Effectiveness of Integrating HPV Vaccine Delivery into Routine EPI in low and middle-income countries – Protocol for a Living Systematic Review

Protocol information

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Note to tactical Group Members – common sections during reviewing the three LSRs

LSRs 6, 7, and 8 form part of a coordinated series of living systematic reviews evaluating different approaches to HPV vaccine delivery. To minimize duplication of effort during protocol review, please note that several sections are intentionally harmonized across the protocols and are identical or substantially similar.

The following sections are common across all three LSRs and generally only need to be reviewed once:

- Background and rationale relating to HPV vaccination and cervical cancer prevention (at least the first three paragraphs)
- Overall methodological approach
- Eligibility criteria relating to populations
    - Study types, Publication status, Participants, Geographical context, Language, Year
- Study designs eligible for inclusion
- Search methods and Screening
    - Study selection procedures
- Risk of bias/critical appraisal methods
- Data extraction procedures
- Analysis
- Certainty of evidence assessment
- Living review procedures and update processes

Note: we encourage focus on detailed review on the sections that differ across protocols, namely:

LSR 6 - Integrated Health Services and HPV Vaccination

- Key terms and concepts; Eligibility criteria - concepts; Outcomes

LSR 7–– HPV Vaccination in Adolescent Health Service

- Key terms and concepts; Description of the interventions; Eligibility criteria - concepts; Outcomes

LSR 8 - HPV Vaccination Through Routine EPI

- Key terms and concepts; Eligibility criteria - concepts; Outcomes

Effectiveness of Integrating HPV Vaccine Delivery into Routine EPI in low and middle-income countries: Protocol for a Living Systematic Review protocol (Version 1.0)

Introduction

This living systematic review (LSR) is being produced for the HPV Living Evidence and Knowledge Partnership.

The partnership includes:

- The Alive team at the Future Evidence Foundation. The goal of Alive is to build innovative evidence systems that empower decision-makers to solve society's most pressing challenges.
- The Center for Evidence-synthesis, Support & Development in Africa (CESDA), an Ethiopia-based organization with expertise in systematic reviews, evidence synthesis, and knowledge translation. CESDA brings strong experience in systematic, rapid, qualitative, and mixed-methods reviews, supporting evidence-informed decision-making across health and development sectors in African contexts.
- University College London (UCL) Evidence for Policy & Practice Information Centre (EPPI Centre). The EPPI Centre aims for better evidence for better decision-making: robust and responsive reviews informing policy and practice
- The HPV vaccine delivery community, represented through three structures: a steering group, a tactical group, and a group of advisors.

Background

Cervical cancer remains a major global public health problem despite being highly preventable. Globally, it was the fourth most common cancer among women worldwide in 2022, with an estimated 662,301 new cases and 350,000 deaths. However, this figure masks a profound geographic disparity where the disease disproportionately (94% of cervical cancer deaths) concentrates in low- and middle-income countries (LMICs), being the leading cause of cancer-related mortality among women across sub-Saharan Africa and parts of Southeast Asia (1,2).

These regional differences reflect disparities in access to vaccination, screening, and treatment services further influenced by broader social and economic determinants, including gender inequality and poverty (3,4).

More than 95% of cases are attributable to persistent infection with oncogenic HPV genotypes, particularly types 16 and 18. A causal relationship that renders cervical cancer, in principle, both preventable through vaccination and detectable through screening (3,5). Because prophylactic HPV vaccination can prevent the majority of HPV-attributable cervical cancers, it is a cornerstone of primary prevention and a critical component of global efforts to reduce the burden of disease (4,5).

Recognizing both the preventability of cervical cancer and the disproportionate burden carried by poorer countries, the World Health Organization (WHO) launched the Global Strategy to Accelerate the Elimination of Cervical Cancer as a Public Health Problem. This strategy established the 90-70-90 targets to be achieved by 2030: 90% of girls fully vaccinated with the HPV vaccine by age 15 years, 70% of women screened with a high-performance test by ages 35 and 45 years, and 90% of women identified with cervical disease receiving appropriate treatment and care. Achieving these targets would place countries on the path toward eliminating cervical cancer as a public health problem (1).

