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Lessons learnt from human papillomavirus (HPV) vaccine demonstration projects and national programmes in low- and middle-income countries

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Abbreviations and Acronyms

ACCF	Australian Cervical Cancer Foundation
AEs	adverse events
cMYP	comprehensive multi-year plan
DRC	Democratic Republic of the Congo
DTP3	Diphtheria, Tetanus, Pertussis vaccine (third dose)
EPI	Expanded Program on Immunization
GAP	GARDASIL® Access Program
Gavi	Global Alliance for Vaccines and Immunization
GIN	Global Immunization News
HMIS	Health management information system
HPV	Human Papillomavirus
IEC	information, education, and communication
LIC	low-income country
LMIC	lower-middle income country
LAMIC	low- and middle-income countries
M&E	monitoring and evaluation
MOE	Ministry of Education
MOF	Ministry of Finance
MOH	Ministry of Health
NCD	non-communicable disease
NGO	non-governmental organisation
PAHO	Pan-American Health Organisation
PIE	post-introduction evaluation
UMIC	upper-middle income country
UNICEF	United Nations Children's Fund
VVM	vaccine vial monitor
WB	World Bank
WHO	World Health Organisation

Executive Summary

Background

Cervical cancer, caused by human papillomavirus (HPV), is a major public health problem. Globally there are estimated to be 528,000 new cervical cancer cases and 266,000 deaths each year[1]. Over 80% of cervical cancer cases occur in women living in low-income countries and lower-middle income countries (LMICs)[1, 2]. Two licensed prophylactic HPV vaccines have high efficacy against persistent infection with HPV vaccine genotypes 16 and 18, the cause of over 70% of cervical cancer and related cervical lesions[3]. In 2012 Gavi announced its support for HPV vaccination demonstration projects or national programmes for 73 countries; 49 Gavi-eligible and 24 'graduating' countries[4]. For some other low and middle income countries (L&MICs), demonstration projects or national programmes have been conducted with vaccines provided by the GARDASIL® Access Program (GAP)[5], from manufacturer donations, or other means.

There have been no comprehensive systematic reviews of results and lessons learnt from the demonstration projects and introductions conducted to date. This study aimed to collate a wealth of information available in the grey literature, peer-reviewed journals, and reported by country representatives in order to inform future Gavi applications and national programmes. We review the delivery strategies chosen and factors correlated with vaccine coverage, present best practices for project/programme success and provide a summary of costing information. Recommendations for planning and sustaining a national programme are discussed, including how HPV delivery can be more fully absorbed into national immunization programmes.

Methods

Forty-six countries, which had completed at least six months of HPV vaccine delivery by 1st May 2016, were selected for inclusion in the review. A systematic literature review of published and grey literature was undertaken. Additional grey literature was requested from representatives of all the included countries, such as evaluation reports from national immunization programmes and international partners. Key informant interviews with project/programme implementers were conducted to fill gaps in the data. Data were extracted from literature and interviews onto an excel matrix developed using the WHO's New Vaccine Introduction Guidelines. Nine countries with high cervical cancer burden that were eligible for Gavi HPV vaccine introduction support, but had not yet submitted an application to Gavi, were also identified. Interviews were conducted with national immunisation teams in these countries, to explore reasons why they had not yet applied to Gavi for HPV vaccine demonstration project funding.

Results

Across the 46 countries with HPV vaccine experience included in this review, data were analysed from 12 countries with experience of national programmes and 66 demonstration projects undertaken in 44 countries. As projects and programmes varied the delivery strategies and target populations, this represents 15 separate delivery experiences in national programmes and 77 separate delivery experiences in the demonstration projects. Among the 66 demonstration projects, 30 were supported by GAP through Axios Healthcare Development, 20 by Gavi, four by PATH (funded by the Bill & Melinda Gates Foundation, implemented by EPI programs with vaccine donated from either GSK or Merck & Co.) and 12 by other means. Key results are shown below.

