% (95% CI 0.99% to 1.00%), followed by intervention to enable communication, which achieved 92% (95% CI 0.92% to 0.92%). Communication intervention to inform and educate achieved 90% (95% CI 0.90% to 0.90%). Targeting both healthcare workers and community leaders with the communication intervention achieved 95% (95% CI 0.91% to 0.98%), while teachers and school boards achieved 92% (95% CI 0.84% to 1.01%). Targeting policymakers achieved 86% (95% CI 0.78% to 0.93%). Based on the method of communication intervention delivery, use of training achieved an uptake rate of 85% (95% CI 0.84% to 0.87%); similarly, drama and dance achieved 85% (95% CI 0.84% to 0.86%). However, use of information, education and communication materials achieved 82% (95% CI 0.78% to 0.87%).

Conclusion HPV vaccine communication is critical in ensuring that the community understands the importance of vaccination. The most effective communication strategies included those which educate the population about the HPV vaccine, facilitate decision-making on vaccine uptake and community ownership of the vaccination process immunisation.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This systematic review and meta-analysis used a comprehensive search for articles not only in improving human papillomavirus (HPV) immunisation uptake but also on HPV vaccine acceptance, completion, knowledge and attitude change.

⇒ This systematic review and meta-analysis reviewed data on fully independent communication intervention strategies and their influence on HPV vaccine uptake.

⇒ Among the intervention data identified, none included adverse events and cost-effectiveness.

⇒ We did not conduct Grading of Recommendations Assessment, Development and Evaluations due to insufficient information from the included studies to assess the quality of evidence.

BACKGROUND

Cervical cancer remains the second most common cancer among women with a prevalence of 604,127 and 341,831 deaths recorded in 2020 globally.1 A trend analysis on the incidence rate of cervical cancer in sub-Saharan Africa (SSA) shows that cervical cancer incidence has been increasing in SSA.2 An analysis of the global burden on cancers caused by infections reveals that human papillomavirus (HPV)-related cancers are about 690,000 cases and burden is highest in low-middle-income countries (LMICs) which SSA, with 120,000 cases, coming in third after the Asian regions.3 4 Since immunisation against HPV has been predicted to avert more deaths per person immunised,5 the global strategy by the WHO to eliminate cervical cancer has set a target of vaccinating at least 90% of
girls before they reach 15 years by 2030 as a preventive measure. Other goals of the strategy include screening of 70% of women by the age 35 years and putting at least 90% of women identified with cervical cancer on treatment. These prevention efforts need to be geared towards effective vaccine communication as recommended by the WHO and understanding the key vaccine safety issues that parents might bring up, and be ready to debunk those that are incorrect.

LMICs introduced HPV immunisation late compared with other developed countries and at a slower pace thereby still lagging behind with only 41% of the countries that have introduced the HPV immunisation in their national schedule. Several LMICs, especially in SSA, are still struggling with poor immunisation uptake despite the fact that HPV immunisation is freely available in government health facilities, mainly through Gavi support with three types being available—9-valent HPV vaccine (Gardasil 9), quadrivalent HPV vaccine (Gardasil) and bivalent HPV vaccine (Cervarix). However, only 18 of the 47 countries reported in Africa had a national HPV vaccination programme by 2019, and out of the 10 countries accounting for 62% of the unprotected children, 4 are in SSA.

Countries introducing HPV vaccine should invest in a communication plan for the introduction and sustained delivery of HPV vaccine so that it becomes positively associated with adolescent girls and a socially acceptable demanded service. Effective communication has the potential to improve immunisation uptake, address vaccine hesitancy, further strengthen routine immunisation services, and increase the use of new and underused vaccines in LMICs. There are various communication strategies that have been used to provide information on HPV immunisation to increase awareness and attitudes and address misinformation to reduce vaccine hesitancy.

The communication strategies include a couple of components that have been used for HPV immunisation that range from communication purpose, channels of communication and targeted audience. These strategies include community involvement used to enhance community ownership through seeking input on the strategy design, planning and implementation. Teach skills offer communication training on how to best communicate or provide vaccination-related education to others. Informational or educational strategies create awareness and address misinformation. Other communication strategies facilitate decision-making through use of HPV-related disease images and HPV vaccine decision aids, provider support in addressing specific challenges or concerns, for example, through motivational interviewing, remind or recall intervention to consumers of required vaccination and follow up those overdue. Another key strategy is enabling communication which purposefully bridges communication gaps targeting particular groups of people through adaptation of materials for low or no literacy population or special groups with disabilities, and use of message framing (gain vs loss) across cultural groups and gender differences. The communication strategy can target various stakeholders, that is, community to include adolescents and caregivers, as well as with users of health service, the policymakers and the healthcare providers.

A number of systematic reviews have looked at communication strategies in various spheres including promotive and preventive health in cervical cancer and other health conditions. One review done in high/middle-income countries evaluated the use of mobile phone application strategies on risk and preventive behaviour among adolescents and found that the intervention served to communicate educational messages and reinforce positive behaviour. Other reviews have captured communication as a strategy partially, for example, a review done in SSA looked at implementation strategies for improving cervical cancer prevention and partially included education as a communication strategy in the review. Another review looked at the barriers to implementation of HPV vaccine in LMICs and examined the challenges around community sensitisation and advocacy.

Though a number of systematic reviews have evaluated communication as a strategy to either increase vaccine acceptance, completeness or uptake, only a few have reviewed communication as a fully independent intervention of other interventions in HPV immunisation. One review done in 2014 evaluated educational interventions to increase HPV acceptance and only examined the studies in the USA, Europe, Asia and Australia. Another review done in 2016 that looked at educational interventions and reminders for HPV vaccine completion included only studies from high-income countries. Another review looked at the association of various social mobilisation strategies and HPV vaccine acceptability in LMICs. Therefore, there is paucity of evidence to summarise the fully independent communication intervention strategies and their influence on HPV vaccine acceptance and uptake. Over and above, we do not know of any systematic review that has evaluated communication strategies to improve HPV vaccine uptake in SSA. Based on these facts, this study aims to explore the communication strategies adopted to enhance HPV immunisation and lessons learnt in their implementation that influence acceptability and uptake.