Although HPV vaccination is central to this elimination agenda, implementation has lagged behind policy ambition. Global HPV vaccine coverage has improved, but it remains well below the 90% target, and progress has been uneven across settings. WHO reported that first-dose HPV vaccine coverage among girls increased from 27% in 2023 to 31% in 2024, while coverage in lower-income countries supported by Gavi reached 25% in 2024 (6,7). Although these gains are important, they remain far below the threshold required for elimination and point to persistent weaknesses in programme reach and continuity.

A recent analysis by Han et al. (2025) found that HPV vaccination coverage among girls aged 15 years in LMICs was 46.4% for the first dose and 39.9% for the complete series, underscoring a substantial gap relative to the WHO target (8). This is mainly attributed to lack of strong community engagement and unacceptability of the services, understaffing, lack of political support and poor coordination of health with other sectors (9,10). Unlike most childhood vaccines, HPV vaccination targets older adolescent girls, requiring countries to adopt delivery strategies that are both effective and sustainable beyond the period of initial programme introduction. This distinction is particularly consequential for LMICs, which continue to face substantial challenges in identifying and implementing such strategies(11). Several delivery platforms have been employed, to reach eligible individuals, including school-based programs, community outreach campaigns, and routine health facility contacts. Integration into routine Expanded Programme on Immunization (EPI) contacts offers potential advantages in terms of programme sustainability and reduced marginal cost per dose delivered (12). School based delivery has achieved high coverage due to its ability to efficiently reach large numbers of girls, however, it may not be ideal as it may fail to reach out-of-school and marginalized girls.

On the other hand, facility based and outreach approaches may have demonstrated high population coverage by efficiently reaching large cohorts of girls, however, this approach may inadequately serve out-of-school and otherwise marginalized

populations, thereby contributing to equity gaps. more targeted or tailored delivery approaches may better address equity gaps by reaching underserved populations, but they are often constrained by operational and logistical challenges. Routinized and integrated delivery models that combine routine immunization infrastructure with periodic outreach activities have also received increasing attention in recent literature as potentially offering a balance for coverage and equity objectives (12).

This review addresses a critical evidence gap by examining the comparative effectiveness, feasibility, equity, and sustainability of integrating HPV vaccine delivery into the routine immunization/EPI contacts relative to alternative delivery strategies. Given the limited and heterogeneous nature of the currently available evidence, and rapidly evolving global HPV vaccination landscape, a living systematic review format is particularly appropriate. It enables the continuous incorporation of emerging evidence to support timely, evidence-informed policy and programmatic decision-making (13,14). Thus, this review will synthesize available evidence on the integration of HPV vaccine delivery into routine EPI contacts, assessing its effectiveness relative to alternative delivery approaches.

Why is it important to do this living systematic review?

Given the rapidly evolving and context-dependent nature of HPV vaccine delivery integration into routine EPI platforms, a traditional static review would quickly become outdated. An LSR provides an approach that can continuously incorporate new evidence, track emerging patterns, and support timely decision-making for countries introducing or scaling up HPV vaccination (15). This is particularly important in LMIC settings, where programs must often adapt to dynamic information environments, resource constraints, and varying program contexts.

The current global priority is the vaccination of adolescent girls before they become sexually active, which is the primary and most effective strategy for reducing the incidence of cervical cancer. Many countries have introduced HPV vaccination into their national immunization programs. Delivery strategies vary across contexts, including school-based delivery, facility-based delivery, and outreach or campaign approaches that are implemented through EPI systems. However, in many settings HPV vaccination is delivered as a vertical or stand-alone activity rather than being fully integrated into routine EPI sessions. These variations reflect ongoing implementation learning, as countries adapt delivery platforms to their school systems, health system capacity, and adolescent reach strategies (16).