Theme	Summary of lessons learnt
Preparation	**Planning** • Political commitment from national authorities provides crucial advantages by increasing interest and support at all levels. • Planning alongside the education sector can improve acceptability and effectiveness of implementation, for example in choosing school grades with the highest female attendance (e.g. confirming sub-nationally whether this was grade 5 or 6) and coordinating vaccination with school calendars to avoid examination days or other important events. • Agreements with national ministries (e.g. MOE) did not necessarily translate into cooperation with sub-national sectoral representatives and, in the case of local departments of education and school authorities, cooperation could often be delayed or problematic if not sought early. **Vaccine management** • Countries have introduced several new vaccines in the past decade and are accustomed to cold chain assessments and expansions. • The HPV vaccine is sensitive to freezing and this is the greatest risk for vaccine wastage. **Staff training** • Cascade training was the most common method of training staff in HPV vaccine introduction; however, a number of countries identified issues around the quality of training for frontline staff. • Teachers are trusted in the community and should be included in micro-planning and trained appropriately. • The ideal timeframe for training is at least two months before vaccine delivery. • Novel aspects of HPV vaccine and its delivery requires specific training, although training could be integrated into other vaccination training for nurses and may be conducted less frequently in the future, as processes become more familiar and existing staff become more experienced.
Communication	**Social mobilisation, acceptability and consent** • General knowledge of HPV, HPV vaccine and cervical cancer is low in communities, and among teachers and health-workers. • Training of influential stakeholders/ spokespersons is needed at every level (i.e. national, regional, district, local). • Problems occur if social mobilisation begins less than a month before vaccination (e.g. due to late fund disbursement or printing). Time allowed should not be underestimated when planning. • Teachers and parents of girls attending urban and private schools often require more information before accepting the vaccine than those elsewhere and need to be identified in a communication plan as potentially requiring more intensive messaging. • Rumours are generally consistent across geographical areas and projects/programmes. • Collaboration between MOH and MOE is necessary to tackle rumours as soon as they arise. • Strategies to address rumours include tailoring communication messages to specific concerns, announcements by high-level officials, dissemination of letters detailing WHO or government endorsement, one-to-one or group meetings in communities and utilising social media networks to disseminate clear, accurate information (e.g. Facebook).

Theme	Summary of lessons learnt
	• Face-to-face interaction remains the most effective way of mobilising parents and communities, especially among groups likely to refuse vaccination. Effective influencers are teachers, health-workers, and community leaders (e.g. religious spokespeople). • If social mobilisation is delayed due to fund disbursement or bureaucracy, activities can be implemented in a stepped approach so that the first schools targeted with vaccine are the first to receive social mobilisation. • The most commonly cited reasons for vaccine acceptance were protecting daughters from cancer, general benefits of vaccines, and perceived cervical cancer risk. • Complicated consent procedures can decrease consent and thus uptake. The most successful opt-in approach appeared to be sending forms home with girls, which could be coordinated by teachers. • No problems were reported with opt-out consent, but most projects/ programmes testing opt-out processes were government-run, with high involvement of the immunisation programme. Additional procedures may be necessary in private schools or where parents expect more information and autonomy over their child's health
Delivery	**Delivery strategy** • HPV vaccine delivery strategies including schools were the most common and were reported as being an efficient way to capture most 9-13 year old girls. However, many projects and programmes found the costs associated with repeat visits to schools prohibitive and potentially unsustainable. There was limited experience with health facility only delivery. • The selection of delivery strategy often had to balance the feasibility of high coverage with country specific operational challenges: the human resources and vaccine transport available, accessibility of vaccination sites, school enrolment and attendance rates, project/programme cost and sustainability. • There are limited data on health facility only delivery strategies and no coverage data from 'routine delivery' strategies where responsibility for the vaccine delivery is decentralised to health centres to deliver in situ or during routine outreach. • Strategies to reach out-of-school girls are difficult to evaluate without specific coverage data for this sub-group. A specific mobilisation strategy for out-of-school girls to encourage them to attend vaccination days or the nearest health centre was generally seen as important. It cannot be assumed that out-of-school girls will attend health centres without targeting them with specific information on the importance of HPV vaccine beforehand. However, if being 'out-of-school' is illegal, strategies to identify girls must avoid stigmatisation; house-to-house visits are expensive unless volunteers can conduct them. • Although different mop-up strategies were conducted, there is not sufficient evidence to ascertain best practices. The scope of activities is generally governed by country-specific factors, e.g. school absenteeism, perceived 'adequate' coverage, and the resources available. A two-stage delivery of each dose can be successful in reaching those girls who initially refused vaccination, especially when implementation of HPV vaccination is in its first year. Countries with low school enrolment could opt to not conduct mop-up activities in order to focus resources on extensive outreach during the initial vaccination dates.