**Objectives**

1. To explore communication strategies adopted to enhance HPV immunisation among adolescents in SSA.
2. To enumerate the successes and challenges in communication strategies for HPV immunisation among adolescents in SSA.
3. To summarise the lessons learnt on communication strategies implemented in sub-Saharan settings and their generalisability in similar settings.
METHODS
This study followed the Preferred Reporting Items for Systematic Review and Meta-Analysis review (PRISMA 2020) checklist (online supplemental appendix A).34 This study protocol was registered with PROSPERO (CRD42021243683).

Inclusion and exclusion of studies
We included observational studies to include cohort studies, case–control studies, before and after studies, pre/post-studies, case–control studies, before and after studies, pilot studies, commentaries and reviews were excluded from the study.

Types of participants
- Adolescents 10–19 years of age according to the WHO definition.35
- Parents and caregivers, teachers, religious leaders, healthcare providers and key stakeholders involved in implementation of HPV immunisation.

Intervention
Communication on HPV vaccination.

Comparator
This included no channels of communication strategies.

Study settings
The review looked at the primary studies conducted in SSA countries.

Outcomes
Primary outcome
- HPV immunisation uptake.

Secondary outcomes
- Acceptance of vaccination among participants.
- Completion of vaccination.
- Change of knowledge, awareness and/or attitude following communication.
- Cost of intervention.
- Adverse effects of the intervention.

Search methods for identification of studies
We developed a comprehensive search strategy for peer-reviewed studies and grey literature from inception of database to May 2022 with no time and language limits for seven electronic publication databases. The electronic databases included PubMed, Hinari, Cochrane Library, Trip database, CINAHL, Web of Science and Scopus. Search terms used for PubMed were adapted in relevant databases accordingly (online supplemental appendix B). For the grey resources, we included the following website links: WHO (www.who.int/); Gavi, the Vaccine Alliance (www.gavi.org); UNICEF (www.unicef.org/); PATH Vaccine Resources Library (www.path.org/); US Centers for Disease Control and Prevention (www.cdc.gov/); The Communication Initiative Network (www.comminit.com/) and Immunization Basics (www.immunizationbasics.jsi.com). In addition, we screened the reference lists of all the included studies and related systematic reviews for other potentially eligible primary studies.

Data extraction and analysis
Study selection
We had a two-step screening process between two authors (SYO and EOO) working independently for all records. First, titles and abstracts were screened for eligible studies. Thereafter, for the eligible studies, full text was obtained for further review and final selection of eligible studies. Duplicates were removed using the EndNote referencing software. We resolved any disagreements regarding the inclusion of studies by discussion or by consulting a third review author (LMM or LHA). We used the PRISMA flow chart36 to summarise the search and selection of studies for the review.

Data extraction
A data extraction form adopted from the COCHRANE collaboration was used by the review team. We had a two-step extraction process between two authors (SYO and EOO) where each reviewer screened each record independently after which the reviewers compared the outputs of each record, and where there was disagreement, agreement was reached through discussions with an independent reviewer (LHA or LMM).

Assessment of risk of bias in included studies
Each of the included studies was assessed for risk of bias using the Critical Appraisal Skills Programme (CASP) risk of bias tool for various studies. CASP has appraisal checklists designed for use with cohort studies,37 case–control studies38 and qualitative studies.39 The other appraisal tools used were cross-sectional study tool40 and mixed-methods risk assessment tool.41

Dealing with missing data
For studies having missing data, efforts were made to contact the primary authors to request for the missing data. For studies with missing data and efforts to reach the primary authors proved unsuccessful, then they were excluded from the final analysis.

Assessment of heterogeneity
Heterogeneity was assessed based on the type of intervention, the study setting, the study design and the risk of bias of the included studies. This was assessed using the X^2 of homogeneity and quantified using the I^2 test statistic. Thereafter, the results were presented using the forest plot and the cut-off will be set at greater than 50% for I^2 test statistics.

Data synthesis
We pooled data from studies of similar study designs, similar interventions, similar participants and similar outcomes in a meta-analysis using the random-effects model if there was no significant statistical heterogeneity, methodological difference or high risk of bias. For outcomes with substantial variation between studies in
the reported interventions, participants, study designs and outcome measures, we did not pool the results but summarise the findings in a narrative format. Overall, we interpreted the study findings by taking into account the methodological quality of the studies and the strength of the evidence. For each observed effect, we explicitly stated the strength of evidence and drew conclusions.

Subgroup analysis and investigation of heterogeneity
Subgroup analyses were conducted taking into account but not limited to: intervention type, target population and setting of the studies. In cases of heterogeneity, the data were reviewed for correctness and units of analysis to ensure that the data were correctly entered and analysed. We used the formal $\chi^2$ test for subgroup differences to test. Significant heterogeneity was assessed using subgroup analysis, and those found to have no or little effect were only described without meta-analysis.

Quality of evidence
We anticipated using the Grading of Recommendations Assessment, Development and Evaluations approach to assess the certainty of evidence at outcome level. However, there was no sufficient information from the included studies to assess the quality of evidence.

Patient and public involvement
It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Results of the search
Our review yielded a total of 874 articles from both peer-reviewed databases (434 records) and grey literature (440 records). Of the 874 records, 870 records were screened after four duplicates were removed. Following screening of abstract and titles, 42 articles were potentially included, of which 22 full-text articles were found to be eligible for inclusion in the systematic review. Twenty studies were excluded with reasons as elaborated in figure 1.