Given the high priority for decision-making and the continuous emergence of new evidence, up-to-date syntheses of studies are needed, particularly in fast-moving and dynamic research areas. Thus, a living systematic review allows for regular and ongoing

updates by incorporating emerging evidence as it becomes available. We currently have funding to keep the review living until early 2027 but are exploring options for sustainability beyond that.

In this protocol, we have considered PRISMA guidance established for living systematic reviews (17).

Research questions

What is the effectiveness of HPV vaccinations delivered through routine EPI contacts compared with alternative delivery platforms in terms of vaccine uptake, series completion, timeliness, equity, cold-chain capacity, cost, and acceptability in eligible populations in low- and middle-income countries (LMICs)?

Primary Research Question

1. What is the effect of delivering HPV vaccination through routine EPI contacts on initiation (uptake) among age-eligible populations compared with alternative delivery platforms?
2. What is the effect of delivering HPV vaccination through routine EPI contacts on completion of the HPV vaccination schedule among initiators compared with alternative delivery platforms?
3. What is the effect of delivering HPV vaccination through routine EPI contacts on timely receipt of HPV vaccine doses according to recommended schedules compared with alternative delivery approaches?

Secondary Research Questions

1. How does delivering HPV vaccination through routine EPI contacts affect equity in vaccination outcomes across population subgroups defined by sex, socioeconomic status, geographic remoteness, and school enrolment status compared with alternative delivery platforms?
2. What is the effect of delivering HPV vaccination through routine EPI contacts on cold-chain capacity and related implementation considerations compared with alternative delivery approaches?
3. What evidence exists on the programme cost, delivery cost, and cost-effectiveness of delivering HPV vaccination through routine EPI contacts compared with alternative delivery approaches?

4. How do health workers, caregivers, and adolescents perceive feasibility and acceptability of HPV vaccination delivered through routine EPI contacts compared with alternative delivery approaches?

Key terms and concepts

Integrated HPV Vaccine Delivery: the delivery of HPV vaccination through the existing Expanded Programme on Immunization (EPI) system, utilizing fixed or outreach service delivery points such as health posts and health centers.

Routine EPI contacts: Scheduled immunization service delivery points established under existing EPI, typically delivered through fixed health facilities and/or outreach sessions, and in some contexts school-based or mobile strategies organized within the EPI system.

Alternative delivery approach: refers to implementation strategies where HPV vaccination is delivered through stand-alone or supplementary delivery modalities within national immunization programs, rather than through established routine EPI schedules. These may include school-based vaccination campaigns, outreach or mobile delivery sessions, or facility-based campaign delivery targeting adolescents. In most settings, these strategies are used because routine adolescent immunization contact points are limited or not yet established, and HPV vaccination is therefore often delivered through dedicated delivery platforms rather than integrated routine EPI visits.

PROGRESS Plus framework: P-Place of residence (urban/rural, region); R - Race/ethnicity/culture/language; O- Occupation; G - Gender/sex; R – Religion; E-Education; S-Socioeconomic status; S-Social capital, Personal characteristics (age and disability), and feature of relationship (schooling status) (18).

Low- and middle-income countries (LMICs): Countries classified as Low- and middle-income economies according to the World Bank country income classification at the time of the study.

Description of the interventions

The intervention of interest for this review is integrated HPV vaccine delivery, defined as the delivery of HPV vaccination through the existing EPI system, utilizing fixed. outreach or mobile service delivery points such as health posts, health centers and community centers

Eligible intervention models include HPV vaccination delivered through routine EPI contacts, including:

1. Scheduled health-facility visits for childhood or adolescent immunizations;
2. School-health visits administered through the health system; and
3. Any contact originally designed to deliver one or more EPI antigens that is co-used for HPV vaccine delivery.

Hybrid models combining routine EPI contacts with additional modalities (e.g., targeted outreach for girls not reached through routine services) will also be included and analyzed separately from pure integration models.