Theme	Summary of lessons learnt
Delivery	• Although different mop-up strategies were conducted, there is not sufficient information/evidence to ascertain particular best practices. The scope of activities is generally governed by country-specific factors, e.g. school absenteeism, perceived 'adequate' coverage, and the resources available. A two-stage delivery of each dose can be successful in reaching those girls who initially refused vaccination, especially when implementation of HPV vaccination is in its first year. Countries with low school enrolment could choose to not conduct mop-up activities in order to focus resources on extensive outreach during the initial vaccination dates. • Providing the first dose to unvaccinated girls at the time of the second dose delivery, and establishing a 'rolling eligibility criteria' where girls can become eligible for the vaccine as soon as they turn 9 years of age can create challenges in yearly reporting if this has not been planned. Delivery the subsequent year when a greater number of vaccine doses are needed and vaccination has to stretch over two age groups or grades can be challenging if strategies are not clear before the project/programme starts. • Drop-out between doses can be minimised if all doses are completed within one school year. • Given the workload and funding required for HPV vaccination programmes and the limited nature of existing services for this age group, multiple countries questioned the feasibility of adding another new intervention to deliver alongside HPV vaccine. • Countries need to be aware that although the recommendations for most girls now state that 2 doses are enough for protection against HPV, HIV infected girls require 3 doses. Country representatives find this impractical and vaccinators often do not know a girl's HIV status. Health workers are generally providing 2 doses for this reason or to avoid stigmatization of HIV positive girls **Target population enumeration** • In almost all demonstration projects, estimation of vaccine supply needs for the first dose of HPV vaccine was a considerable challenge. • School registries from schools themselves or the MOE, existing population censuses, and surveys of school enrolment rates were unreliable data sources • Planning and implementation of a census to determine the size of the target population for demonstration projects requires substantial resources and is likely to delay vaccine delivery if not adequately planned. • Pre-registration of out-of-school girls is important to ensure their identification and vaccination; however, house-to-house activities to enumerate and pre-register out-of-school girls are expensive. If volunteers are available this could be more feasible than census or health workers. Peer tracing or use of local civil society groups are other strategies to identify girls, all need to be budgeted for during planning. • Accurate determination of the number of eligible girls is more of a challenge for demonstration projects that implement in specific districts and may require specific activities such as school pupil enumeration. • For demonstration projects, enumeration in urban settings has been more difficult than rural areas due to more mobile populations, and less distinct district boundaries. • Several countries have implemented reliable registries for numbers of eligible girls after the delivery of the first dose.