Included studies

Settings
Of the 22 studies included, 4 (18.2%) were conducted in Nigeria, 6 (27.3%) from South Africa, 3 (13.6%) from Kenya, 2 (9.1%) from Uganda, and 1 (4.5%) study each from Cameroon, Mali and Tanzania. Four studies were conducted in various countries classifying them as multicountry studies.

Study design
The study designs included were 10 (45.5%) cross-sectional studies, 7 (31.8%) cohort studies, 1 (4.5%) qualitative study, 3 (13.6%) mixed-methods studies, and 1 (4.5%) case-control study, as illustrated in table 1.

Comparison
Only one (4.5%) before and after study had a comparison system where the baseline data were compared with the end-line data. This population-based study conducted in southeast Nigeria among women and their daughters used house-to-house education intervention. Following the communication intervention, the vaccine uptake rates increased to 33.2% compared with 0.9% at the baseline. Vaccine acceptance also improved compared with the baseline rates.

Participants
Fourteen (63.6%) studies reported on targeting adolescent girls with the communication intervention, while 17 (77.3%) studies considered targeting guardians and parents of adolescent girls for vaccine communication. Six studies (27.3%) focused on targeting community leaders with communication intervention. Seven (31.8%) studies focused on targeting community leaders with communication intervention. Three (13.6%) studies focused on targeting healthcare workers with communication intervention. Similarly, some five (22.7%) studies reported on targeting policymakers and government departments for the communication intervention. Two (9.1%) focused on targeting high school girls was reported by two (9.1%) studies. This is presented in table 1.

Figure 1  The flow diagram of the screening process.
### Table 1  Summary of included studies

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Country</th>
<th>Study design</th>
<th>Communication intervention(s)</th>
<th>Outcome measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>PATH and child health and development centre57 (2011)</td>
<td>Uganda</td>
<td>Cross-sectional</td>
<td>Educate and inform</td>
<td>HPV vaccine uptake rates</td>
</tr>
<tr>
<td>Ladner et al62 (2012)</td>
<td>Lesotho and Cameroon</td>
<td>Cross-sectional (mixed methods)</td>
<td>Educate and inform, enhance community ownership, enable communication</td>
<td>Vaccine uptake</td>
</tr>
<tr>
<td>Wamai et al68 (2012)</td>
<td>Cameroon</td>
<td>Cross-sectional</td>
<td>Educate and inform, enhance community ownership, facilitate decision-making, enable communication</td>
<td>Vaccine awareness</td>
</tr>
<tr>
<td>Watson-Jones et al69 (2012)</td>
<td>Tanzania</td>
<td>Case-control</td>
<td>Educate and inform, enhance community ownership</td>
<td>Receiving or not receiving HPV vaccine</td>
</tr>
<tr>
<td>Moodley et al49 (2012)</td>
<td>South Africa</td>
<td>Cohort</td>
<td>Educate and inform, teach skills, enable communication, facilitate decision-making</td>
<td>Vaccine uptake</td>
</tr>
<tr>
<td>Galagan et al56 (2013)</td>
<td>Uganda</td>
<td>Cohort</td>
<td>Educate and inform</td>
<td>Vaccine acceptance, uptake and completion rates</td>
</tr>
<tr>
<td>Hoque and Van Hal48 (2014)</td>
<td>South Africa</td>
<td>Cross-sectional</td>
<td>Educate and inform</td>
<td>Vaccine acceptability</td>
</tr>
<tr>
<td>Vermandere et al55 (2014)</td>
<td>Kenya</td>
<td>Cohort</td>
<td>Educate and inform, remind or recall, facilitate decision-making, provide support</td>
<td>Vaccine acceptability, uptake and barriers</td>
</tr>
<tr>
<td>Ladner et al62 (2014)</td>
<td>Cameroon, Kenya, Lesotho, Tanzania and Uganda</td>
<td>Cohort</td>
<td>Educate and inform, enhance community ownership</td>
<td>Vaccine uptake and adherence</td>
</tr>
<tr>
<td>Dreyer et al52 (2015)</td>
<td>South Africa</td>
<td>Cross-sectional</td>
<td>Educate and inform, facilitate decision-making</td>
<td>Knowledge on HPV vaccination</td>
</tr>
<tr>
<td>Snyman et al57 (2015)</td>
<td>South Africa</td>
<td>Cohort</td>
<td>Educate and inform, facilitate decision-making, enable communication</td>
<td>Vaccine acceptance, uptake and completion rates</td>
</tr>
<tr>
<td>Tathiah et al51 (2015)</td>
<td>South Africa</td>
<td>Cross-sectional</td>
<td>Educate and inform, enhance community ownership, facilitate decision-making</td>
<td>Vaccine acceptance and uptake</td>
</tr>
<tr>
<td>Watson-Jones et al64 (2015)</td>
<td>Kenya</td>
<td>Qualitative study</td>
<td>Enhance community ownership</td>
<td>Vaccine knowledge and acceptability</td>
</tr>
<tr>
<td>Vermandere et al53 (2016)</td>
<td>Kenya</td>
<td>Cohort</td>
<td>Educate and inform</td>
<td>HPV vaccine uptake</td>
</tr>
<tr>
<td>Ladner et al61 (2016)</td>
<td>Cameroon, Ghana, Kenya, Lesotho, Mali, Tanzania, Uganda and Zambia</td>
<td>Cross-sectional (mixed-methods study)</td>
<td>Enhance community ownership, facilitate decision-making</td>
<td>Barriers, obstacles and strategies to analyse key concerns and lessons learnt</td>
</tr>
<tr>
<td>WHO14 (2017)</td>
<td>Countries introducing HPV vaccine</td>
<td>Cross-sectional</td>
<td>Enable communication</td>
<td>Assess country-level policies on HPV vaccination</td>
</tr>
<tr>
<td>Chigbu et al45 (2017)</td>
<td>Nigeria</td>
<td>Cross-sectional</td>
<td>Educate and inform, teach skills, community ownership</td>
<td>Vaccine awareness, uptake, adherence and completion</td>
</tr>
</tbody>
</table>

Continued
Effect of the interventions

Over half (54.5%) of the studies (n=12) were primarily concerned with vaccine uptake, 27.3% completion (n=6) and 72.7% acceptance (n=16). The other indicators assessed were knowledge, attitudes and practices on immunisation against HPV reported by 63.6% (n=14) of the studies.