Comparators will include alternative delivery approaches, defined as delivery of the HPV vaccine as a standalone intervention through school-based programs, outreach, mobile, campaigns, facility-based campaigns, or hybrid or multi-platform approaches without integration into routine EPI contacts.

Engagement and reporting

The primary users of this LSR will be decision-makers and primarily their advisors in LMICs, involved in HPV vaccine delivery, including but not limited to: representatives from National and Regional Immunization Technical Advisory Groups (NITAGs), EPI teams, Ministries of Health, Ministries of Education, Ministries of Finance, technical partners, academia, researchers, implementing partners, and civil society. However, this LSR also has application to policy, program design, and implementation decisions for normative and financing institutions, technical and learning partners, and evidence intermediaries at global and regional levels.

This review is not intended to replace national decision-making processes. Rather, it aims to strengthen evidence-informed deliberation by providing decision-makers at all levels with a continuously updated and contextually relevant synthesis of evidence on HPV vaccine delivery integration into routine EPI platforms.

Alive as the partnership secretariat will facilitate and convene a community of users to engage with, support the dissemination of, and directly use evidence that emerges from this LSR. This community and engagement process will focus on collectively refining a rigorous body of evidence to ensure policy and practice questions are met with timely and context-specific answers.

The community will be engaged through three structures.

- Steering Group (SG) which provides stewardship to the development of the living HPV vaccine delivery evidence base. It provides strategic direction and ensures

that the living evidence serves the needs of the broader research and delivery community and meets the needs of end users. See here for the involved individuals.

- Tactical Group (TG) which provides expert guidance and technical oversight to CESDA, UCL and Alive, the teams responsible for developing the LSR. Members of the TG will provide technical oversight to ensure the LSR is both methodologically sound and meets the needs of decision-makers. The TG will provide technical oversight to ensure the development of robust, high-quality living protocol, providing input on PICO frameworks, search strategies, and inclusion criteria.
- Advisory Group (AG): Provides technical input and systems insight to inform the SG's strategic decisions. The AG includes membership from global normative and financing institutions and regional technical and learning partners and evidence intermediaries

Methods

This study is an LSR and will be updated continually. An LSR is a high quality, up-to-date online synthesis of research that is updated as data from new relevant research that meets study inclusion criteria becomes available (15). This means that, following an initial search up to September 2026, repeat searches will be re-run monthly, any new studies incorporated into the review, and updates will be regularly published. Based on current funding, we anticipate that the last update will be in February 2027, but options for sustainability beyond that are being explored. The protocol will be registered on PROSPERO. In this protocol, we have considered PRISMA guidance established for LSRs (19). All the data and analyses compiled and generated by the project will be stored at data.evidence-repository.org .

Eligibility criteria

Study types

Inclusion

The review will include eligible studies that employed

- Experimental and quasi-experimental study designs (randomized controlled trials, cluster RCTs, and controlled before-and-after studies) and observational studies (cohort, case-control, and cross-sectional).
- The review will also include qualitative studies and mixed-methods studies to capture implementation determinants (barriers and facilitators), feasibility and

acceptability, and unintended consequences along with contextual, stakeholder perspectives related to integrating HPV vaccine delivery into the routine immunization services.

Exclusion

The review will exclude

- Editorial comments, conference abstracts that don't provide full data, non-evaluative program reports, narrative reviews, and animal studies.
- Studies lacking sufficient methodological detail or outcome data will also not be considered for inclusion.

Publication status

Inclusion

- Published studies (identified through MEDLINE, CINAHL, Cochrane Library, Embase, PsycInfo, and Web of Science databases)
- Unpublished or grey literature sources. Grey literature will include materials identified through Google Scholar, OpenAlex, WHO IRIS, UNICEF, and Gavi repositories, as well as relevant studies identified through reference list screening of included papers.