Theme	Summary of lessons learnt
	• National programmes which have started delivery to 9-13 year olds have experienced decreasing target populations year after year as the target group decreases to a single age cohort of 9 year olds. • Census data may be more accurate and useful when enumerating the national target population than when attempting to enumerate girls in a demonstration project; however, additional data from school registries is still needed to aid distribution of the correct amounts of vaccine at the sub-national level to the districts and health facilities. **Staff availability** • The level of workload generated by HPV vaccination activities was variable; the effect on routine services was difficult to estimate as many demonstration projects were small-scale, resource intensive and were not fully integrated into EPI services. • Countries concerned about the impact on routine services can test strategies to mitigate this during demonstration projects but should be aware that some of the strategies are unlikely to be possible during national roll-out unless a staggered vaccine delivery is planned e.g. using staff from other regions or employing temporary staff. Trainee health workers may prove useful to fill some gaps in capacity. • There was no evidence that changing from a 3-dose to a 2-dose schedule has changed the proportion of experiences that reported an impact of campaign activities on routine health services. • One strategy to mitigate impact on routine services is to extend the time period of HPV vaccine delivery to transform a campaign-like strategy into a phased delivery over a number of months. There is limited experience of this and no available evaluation data on the impact on staff workload. • Coincidental introduction of multiple new vaccines can exacerbate capacity issues at all levels (national, regional, district and local). **Staff supervision** • Supervision is necessary when adding another activity like HPV vaccine introduction to health workers' workload. It can be motivational, can ensure successful implementation and high quality data collection. • Supervision was usually carried out in a cascade from national level to frontline staff. • Checklists and logbooks can help to ensure supervision activities are completed if these are audited by higher level supervisors. **Staff remuneration** • The use of per diems for outreach activities or any activity which involves the health worker leaving their station is widespread. • Per diems are a major consideration when countries assess the sustainability of a programme • Per diems may be required in demonstration projects which can be seen as 'special' and 'non-routine' and may not be required in national roll-out when delivering the vaccine can be normalized into health workers routine responsibilities, e.g. routine outreach. **Adverse events (AE) monitoring** • Non-EPI stakeholders, particularly teachers and parents, were a useful resource in monitoring and reporting AEs. • There were noticeable differences among projects/programmes in AE reporting procedures.

Theme	Summary of lessons learnt
Coverage achievements	**Factors for success** • High HPV vaccine coverage is feasible in L&MICs; no projects attained <50% final dose coverage. • It is difficult to obtain meaningful data on vaccine coverage without a well-designed coverage survey. • Limitations in administrative data need to be realised by national and international agencies. • Delivery strategies including a school-based component are likely to achieve high uptake, completion and final dose coverage, due to the relative ease of capturing a large number of girls in one place, gaining consent if required and following up girls. However, these strategies are resource intensive. Data on health facility only strategies is limited and the coverage achievements to date have been highly variable. • Urban areas may be more exposed to negative media, contain more mobile populations and be harder to enumerate than rural areas; it may be harder to achieve high coverage in urban centres for these reasons. • High-level political commitment and the involvement of the EPI team or national immunisation programme and the MOE early in the planning process is critical to obtain good coverage. • Early collaboration between EPI and education representatives at lower levels (provincial, regional or district) can ensure efficient micro planning, i.e. the vaccine schedule is planned to fit into the school calendar, can aid in enumerating school-based target populations, can coordinate an effective response to vaccine rumours within the community and can help to follow up girls who missed doses – all of these functions can help to ensure high coverage. They can also more efficiently identify potentially problematic groups within the target communities e.g. private schools or vocal anti-vaccination groups. • The EPI/national immunisation team involvement can ensure timely vaccine delivery, which is important to maintain interest in vaccination in the community and to reduce drop-out. • Specific strategies are needed to identify and mobilise out-of-school girls; the absence of specific strategies can result in low uptake if the vaccine is simply made available at the health centre. • The 2-dose schedule achieved high coverage, uptake and completion and was reportedly easier and cheaper to implement when compared to the 3-dose schedule. Only one country attempted a 12 month interval between the 2 doses, rather than 6 months, and stated an annual campaign was easier to implement. • Delivery of HPV vaccine simultaneously with another intervention to the same target group did not seem to affect HPV vaccine coverage rates. However, few countries attempted to deliver other services with HPV vaccine. Coverage data from experiences that tested delivery of other interventions were only available for 6 countries. **Factors for success** • Use of electronic monitoring and reporting systems appeared to reduce errors and, in some cases, simplified the process of data recording. For example, at least two countries created a database of girls to be vaccinated in advance so that all forms already had names on them, thus simplifying and speeding data recording. Other projects noted logistical difficulties with paper forms (e.g. insufficient space on forms, difficulty in following-up girls who missed vaccinations).