Vaccine uptake

The vaccine uptake rates ranged from 31.1% in Kenya55 to 99.7% in South Africa49 51 depending on the study design, population targeted and the communication approach adopted.

Subgroup analysis showed that based on the purpose of the intervention, communication purpose to facilitate decision-making47 48 51 55 achieved 100% (95% CI 0.99% to 1.00%) uptake, followed by communication purpose to enable communication,47 49–51 which achieved 92% (95% CI 0.92% to 0.92%) uptake rates (figure 2). Based on the study design, the overall uptake was 84% with cross-sectional studies48 50 51 having the highest uptake of 94%. Majority of the studies which reported on vaccine uptake rates were cohort,47 49 55 56 62 which achieved 85% (95% CI 0.80% to 0.89%) uptake rate (figure 3). Further, based on the population targeted with the communication intervention, the overall uptake achieved was 85% with studies involving both community leaders and healthcare workers in the communication achieving 95% (95% CI 0.91% to 0.98%) uptake rates49 51 56 (figure 4). Lastly, based on the communication delivery method used, overall uptake rate was 81% with studies which included drama and dance60 and training50 56 achieving 85% (95% CI 0.84% to 0.87%) (figure 5).

Vaccine acceptance

Following communication intervention, vaccine acceptance was reported to be high by 16 studies.22 44 45 47–51 53–57 59 61 62 Targeting adolescent girls with the communication intervention reported high acceptance of the vaccine according to 11 studies.22 44 45 47–51 53–57 59 Likewise, targeting parents and guardians achieved high vaccine acceptance.44 45 47–51 54–57 59 Further, where community leaders are also targeted with communication intervention, the vaccine acceptance improved.49 51 54 56 57 Similarly, communication intervention targeting religious leaders recorded improved vaccine acceptance.54 Six studies49–51 54 56 57 reported high vaccine acceptance when teachers and educators are targeted with the communication intervention. Similarly, inclusion of healthcare workers also improved vaccine acceptance according to three studies.49 51 56 High vaccine acceptance was also reported by four studies49–51 57 when policymakers and government departments were included in the communication intervention. Further, the vaccine was accepted according to two studies,49 51 54 which included the school management boards in the communication intervention. Including boys in the communication intervention and sharing information with all learners improved acceptance.51 54 Door-to-door communication delivery also improved vaccine acceptance in Nigeria.45 Similar findings were reported where information, education and communication (IEC) materials were used according to eight studies.22 44 47 48 60 51 55 56 Similarly, five of studies22 50 51 55 56 reported high vaccine acceptance rates when the media was used in the communication intervention. Likewise, vaccination campaigns also achieved improved
Further, seven studies,\textsuperscript{22} 45-49,51,56-63 which included community meetings in the communication intervention, reported high vaccine acceptance rate.

Four studies reported high acceptability where training was part of the communication intervention.\textsuperscript{50,56,57,60} Similarly, use of letters sent to parents to notify them about vaccine availability improved acceptance rate,\textsuperscript{53} as did face-to-face communication as was reported by three studies.\textsuperscript{44,57,59}

One-time vaccine communication during the vaccination achieved vaccine acceptance in four studies.\textsuperscript{44,47,49,55,59} Similarly, communication before vaccine introduction also improved vaccine acceptance.\textsuperscript{56,57} Further, continuous communication also improved vaccine acceptance.\textsuperscript{45} Likewise, vaccine acceptance when training was included in the communication intervention was high as was reported by eight studies.\textsuperscript{22,45,50,51,55-57,59}

The training targeted both the healthcare providers and the policy-makers and included use of PowerPoint presentations and role-plays. Vaccine acceptance was also reported by 12 studies\textsuperscript{44,45,47-49,51,53-56,58} and one report\textsuperscript{57} when the content of the communication intervention was HPV