Exclusion

- Conference abstracts and preprints (including non-peer-reviewed preprints) for which a full-text version or complete report cannot be obtained after reasonable attempts

Concepts

Inclusion

- Studies reporting on HPV vaccine delivery through routine EPI contacts or comparing EPI-integrated delivery with school-based, outreach, facility-campaign, or hybrid platforms; reporting at least one outcome on uptake, completion, timeliness, equity, system performance, cost, acceptance, or acceptability

Exclusion

- Studies delivering HPV vaccine solely through dedicated campaigns without any routine EPI component; studies not reporting any eligible outcome. Studies

primarily evaluating the integration of other health services alongside HPV vaccination delivery and integration of HPV vaccination with adolescence health service points will be excluded, as these integrations/interventions are addressed in LSR 6 and LSR 7.

Participants

Inclusion

This review will consider

- Studies involving early adolescent and adolescent girls as the primary target population, defined as all girls aged 9-14 years, consistent with WHO priority recommendations for HPV vaccination.
- Studies involving secondary target populations will also be considered, including
    - Females aged 15 years and older (including women in catch-up cohorts), boys and men
- Relevant stakeholders
    - Parents/caregivers
    - Healthcare providers
    - Teachers/school administrators
    - Policymakers/program managers

Exclusion

- Adults above 45 years of age (the age limit applies only to the vaccine-recipient population, not to stakeholder respondents)
- Pregnant women
- Populations with existing HPV-related cancers

Geographical context

Inclusion

- Studies conducted in LMICs as defined by the World Bank classification
- Multi-country studies will be eligible if data from LMIC settings can be extracted separately.

Exclusion

- Studies conducted exclusively in high-income countries (HICs) will be excluded.

Language

Inclusion

- Publications in any language will be eligible.
- Non-English records identified during the search will be screened for potential eligibility using automated translation tools (e.g., Google Translate) at the title and abstract stage. Where studies are deemed potentially relevant, full-text Translation support will be sought where feasible to enable full-text review and inclusion.

Exclusion

- None; no language restrictions are applied
- Studies for which full-text translation is not possible or feasible will not be included in the review. These studies will be documented and their potential relevance will be noted, but they may be excluded from full-text review, data extraction and synthesis.

Year

Inclusion

- All studies/records with no date restriction

Exclusion

- None

Outcomes

This review will consider studies that report one or more of the following outcomes:

Primary outcome

- **HPV vaccine uptake**: The proportion of the target population (e.g., eligible adolescents) that has received at least one dose of the HPV vaccine within a specified period (20).
- **HPV vaccine completion**: The proportion of individuals who finish the full recommended HPV vaccination schedule (e.g., all required doses) among those who initiated the vaccine. This will for instance include a one or two-dose schedule for girls aged 9-14; a one or two-dose schedule for girls and women aged 15-20; two doses with a 6-month interval for women older than 21 years [*Human papillomavirus vaccine (21) :*
- **HPV vaccine timeliness**: The proportion completing the series within the recommended schedule window at recommended age (22).

Secondary outcomes

- **Equity** : Measured by analyzing distribution of HPV vaccination outcomes (e.g., uptake, completion, timeliness) across population groups based on factors that create social disadvantage or vulnerability including place of residence (urban/rural, geographic location, region), disability, migration, race/ethnicity/language, occupation, gender/sex, religion, education, schooling status, socioeconomic status, social capital (23).
- **Cold-chain capacity:** the ability of a health system to safely store, transport, and manage required vaccine volumes within recommended temperature ranges across all levels of the supply chain, from storage facilities to the point of administration, in order to preserve vaccine potency and minimize losses from temperature excursions or storage limitations (24).
- **Cost**: The total reported cost of integrated HPV vaccine service versus non-integrated HPV vaccine service alone
- **HPV vaccine acceptability**: The willingness of individuals, parents, or communities to agree to receive or allow administration of the HPV vaccine, regardless of whether vaccination actually occur (22).
- **Unintended effects**: Any unintended outcomes resulting from integrating HPV vaccination with EPI. These could include misinformation, changes in health-seeking behaviours, logistical strain on health systems, or increased awareness of other health services (25).