Theme	Summary of lessons learnt
	• Early and thorough training of health-workers in correct and timely recording, reporting, and monitoring procedures was not always given enough attention, which caused later difficulties in timeliness and accuracy of reporting. • More discussion appears warranted on who should hold vaccination cards (e.g. whether this should be health-workers, schools, or girls).
Sustainability	**Financing** • Several projects found it challenging to secure funds for implementation costs, especially transportation costs and per diems. • Countries expressed considerable uncertainty around the ability to finance HPV vaccination in the future. • Several countries are considering or have already changed delivery strategy due to concerns over cost and sustainability. • Reported recurrent financial costs of delivery (excluding vaccine costs) were between USD 1-9 per dose. **Scale-up** • Demonstration projects appeared most useful for countries with little experience of rolling-out new vaccines or of vaccinating older children; however, substantial lessons have been learnt during scale-up and national programmes also. • Some countries indicated they could have gone straight to national or phased national programmes rather than spent time on demonstration projects if funding had been available. • Demonstration projects did not appear to be particularly useful in influencing the decision of whether to scale to national HPV introduction, which was either already decided or was governed by the availability of funding. However, demonstration projects did appear useful in influencing plans for future implementation (e.g. consent, enumeration processes, delivery strategies). • Continuity of access to Gavi funding was a major concern when considering scale-up and longer-term sustainability. • A number of sources appeared unaware of the relative flexibility of the HPV vaccine dosing schedule (e.g. several did not know it could be given in two doses one year apart), which could have potential logistical and cost implications. • While Gavi sources indicated that Gavi will continue to offer vaccine at a subsidised price to countries after they graduate from Gavi support, exploration of alternative sustainable funding options could encourage more countries to scale-up HPV vaccination.

Theme	Summary of lessons learnt
Integration of HPV vaccine with immunization programmes and the health system	• When EPI was leading the demonstration projects, integration with routine immunisation activities was usually strong and the regular routine human resources and infrastructure was used to deliver the HPV vaccine. • Smaller scale projects run by entities other than the MOH showed minimal or no integration with routine services, and in some cases were run in parallel to the routine health service, hence limiting understanding of scalability. These projects also ended up using some EPI capacity (e.g. cold chain and logistics), often with minimal or late involvement of EPI, thereby reducing its capacity to integrate activities within the routine programme. • Many countries used familiar delivery models and therefore the level of integration into standard processes tended to be high (e.g. (repeated) school-based campaign model, with additional mop-up activities in regular health centres). Hence delivery shared practices specific to campaign delivery (limited duration, additional staff, allowances, intensive supervision and reporting). • There were only a limited number of unique traits to HPV vaccination that distinguished it from other routine vaccines. These involved the targeting of older girls, the often-complex enumeration process and the repetitive vaccination campaigns in schools for countries without existing school health programmes. • Many aspects of integration with the routine immunisation programme process remained challenging to assess because of the small size of demonstration projects. Scale up may produce new challenges and learning curves and result in changes of strategy. • Despite reporting high workload, negative effects on the routine delivery of other services were rarely commented upon. This may be owing to the small scale of the programmes (Section 7.3.3: Staff workload). • A small number of countries had in the past or were envisaging switching in the future from the campaign-style delivery to a health facility based strategy to foster a more cost-effective and integrated approach. One country that made this change reversed to school delivery because of poor coverage. Countries will have to trade-off the high coverage attainable in campaign style delivery with the more integrated approach to childhood routine vaccination and possible lower coverage outcomes. • An increasing number of countries originally intended to test combining at least one other intervention with HPV vaccination but few have translated this into actual implementation. None have formally evaluated combined delivery.
Decision not to introduce HPV vaccine among Gavi eligible countries	• Among the nine country representatives approached, five agreed to be interviewed. All five felt cervical cancer was a public health problem and were aware of Gavi funding for HPV vaccine introduction. • Two countries were aiming to submit applications for funding within the next year. • Two other countries prioritised other new vaccine introductions; an application for HPV vaccine support was thought to be planned for some point in the future. • One country felt there was not enough country-specific data on HPV epidemiology or funding to warrant starting an HPV vaccination project/ programme.