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### Table 1

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Logit(Proportion)</th>
<th>SE</th>
<th>Total</th>
<th>Total Weight</th>
<th>IV, Fixed, 95% CI</th>
<th>Proportion</th>
<th>SE</th>
<th>Total</th>
<th>Total Weight</th>
<th>IV, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccine education</td>
<td></td>
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</tr>
<tr>
<td>Cogntu 2017</td>
<td>-1.13 (0.07)</td>
<td>71</td>
<td>214</td>
<td>0.00%</td>
<td>0.33 [0.27, 0.40]</td>
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<tr>
<td>Derby 2018</td>
<td>-0.14 (0.01)</td>
<td>365</td>
<td>58723</td>
<td>11.1%</td>
<td>0.87 [0.80, 0.94]</td>
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<tr>
<td>Gallopin 2012</td>
<td>0.17 (0.01)</td>
<td>1251</td>
<td>1486</td>
<td>0.01%</td>
<td>0.94 [0.82, 1.00]</td>
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<tr>
<td>Hoque and Van Hal 2014</td>
<td>0.03 (0.01)</td>
<td>142</td>
<td>146</td>
<td>0.01%</td>
<td>0.97 [0.95, 1.00]</td>
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<tr>
<td>Laffer 2014</td>
<td>-0.17 (0.02)</td>
<td>3300</td>
<td>40106</td>
<td>2.3%</td>
<td>0.94 [0.84, 1.03]</td>
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<tr>
<td>Laffer 2015</td>
<td>-0.19 (0.01)</td>
<td>1032</td>
<td>1606</td>
<td>0.00%</td>
<td>0.94 [0.82, 1.00]</td>
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<tr>
<td>Laffer 2016</td>
<td>0.00 (0.01)</td>
<td>5739</td>
<td>6400</td>
<td>0.7%</td>
<td>0.99 [0.95, 1.00]</td>
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<tr>
<td>Laffer 2016a</td>
<td>0.12 (0.02)</td>
<td>2506</td>
<td>3006</td>
<td>0.02%</td>
<td>0.97 [0.95, 1.00]</td>
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<tr>
<td>Laffer 2016b</td>
<td>0.12 (0.01)</td>
<td>7000</td>
<td>8006</td>
<td>1.1%</td>
<td>0.99 [0.96, 1.00]</td>
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<tr>
<td>Laffer 2016c</td>
<td>-0.17 (0.02)</td>
<td>4216</td>
<td>5632</td>
<td>0.2%</td>
<td>0.76 [0.70, 0.79]</td>
<td></td>
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<tr>
<td>Laffer 2016d</td>
<td>-0.00 (0.01)</td>
<td>997</td>
<td>995</td>
<td>0.02%</td>
<td>0.95 [0.93, 0.97]</td>
<td></td>
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<tr>
<td>Mondal 2013</td>
<td>-0.03 (0.02)</td>
<td>966</td>
<td>966</td>
<td>2.3%</td>
<td>1.00 [0.98, 1.02]</td>
<td></td>
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<tr>
<td>Sherman 2010</td>
<td>-0.02 (0.01)</td>
<td>1063</td>
<td>1059</td>
<td>0.00%</td>
<td>0.99 [0.98, 1.00]</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Taylor 2015</td>
<td>-0.03 (0.02)</td>
<td>966</td>
<td>966</td>
<td>2.3%</td>
<td>1.00 [0.98, 1.02]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vermanders 2016</td>
<td>0.17 (0.04)</td>
<td>78</td>
<td>76</td>
<td>0.05%</td>
<td>0.31 [0.25, 0.37]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watson-Jones 2013</td>
<td>-0.16 (0.08)</td>
<td>4664</td>
<td>5632</td>
<td>0.3%</td>
<td>0.95 [0.84, 1.06]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>489166</td>
<td>579562</td>
<td>0.98%</td>
<td>0.98 [0.96, 0.99]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Figure 2** Effect of the intervention on vaccine uptake rates categorised by purpose of the communication intervention.
Further, focusing on HPV screening led to vaccine acceptance according to two studies.44 59 Vaccine adherence and completion was reported by six studies.22 47 51 55 62 The completion rates ranged from 60.9% in Cameroon22 where the communication channels used included community meetings, informational posters, flyers, television, radio and newspapers, to 97.8% in South Africa51 where intensive communication and education of all stakeholders were done prior to the initiation of the vaccination project. According to two studies51 62 which involved community and religious leaders, teachers and educators, healthcare workers, school management boards and policymakers, the completion rate was 97.8%. The other stakeholders included according to other studies are: the Department of Health and the Department of Education at national, provincial and district level, parents, learners, educators, healthcare workers, community leaders and the media.22 45 50 Similar results were reported by two studies,51 56 which targeted healthcare workers with the communication intervention.

According to nine studies,43 44 47 48 50–52 56 60 use of IEC materials, like brochures, pamphlets, fact sheets and flyers, achieved a change in knowledge and attitude towards the vaccine. School-based training was shown to improve knowledge and attitude towards the vaccine by two studies46 58 as well as use of mass media.50 51 56 58 60 Use of HPV screening led to vaccine acceptance according to two studies.44 59

Knowledge and attitude improved following communication intervention as was reported by 18 studies.43–48 50–52 54 55 57–62 Targeting adolescent girls also recorded improved knowledge and attitude. This was reported by eight studies.47 50 54 56–60 Similarly, change in knowledge and attitude was recorded by 11 studies.44 47 48 50–52 56–60 when parents and guardians were the target for the intervention. Communication intervention targeting community leaders also reported change in knowledge and attitude towards the vaccine.51 54 56 Further, communication intervention targeting religious leaders recorded change in knowledge and attitude towards the vaccine54 as was also recorded by five studies44 47 48 50–52 56 after the intervention targeted the teachers and educators. Similar results were reported by two studies,51 56 which targeted healthcare workers with the communication intervention.

According to nine studies,43 44 47 48 50–52 56 60 use of IEC materials, like brochures, pamphlets, fact sheets and flyers, achieved a change in knowledge and attitude towards the vaccine. School-based training was shown to improve knowledge and attitude towards the vaccine by two studies46 58 as well as use of mass media.50 51 56 58 60 Adverse event

No study reported on adverse event following communication strategy for HPV vaccination.

Cost

None of the studies reported on the cost of the communication intervention, rather the studies discussed the cost of immunisation.