Search and screening

Search strategy

A comprehensive search strategy will be developed by the team which includes an information specialist with a background in evidence synthesis reviews. The search strategy will aim to locate both published and unpublished records including institutional reports with no time limit. Searches will be performed in the following electronic databases: CINAHL (Ebsco), Cochrane Library, Embase (Elsevier), MEDLINE (Ebsco), PsycInfo (Ebsco), and Web of Science (Clarivate). Grey literature will be searched through Google Scholar, OpenAlex, WHO IRIS, UNICEF, WHO's ICTRP, and Gavi repositories, and directly on the websites of relevant organizations if identified.

The search will combine controlled vocabulary as appropriate with title/abstract keywords to account for evolving terminology in integrating other health services with HPV vaccination research. The strategy will incorporate truncation, wildcards, and proximity operators where supported, and will be adapted for each database as appropriate. An example search strategy for MEDLINE is presented in *Appendix 1*.

Title and abstract screening

Following the search, all identified citations will be collated and uploaded into EPPI Reviewer, a web application that enables researchers to manage the entire lifecycle of a review in a single location (26), and duplicates removed. A pilot test will be done on titles and abstracts which will be screened by two independent reviewers for assessment against the inclusion criteria for the review. Any disagreements will be resolved by a third reviewer or through team discussions. After achieving high agreement (80% and above) a further subset of references will be single screened with a 10% check in by the team lead.

The double screened references will be divided into 10% subsets . These subsets will be used to iteratively develop and test the use of Large Language Models (LLMs) for screening. Prompts will be developed using the inclusion and exclusion criteria for the review and run in EPPI Reviewer using the integrated OpenAI GPT-4.1 model on the first 10%. The performance of the LLM will be evaluated by comparing it to the gold standard human reviewer judgements to determine the accuracy of the model in correctly including and excluding citations. Once the prompt has been refined and evaluated to accurately achieve above .95 recall, it will be deployed on all remaining unscreened citations. A 10% random selection of records will then be screened by the team lead to calculate agreement with the LLM.

Full text screening

Reviewers will independently assess the full text of studies retained after title and abstract screening. Discrepancies will be resolved by a third reviewer, or through team discussions. Reasons for exclusion will be documented. The results of the search and the selection process will be illustrated on a PRISMA flow diagram.

Data extraction

Data will be extracted using a standardized form (see Appendix 2) for the data extraction form). For each study retained after full-text screening, one reviewer will extract the data and a second reviewer will verify the data for accuracy and completeness.

Using a subset of studies with data extraction verified by two reviewers, LLM prompts will be iteratively developed and tested for all items on the data extraction form using the integrated OpenAI GPT-4.1 model within EPPI Reviewer. The prompts will be applied to all studies included at full text with a 10% random subset double screened by a human reviewer. If agreement is above 95%, the LLM will extract the remaining studies and then verify by a human reviewer for accuracy and completeness.

The data extraction form will be used to systematically collect information on study characteristics, intervention and comparator details, and review outcomes. Extracted information will include the country in which the study was conducted, participant characteristics, sample size, study design and methods, study setting and context, and characteristics of the intervention and comparator(s). Data will also be extracted on all review outcomes, including primary outcomes (HPV vaccine uptake, completion, and timely receipt where applicable) and secondary outcomes (equity, feasibility, acceptability, cost, cold-chain capacity where applicable, and unintended effects). Information on implementation barriers and facilitators reported by study authors will be captured and synthesized under the relevant outcome domains, particularly feasibility, acceptability, and unintended effects.

Risk of bias (RoB)

Two reviewers will independently conduct the appraisal using the JBI critical appraisal tool dedicated to study types, with any disagreements resolved through discussion or consultation with a third reviewer. All studies, regardless of the results of their methodological quality, will undergo data extraction and synthesis. For this LSR, RoB assessments will be updated as new studies are incorporated. The results will be

presented in summary tables and will inform the interpretation of findings and the overall confidence placed in the body of evidence.