Conclusions

Considerable experience in HPV vaccine delivery is available from many contexts. Common lessons have been learnt in different countries. These should make it easier for countries still considering HPV vaccination to plan their projects/programmes and perhaps consider delivering vaccine through phased national delivery. Limited data are available and further evaluation is needed on a number of topics including: catch-up strategies, scale-up to national programmes, delivery of HPV vaccination alongside other interventions, integration with existing health system structures and the key drivers of delivery costs to ensure HPV vaccine programmes are sustainable.

1. Background

1.1 HPV vaccination

Cervical cancer, caused by human papillomavirus (HPV), is a major public health problem. Globally there are an estimated 528,000 new cervical cancer cases and 266,000 deaths each year[1]. Over 80% of cervical cancer cases occur in women living in in low and middle-income countries (LAMICs) [1, 2]. It is the most common cancer among women between 15 and 44 years of age in many LAMICs. In settings where effective cervical screening programmes are available, the incidence of cervical cancer has markedly decreased[2]. However, in many LAMICs, screening programmes are not in place or are only available on a limited scale, and women frequently present late with the disease, leaving palliative care as the only treatment option.

Primary prevention for cervical cancer is now possible through vaccination. Three licensed prophylactic HPV vaccines have high efficacy against persistent infection with HPV vaccine genotypes (a necessary pre-requisite for the development of cervical cancer) and related cervical lesions[3]. Two are available worldwide, Cervarix® (GlaxoSmithKline Biologicals) targets HPV types 16 and 18; GARDASIL® (Merck & Co. Inc) also targets HPV 16, 18 as well as HPV 6 and 11, which are the primary cause of genital warts[8]. The World Health Organisation (WHO) recommends targeting HPV vaccination to girls aged between 9 and 13 years, prior to sexual debut, as the vaccines are most efficacious in those who have not yet acquired HPV[9]. By February 2015, 80 countries and/or territories had commenced national HPV vaccination programmes and another 39 had completed or had ongoing HPV vaccine demonstration or pilot projects. Initial impacts of HPV vaccination on genital warts have been observed in countries that commenced national vaccination programmes early, such as Australia, the United Kingdom, the United States, Denmark and Sweden[10-17].

Merck & Co established the GARDASIL® Access Program (GAP) in 2007, when they donated three million doses of HPV vaccine for use in low-income countries. A consultancy company, Axios Healthcare Development, managed the GAP for Merck. The GAP provided free vaccines, but organisations implementing the demonstration projects were responsible for procuring injection supplies, paying customs duties for the vaccine and for financing all delivery costs [18, 19]. GAP ceased to accept new applications when Gavi started to provide support for HPV vaccine demonstration projects in 2012. Demonstration projects allow countries to gain experience in delivering the vaccine to a novel age group and/or alongside other adolescent health interventions[6]. Gavi supports national programmes if the country has prior experience of HPV vaccination. This support is available for 73 countries: 49 Gavi-eligible and 24 'graduating' countries[20]. By mid-2015, 25 countries had been approved by Gavi for demonstration projects and three countries had received approval for support of national programmes (Rwanda, Uganda and Uzbekistan)[21]. In addition to GAP and Gavi, other demonstration projects have been funded by NGOs, manufacturer donations, or other means. For Gavi-supported projects, the Ministry of Health (MOH) is required to lead applications and close collaboration with the Ministry of Education (MOE) is recommended [6]. They are also required to plan a number of mandatory evaluations: cost[22], coverage surveys [23] and a post-introduction evaluation (PIE) [24].

There are several identified gaps for countries' decision-making with respect to HPV vaccine introduction. Although there have been some initial reviews (see section 1.2), there have been no comprehensive systematic reviews of results and lessons learnt from the demonstration projects conducted to date or early scale-up in LAMICs. A wealth of information from sources other than peer-reviewed journals is available, but has not yet been collated in order to inform future Gavi applications and national programmes. A review of the rationale for the delivery strategies chosen, best practices, factors affecting coverage and a summary of costing information will provide crucial information for countries when applying for HPV vaccination demonstration projects or starting national HPV vaccination programmes. Moreover, a number of countries did not deliver HPV vaccine through the national immunization programme during their demonstration phases. As they move to consider national scale-up, recommendations on how HPV delivery can be more fully absorbed by national immunization programmes may assist in planning and sustaining a national programme.