Successes, challenges and lessons

The main successes of the intervention included increased support and trust in the vaccine, and improved

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Log(proportion)</th>
<th>SE Total</th>
<th>Weight IV Total</th>
<th>Proportion Random, 95% CI</th>
<th>SE Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galagan 2013</td>
<td>-0.174 0.111</td>
<td>1215 1489</td>
<td>6.7</td>
<td>0.68</td>
<td>0.62 0.88</td>
</tr>
<tr>
<td>Linnstetter 2014a</td>
<td>-0.995 0.046</td>
<td>1579 1530</td>
<td>6.9</td>
<td>0.68</td>
<td>0.62 0.88</td>
</tr>
<tr>
<td>Lauder 2014b</td>
<td>-1.161 0.258</td>
<td>2550 5550</td>
<td>6.9</td>
<td>0.68</td>
<td>0.62 0.88</td>
</tr>
<tr>
<td>Latner 2014c</td>
<td>-1.122 0.003</td>
<td>70889 80100</td>
<td>6.9</td>
<td>0.68</td>
<td>0.62 0.88</td>
</tr>
<tr>
<td>Latner 2014d</td>
<td>-2.273 0.008</td>
<td>4210 5532</td>
<td>6.6</td>
<td>0.76</td>
<td>0.75 0.77</td>
</tr>
<tr>
<td>Latner 2014e</td>
<td>-0.04 0.007</td>
<td>937 995</td>
<td>6.9</td>
<td>0.00</td>
<td>0.54 0.90</td>
</tr>
<tr>
<td>Wino 2013</td>
<td>-0.983 0.002</td>
<td>980 963</td>
<td>6.0</td>
<td>1.00</td>
<td>0.80 1.00</td>
</tr>
<tr>
<td>Ynman 2015</td>
<td>-0.806 0.002</td>
<td>1053 1059</td>
<td>6.8</td>
<td>0.98</td>
<td>0.90 1.02</td>
</tr>
<tr>
<td>Vendernier 2014</td>
<td>-1.176 0.084</td>
<td>79 256</td>
<td>2.5</td>
<td>0.72</td>
<td>0.20 2.07</td>
</tr>
</tbody>
</table>

Heterogeneity Tau^2 = 0.01; Chi^2 = 5534.89; df = 8; P < 0.00001; I^2 = 100%

Test for overall effect: Z = 9.15 (P < 0.00001)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Log(proportion)</th>
<th>SE Total</th>
<th>Weight IV Total</th>
<th>Proportion Random, 95% CI</th>
<th>SE Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiqui 2017</td>
<td>-1.102 0.087</td>
<td>71 211</td>
<td>2.4</td>
<td>0.33</td>
<td>0.27 0.40</td>
</tr>
<tr>
<td>Dufour 2015</td>
<td>-0.146 0.004</td>
<td>35964 40073</td>
<td>6.9</td>
<td>0.87</td>
<td>0.56 1.57</td>
</tr>
<tr>
<td>Hoque and Van Hal 2014</td>
<td>-0.505 0.044</td>
<td>142 146</td>
<td>6.0</td>
<td>0.97</td>
<td>0.91 1.03</td>
</tr>
<tr>
<td>Truhill 2015</td>
<td>-9.093 0.002</td>
<td>900 963</td>
<td>6.8</td>
<td>1.00</td>
<td>0.90 1.10</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>-354.7 0.4046</td>
<td>313.1 400.4</td>
<td>22.7</td>
<td>0.81</td>
<td>0.73 0.90</td>
</tr>
</tbody>
</table>

Heterogeneity Tau^2 = 0.04; Chi^2 = 47.16; df = 3; P < 0.00001; I^2 = 100%

Test for overall effect: Z = 3.10 (P < 0.0001)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Log(proportion)</th>
<th>SE Total</th>
<th>Weight IV Total</th>
<th>Proportion Random, 95% CI</th>
<th>SE Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latner 2013a</td>
<td>-0.177 0.002</td>
<td>3305 40150</td>
<td>6.9</td>
<td>0.84</td>
<td>0.84 0.65</td>
</tr>
<tr>
<td>Latner 2013b</td>
<td>-0.439 0.019</td>
<td>1032 1600</td>
<td>6.4</td>
<td>0.64</td>
<td>0.62 0.67</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>-348.33 418.90</td>
<td>313.3 400.4</td>
<td>12.5</td>
<td>0.74</td>
<td>0.57 0.95</td>
</tr>
</tbody>
</table>

Heterogeneity Tau^2 = 0.04; Chi^2 = 198.78; df = 1; P < 0.00001; I^2 = 99%

Test for overall effect: Z = 2.27 (P < 0.02)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Log(proportion)</th>
<th>SE Total</th>
<th>Weight IV Total</th>
<th>Proportion Random, 95% CI</th>
<th>SE Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watson-Jones 2012</td>
<td>-0.166 0.006</td>
<td>4694 5532</td>
<td>6.8</td>
<td>0.85</td>
<td>0.84 0.86</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>-468.33 518.90</td>
<td>400.4 518.90</td>
<td>8.8</td>
<td>0.85</td>
<td>0.84 0.86</td>
</tr>
</tbody>
</table>

Heterogeneity Not applicable

Test for overall effect: Z = 2.27 (P < 0.0001)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Log(proportion)</th>
<th>SE Total</th>
<th>Weight IV Total</th>
<th>Proportion Random, 95% CI</th>
<th>SE Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (95% CI)</td>
<td>-48193.56 52792.6</td>
<td>100.0</td>
<td>0.84</td>
<td>0.81 0.87</td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity Tau^2 = 0.00; Chi^2 = 11912.24; df = 1; P < 0.00001; I^2 = 100%

Test for overall effect: Z = 9.21 (P < 0.0001)

Test for subgroup differences: Chi^2 = 1.84; df = 3; P = 0.58; I^2 = 0%
knowledge about HPV, HPV vaccine and cervical cancer. The communication intervention also improved the vaccine acceptance and its recommendation. Lastly, the intervention was able to foster partnerships between the community, the health workforce and both local and international organisations.

The challenges faced included fears about the vaccine side effects and its effectiveness, the vaccine not being given the due priority, prior negative campaigns from the media and poor promotion, mistrust about the vaccine by the community and language barrier. From these challenges and successes, it is important to include information on the vaccine safety and effectiveness in the messaging; the hard-to-reach population should be targeted with the communication and use of community outreach; and the media are effective in passing the information. Use of community influencers including community health volunteers is effective in mobilising the community as illustrated in table 2.