Analysis

Quantitative evidence will, where possible be pooled in statistical meta-analysis using Eppi-Reviewer. Effect sizes for binary outcomes will be expressed as either odds ratios or risk ratios with 95% confidence intervals. Effect sizes for continuous outcomes will be expressed as weighted mean differences (WMD) or standardized mean differences (SMD) and with their 95% confidence intervals. Statistical heterogeneity will be assessed using the standard chi-squared and I squared tests. Heterogeneity will be considered significant if $p < 0.05$ or $I2 > 50\%$. A random-effects model will be used as the primary analysis in order to account for expected variations in healthcare delivery platforms across different national contexts. If sufficient data are available, subgroup analysis will be done based on the country of primary study, study design, context of intervention, context of implementation, age group of the target population, type of health services integrated with HPV, and year of primary study publication.

Sensitivity analyses will be conducted to test decisions made regarding the influence of one study over the other for quantitative study. A funnel plot will be generated to assess publication bias if there are 10 or more studies included in a meta-analysis. Statistical tests for funnel plot asymmetry (Egger test, Begg test, Harbord test) will be performed where appropriate. Where meta-analysis is not possible, the findings will be presented in narrative form including tables and figures to aid in data presentation.

Equity analysis will be done using the PROGRESS-Plus framework (27). Data will be extracted and synthesized on differences in uptake, completion, and timeliness across population subgroups defined by place of residence, gender, socioeconomic status, and other relevant factors. Where quantitative data are available, differences between subgroups will be summarized descriptively. Where studies report differential effects of the intervention across subgroups, the direction of impact on equity will be categorized as reduced inequity, increased inequity, no difference or unclear. Qualitative findings will be synthesized using thematic synthesis. Data will be analysed inductively and deductively using relevant domains from the Consolidated Framework for Implementation Research (CFIR). The CFIR will be used as an analytical lens to identify and interpret barriers and facilitators to implementation and to explain variations in intervention delivery and outcomes across contexts. Themes will be mapped to CFIR domains and constructs and synthesized narratively.

Certainty assessment

Certainty of the evidence of effect will be assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach. The GRADE approach offers a structured framework for assessing the certainty of a wide range of different evidence types and supporting healthcare decision-making (Neumann I, Schünemann H (Editors) 2024). GRADEpro GDT 2020 will be used to generate Summary of Findings (SoF) tables including pooled effect estimates, relative and absolute risks, and quality ratings based on directness, precision, heterogeneity, risk of bias, and risk of publication bias. For qualitative findings, confidence will be assessed using the GRADE-CERQual approach (28).

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Appendices

Appendix 1. Example Search Strategy

MH – MeSH heading; XB – title/abstract; N2 – within two words (either order); * - stem plus 0 or more letters

((MH "Papillomavirus Vaccines+" AND MH "Immunization+") OR XB(((HPV* OR “Human Papilloma*”) N2 (immuni* OR vaccin*)) OR cecolin OR cervarix OR gardasil OR walrinvax))

AND

(MH "Adolescent Health Services" OR MH "Delivery of Health Care" OR MH "Delivery of Health Care, Integrated+" OR MH "Health Services Accessibility" OR MH "Immunization Programs" OR MH "Preventive Health Services” OR MH "Primary Health Care" OR MH "School Health Services" OR XB(anthelminthic OR "bed net*" OR bundle* OR combin* OR contracept* OR "condom us*" OR codeliver* OR coordinat* OR "co-implement*" OR “co-ordinat*” OR deliver* OR embed* OR EPI OR “expanded program*” OR “general practic*” OR “health check” OR "health education" OR "health system*" OR hybrid OR integrat* OR “life course” OR lifestyle* OR opportunistic OR packag* OR platform* OR "primary care" OR parallel* OR promot* OR routine OR "sanitary pad*" OR schedul* OR schistosomiasis OR school* OR "service delivery" OR "skills building" OR soap* OR "social behavio*" OR SBC* OR "vaccine delivery" OR "vitamin A"))