Integration into the immunization programme is an important question as school immunization is a relatively new form of delivery for many of the studied countries [25, 26]. Strategies for reaching out-of-school girls

also need to be well integrated into the national programme to ensure optimal use of resources [27].

This study aimed to address the above gaps and use the synthesis of lessons learnt from demonstration and national programmes in LAMICs to develop recommendations on how HPV vaccine delivery can be successfully designed and integrated into national immunization programmes.

1.2 Previous reviews of HPV vaccine demonstration projects

Two reviews have examined vaccine uptake and delivery strategies for 21 GAP-supported demonstration projects covering a total of 14 countries [18, 28]. High uptake (first dose coverage) and completion rates (the proportion of girls who started the vaccine schedule and went on to receive the final dose) were reported; all but one project had an uptake rate of >70%. School delivery and short duration of vaccination activity were associated with high uptake and completion rates. The 'duration of vaccination activity' referred to the total time taken from shipment of the vaccine to final dose delivery, which may reflect the preparation, organisation and level of bureaucracy involved in each project.

There have There have been two additional publications collating experiences from demonstration projects in multiple countries [29, 30] and three reviews of HPV vaccine delivery strategies and acceptability [31-33]. Different delivery strategies were tested in demonstration projects in Peru, Uganda, India and Vietnam and their coverage and acceptability were analysed [30]. High coverage was documented across the different strategies tested; school-based vaccination strategies gave consistently high coverage whilst integration with existing outreach services gave the lowest coverage. Wigle et al. identified specific barriers to successful HPV vaccine implementation through a literature review and key informants interviews [29]. A review of the acceptability of HPV vaccine in 13 sub-Saharan African countries found consistently high willingness to vaccinate and hypothetical acceptance of the vaccine [31]. A review of the published literature on delivery strategies in nine LAMICs found school-based delivery using grades as eligibility criteria for vaccination attained high coverage [32]. The third review summarised lessons learnt from HPV vaccination in 15 countries and reported on operational, logistical and communication issues [34].

There have been no comprehensive systematic reviews of results and lessons learnt from all the demonstration projects conducted to date. This study aims to collate the wealth of information available in the grey literature, peer-reviewed journals and reported by country representatives, in order to inform future Gavi applications and national programmes. We review the delivery strategies chosen, correlates and best practices for success or failure to achieve high coverage. Recommendations of how HPV delivery can be more fully absorbed by national immunization programmes may assist in planning and sustaining a national programme.

1.3 Published costing studies of HPV vaccine demonstration projects

Costs per fully vaccinated girl in developing countries have been documented in five articles to be in the range of $1.5 - $18.9 [28, 35-38]. Demonstration projects in eleven L&MICs are included in these articles: Peru, Uganda, India, Vietnam, Tanzania, Kenya, Cambodia, Honduras, Lesotho, Moldova, Nepal. The methods used to estimate costs and the way results are reported vary across articles, occasionally leading to differing estimates of delivery costs within the same demonstration projects, depending on the analysis. There is a need to review methods used to estimate costs of demonstration projects and national programmes in order to aid future evaluations and create comparable estimates. The relative cost-effectiveness of different delivery strategies within countries can then be modelled and compared.

2. Objectives

The study had the following three objectives:

1 To collate and synthesize lessons from completed HPV vaccine demonstration projects and national programmes for critical themes and determinants of success.

2 To generate insights and recommendations on how HPV vaccine delivery can be successfully integrated into national immunization programmes.

3 To use creative mechanisms to disseminate the synthesized lessons/insights and best practices, both for HPV demonstration projects and national programmes.