### Excluded studies

A total of 20 studies were excluded and the reasons for exclusion included studies that did not have any communication intervention, studies done outside the study settings, studies not in line with the outcome of interest and one study that was not focused on HPV vaccination (online supplemental appendix C).
Risk of bias

We had 18 observational studies (7 cohort studies, 1 case–control and 10 cross-sectional studies). All the eight cohort studies had a low risk of bias as most of the domains in the risk of bias assessment had minimal flaws as shown in figure 6.

From the cross-sectional (n=6), case study (n=1), before and after (n=1) and pretest and post-test (n=1), three were high risk while six were of moderate risk of bias as presented in figure 7.

Only one qualitative study was assessed using the qualitative tool included, which had low risk of bias as shown in figure 8.

There was one case–control study that had a low risk of bias as most of the domains in the risk of bias assessment had minimal flaws as shown in figure 9.

Out of the three mixed-methods studies, two studies had descriptive cross-sectional analysis with low risk, while one study that had analytical cross-sectional analysis had a high risk of bias as illustrated in figures 10 and 11, respectively.

DISCUSSION

From the 22 included studies, the communication interventions majorly focused on the strategies involving sharing of information and/or educating the population about HPV and the vaccine, facilitating decision-making about taking up the vaccine and improving community ownership of the process. As recommended by the European Union and WHO in the ‘Ten actions towards vaccination for all’, healthcare professionals as well as
<table>
<thead>
<tr>
<th>Communication Intervention</th>
<th>Successes</th>
<th>Challenges</th>
<th>Lessons Learnt/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform or educate</td>
<td>► Led to general support and trust in vaccines.54</td>
<td>► Most of the general population reported fears of potential side effects as barriers to vaccine acceptance.48,55</td>
<td>► Messaging to include more information on the HPV vaccine safety and effectiveness.48,61</td>
</tr>
<tr>
<td></td>
<td>► Sensitisation campaigns effective.58</td>
<td>► Cervical cancer vaccination was not considered a priority by others.55</td>
<td>► Information on HPV should target the hard-to-reach population and be tailored to specific population.54,60</td>
</tr>
<tr>
<td></td>
<td>► Increased cervical cancer knowledge, awareness or intent due to educational intervention.44,47</td>
<td>► Negative messaging from media campaigns in print, broadcast and online.50</td>
<td>► Community outreach strategies like mass media are effective approaches to disseminate information.49</td>
</tr>
<tr>
<td>Facilitate decision-making</td>
<td>► After receiving basic HPV information, participants were willing to accept HPV immunisation.48,58</td>
<td>► Poor promotion due to lack of invitation from consent issued.55</td>
<td>► Parents/caregivers should be provided with an opportunity and means to provide informed consent.49</td>
</tr>
<tr>
<td></td>
<td>► A prior measles campaign made parents familiar with vaccination.55</td>
<td>► Logistical challenge of obtaining informed consent prior to a child’s vaccination.</td>
<td>► Use of community influencers is an important factor in the parent’s vaccine decision-making for the child.56</td>
</tr>
<tr>
<td>Enhance community ownership</td>
<td>► CHV utilisation was considered a valuable source of information.54</td>
<td>► Vaccine mistrust by community.54</td>
<td>► CHV utilisation is a promising strategy as CHVs are valued as source of information and mobilisers in the community settings.54</td>
</tr>
<tr>
<td></td>
<td>► High awareness and knowledge among parents/guardians.58</td>
<td>► Pastoral communities practising FGM misunderstood the HPV vaccination information as a government strategy to counter their traditional practice of FGM leading to community resistance.54</td>
<td>► Critical need to provide detailed information on vaccine benefits to avoid misinformation.54</td>
</tr>
<tr>
<td></td>
<td>► More willingness to vaccinate and recommend vaccination.58</td>
<td>► Misinformation about infertility as vaccines’ effects from a previous tetanus campaign.54,61</td>
<td>► Extensive social mobilisation is key in improving uptake.54,61</td>
</tr>
<tr>
<td></td>
<td>► Partnership building through vaccine donation to local organisations and institutions.22,58</td>
<td>► Concerns on effectiveness and side effects.58</td>
<td>► There were concerns around HPV vaccine messaging indicating the targeted girls before their sexual debut who would discourage eligible girls who had passed their sexual debut.54</td>
</tr>
<tr>
<td></td>
<td>► Successful community involvement in awareness creation, vaccination announcements and follow-up of girls for the 3 vaccine sessions.22</td>
<td>► Involvement of multiple stakeholders complicated the social mobilisation.50</td>
<td>► Need for more expanded outreach programmes to address misconception and adequate information is available.58</td>
</tr>
<tr>
<td></td>
<td>► Voluntary financial contribution to cover administrative costs led to increased community involvement and support.22</td>
<td></td>
<td>► Future programme to conform to local norms.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>► Community-based educational interventions that are specifically focused on gender and context increase vaccination.44</td>
</tr>
<tr>
<td>Provide support</td>
<td>Not indicated.</td>
<td>► Partners’ objection and religious belief lowered vaccine acceptance.56</td>
<td>► Tailor promotional messages to the needs of various groups.55</td>
</tr>
</tbody>
</table>

Continued
the media should be empowered to provide effective, transparent and objective information to the public and fight false and misleading information. The increasing economic pressure globally requires evidence-based tools to support a value-based decision-making process in the prevention field of immunisation. Understanding of this value should be shared by all health actors and be geared towards the goal of maximising social well-being.