AND

(MH "Developing Countries" OR XB(((low* OR middle) N2 (income)) OR "LMIC" OR "LMICs" OR "third world" OR "central asia*" OR "north* asia*" OR "southeast* asia*" OR "south east* asia*" OR "western asia*" OR "east* europe*" OR africa* OR caribbean OR "south america*" OR "latin america*" OR "central america*" OR "global south" OR "middle east*" OR "south pacific" OR afghan* OR albania* OR algeria* OR angola* OR argentin* OR armenia* OR azerbaij* OR bangladesh* OR belarus* OR byelarus* OR belorus* OR byelorus* OR beliz* OR benin* OR dahomey* OR bhutan* OR bolivia* OR bosnia* OR herzegovina* OR botswana* OR bechuanaland* OR brazil* OR brasil* OR bulgaria* OR "burkina fas*" OR "upper volta*" OR burundi* OR urundi* OR "cabo verde*" OR "cape verde*" OR cambodia* OR kampuchea* OR khmer* OR cameroon* OR cameron* OR cameroun* OR "ubangi shari" OR chad* OR chile* OR china OR chinese OR colombia* OR comoro* OR mayotte* OR congo* OR zair* OR "costa rica*" OR "cote d’ivoire*" OR "ivory coast" OR cuba* OR djibouti* OR dominica* OR ecuador* OR egypt* OR "united arab republic" OR "el salvador*" OR eritrea* OR eswatini* OR ethiopia* OR fiji* OR gabon* OR gambia* OR georgia* OR ghana* OR "gold coast" OR grenada* OR guatemala* OR guinea* OR guyana* OR guiana* OR haiti* OR hispaniola* OR hondura* OR india* OR indonesia* OR iran* OR iraq* OR jamaica* OR jordan OR kazakh* OR kenya* OR "north korea*" OR "democratic people’s republic of korea" OR kosov* OR kyrgyz* OR kirgiz* OR kirghiz* OR lao* OR latvia* OR lebanon* OR lesoth* OR basutoland* OR liberia* OR libya* OR lithuania* OR macedonia* OR madagascar* OR malagas* OR malawi* OR nyasaland* OR malaysia* OR maldiv* OR mali* OR micronesia* OR kiribati OR "marshall island*" OR nauru*

OR palau OR tuvalu OR maurit* OR mexic* OR moldova* OR mongolia* OR montenegr* OR morocc* OR ifni OR mozambiqu* OR myanmar OR burm* OR namibia* OR nepal* OR "netherlands antill*" OR nicaragua* OR niger* OR pakistan* OR panam* OR paragu* OR peru* OR philippin* OR philipin* OR phillipin* OR phillippin* OR filipin* OR romania* OR russia* OR rwanda* OR ruanda* OR samoa* OR "pacific island*" OR polynesia* OR "sao tome*" OR senegal* OR serbia* OR seychell* OR "sierra leon*" OR melanesia* OR "solomon island*" OR "norfolk island*" OR somali* OR "sri lanka*" OR ceylon* OR "saint kitts" OR "st kitts" OR "saint lucia*" OR "st lucia*" OR "saint vincent*" OR "st vincent*" OR grenadine* OR sudan* OR surinam* OR syria* OR swaziland OR tajikistan OR tadjikistan OR tadzhik* OR tanzania* OR tanganyika* OR thai* OR siam* OR timor* OR togo* OR tonga* OR tunisia* OR turk* OR uganda* OR ukrain* OR uruguay* OR uzbek* OR vanuatu* OR "new hebride*" OR venezuela* OR vietnam* OR "viet nam*" OR "west bank" OR gaza* OR palestin* OR yemen* OR zambia* OR zimbabwe* OR rhodesia* OR magreb* OR maghrib* OR sahara*))

Appendix 2. Data Extraction Form

Draft Extraction tool: LSR 6,7,8