The meta-analysis highlights the importance of sharing information about the vaccine, targeting the various stakeholders and using channels which allow for interaction and provide reference materials as the most effective combination if the 90% coverage set by the WHO is to be achieved by 2030. However, the completion rates remained below 90% despite the communication interventions, with only three studies achieving

Table 2 Continued

<table>
<thead>
<tr>
<th>Communication intervention</th>
<th>Successes</th>
<th>Challenges</th>
<th>Lessons learnt/recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable communication</td>
<td>Not indicated.</td>
<td>Difficulty in translation of basic cervical cancer information to local terms, for example, 'cervix' equivalent does not exist in some local languages.</td>
<td>Participatory training strategy that uses simple visual materials in an understandable language is an effective strategy.</td>
</tr>
<tr>
<td>Teach skills</td>
<td>Use of community health educators led to trust of the local population.</td>
<td>The use of health educators working in primary healthcare is a sustainable option.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased knowledge from peer education.</td>
<td>Peer education system is an effective strategy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training of primary health workers builds the skills and capacities of cancer prevention at the community level.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHV, community health volunteer; FGM, female genital mutilation; HPV, human papillomavirus.

Figure 6 Risk of bias graph for cohort studies.

Figure 7 Risk of bias graph for cross-sectional studies.
a completion of 90% and above. It is also important to target all the stakeholders involved in the care of the targeted adolescent girls and the girls themselves in order to achieve maximum vaccine uptake and completion rates.

The included studies reported HPV vaccine completion outcomes using varying communication strategies based on the vaccine dose offered comprising of either a three-dose or two-dose vaccination. Previous study findings have highlighted logistical and intensive infrastructure for administering multiple vaccine doses. The efficacy and use of single-dose vaccine are evolving rapidly with recommendation for use by the WHO; therefore, integrating communication interventions with a one-time dosage would create demand and address the completion barriers. Further, except for one study, baseline vaccination rates were not reported to measure the impact of the communication intervention. In addition, vaccine acceptance and change in knowledge were also not quantified.

This review points out the importance of proper communication about the HPV vaccine; this is in agreement with the findings of other primary studies which pointed out the importance of proper communication that addresses the concerns of the community and also points out any adverse effects associated with the vaccine and its efficacy. Similarly, a communication strategy, incorporating an appropriate selection of the available communication tools, should be an integral part of every immunisation programme, addressing the specific factors that influence hesitancy in the target populations while emphasising the overall value of vaccination, which includes the technical value, the allocative value, the personal value and the social value. Similar to our
study findings, a review of literature from 1999 to 2017 on vaccine hesitancy revealed that evidence-based communication at the community level is necessary to address vaccine hesitancy. Another systematic review on factors affecting vaccine uptake among children also pointed out the need for information sharing with both the community and the healthcare providers to increase the knowledge about the vaccine.26 Yet, another review reported that communication strategies targeting the parents, healthcare workers and the adolescents themselves could be effective in improving HPV vaccine uptake.93

To achieve the WHO target of 90% coverage by 2030, the population to be targeted by the communication intervention needs to be chosen carefully. The subgroup analysis revealed that targeting community leaders, healthcare workers, and teachers and school management boards yielded the best results;47 52 53 57 this is due to the influence these groups of people have on the parents and targeted adolescent girls in the community and school. Similar findings were reported by two primary studies which noted the importance of involving healthcare workers, political leaders and all stakeholders in communication intervention.17 23 However, a systematic review on provider communication about HPV vaccination found that healthcare providers were a weak link in the vaccine communication channel. The providers often sent mixed messages by failing to endorse HPV vaccine strongly, differentiating it from other vaccines, and presenting it as an ‘optional’ vaccine that could be delayed.21 This is contrary to this review findings that found provider recommendation to be a key positive influencer of vaccine uptake hence the need to train the health providers for optimal vaccination coverage.

Finally, it is important to note the strength of this study lies in the nature of its design. It is a systematic review that included electronic and grey resources and therefore reduced bias by systematically identifying studies, appraising them using predetermined and explicit methods where possible and the results were aggregated using meta-analysis methodology where applicable. Despite the comprehensive search, some studies might have been missed nonetheless. Further, studies published in other languages other than English did not meet the inclusion criteria for this review. A limitation of this review is that it relied on data from original publications and we did not have sufficient time or resources to contact authors for additional information. In addition, many of the original studies did not provide sufficient details to enable assessment of the quality of evidence of each study; therefore, we cannot report on the methodological quality of the included studies.

CONCLUSION

Vaccine communication is a very important part of vaccine uptake introduction to the population. Communication needs to pass critical information about the vaccine and its benefits while also addressing the concerns of the community about the vaccine. This can take various forms, from face-to-face communication, to use of IEC materials and the media to reach a wider population. The communication also needs to be sustained throughout the campaign period to encourage the target population to be fully vaccinated. Additionally, the communication intervention needs to target the key members of the community including teachers, school management boards, community and religious leaders, and the parents. This ensures greater level of community ownership and ease of decision-making about the vaccine with better completion rates.

As SSA countries move towards the introduction and implementation of HPV vaccination at the national level, strategies that enhance vaccination campaigns and stakeholder engagement are crucial to increase vaccination uptake and completion. Targeting the healthcare and the education systems with these communication interventions could potentially achieve the best results. Similarly, using training, face-to-face communication and IEC materials allows for information exchange and future reference, respectively. Worthwhile to note, the included studies did not assess the adverse effects and the cost-effectiveness of the intervention used. This is an indication of a research gap, which needs to be addressed. Lastly, high levels of heterogeneity observed mean that future studies need to be harmonised in terms of the intervention, target population, reporting and the definition of vaccine completion either as two or three doses for uniformity of reporting and assessment of completion rates.

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Contributors All the authors (SYO, EOO, LMM, JAO and LHA) participated in the conception and design, SYO and EOO contributed to acquisition of data, LHA conducted the meta-analysis of the data. All the authors (SYO, EOO, LMM, JAO and LHA) participated in interpretation of data and manuscript writing. SYO is responsible for the overall content as the guarantor.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval This systematic review and meta-analysis was based on published data. As researchers did not access any information that could lead to the identification of an individual patient, no concerning ethical issue was raised in this research. Therefore, obtaining ethical approval and consent of participants was waived.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

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