3. Methods

3.1 Study countries

3.1.1 Definitions

Throughout the report, themes and findings are described relevant to three classifications: 1) the country, 2) the project/programme, 3) the delivery experience. One country may have conducted multiple different HPV projects/programmes, which included multiple different delivery experiences. Definitions and examples are as follows:

Country
One of the countries included in the review (See Section 3.1.2: Country selection).

Programme
A national-level HPV vaccination programme

Project
The activities funded through a specific GAP, Gavi or other funder application for a demonstration/pilot project. A distinct project was defined by the funder and/or implementer and grant award details, e.g. GAP awarded Bolivia support for four separate demonstration projects at distinct geographical sites and therefore, for this study, Bolivia was considered as contributing data from four different projects. Gavi awarded Laos PDR support for one demonstration project which was stipulated to span the course of 2 years and is defined in this review as one project. Botswana conducted one demonstration project implemented by the non-communicable disease (NCD) department and a second implemented by the national immunisation team; these were counted as two projects.

Delivery experience
An HPV vaccine experience was defined by the specific target population (age range in years or school grade) and vaccination venue (health facility-based, school-based, outreach, or a combination of the three) within a specific project/programme (defined by funding source). One country may have contributed multiple distinct experiences; if a project that spanned two calendar years changed delivery strategy (e.g. from school-based to health facility-based), that project would be counted as contributing two distinct delivery experiences, or if a project simultaneously tested two different delivery strategies in two different populations, this would be counted as contributing information from two different delivery experiences. e.g. PATH supported one demonstration project in India which tested two different delivery strategies in the same year, therefore India contributes information from one project and two delivery experiences. Honduras was awarded three GAP demonstration projects; each project implemented one delivery strategy and therefore Honduras contributes data from three projects and three delivery experiences.

The logistical requirements, social mobilisation needs, coverage achieved were a-priori thought to be heavily dependent on the specific delivery experience; therefore these themes and key findings are summarised by delivery experience. Planning and financing were summarised at the project/programme level.

3.1.2 Countries included in the lessons learnt component

In total 46 countries (18 LIC, 22 LMIC, 5 UMIC, 1 HIC) that had completed at least 6 months of an HPV vaccine project/programme by the first quarter of 2016 were included in the study (Table 1). Upper-middle income countries were only included if they had conducted a demonstration project; they were not included if they went straight to national roll out as the objectives of the review focus on LAMIC demonstration projects. One high-income country, Chile, was included due to its choice of delivery strategy; an annual campaign with a 12-month interval between doses. This was identified as potentially exposing some good alternative lessons for low-income countries. The 46 countries included in this study are summarized in Table 1, according to the type of financing used to support or implement the demonstration projects.

Across the 46 countries included in the review, two went straight to national roll-out (Chile, Rwanda), 10 had conducted demonstration projects and had scaled-up to national programmes by the first quarter of 2016 and 34 had only conducted demonstration projects. In total 66 demonstration projects were conducted across 44 countries; 30 projects (in 22 countries) were supported by GAP through Axios Healthcare Development, 20 projects (in 20 countries) by Gavi, four by PATH (funded by the Bill & Melinda Gates Foundation, implemented by EPI with vaccine donated from either GSK or Merck & Co.) and 12 by other means.

Several countries conducted multiple types of demonstration projects supported by different donors. Guyana, Honduras, Lesotho, Bhutan, Botswana, Brazil, Vanuatu, Peru, Uganda and South Africa had already scaled-up from demonstration projects to national implementation by January 2016. Uzbekistan is planning to scale-up to a national programme in 2016-17 and contributed data on plans for the national programme. A detailed description of the countries and projects/programmes included in the review can be found in Appendix A.

Table 1. The 46 countries and donors included in this study

	Country	Type of financing[1]		Country	Type of financing[1]
1	Bhutan	GAP and national (donation)	24	Mali	GAP and Gavi demos
2	Bolivia	GAP	25	Moldova	GAP
3	Botswana	World Bank (WB), MOH demos and national (MOH)	26	Mongolia	GAP
4	Brazil	GAP, MOH demos and national (MOH)	27	Mozambique	Gavi
5	Burkina Faso	Gavi	28	Nepal	GAP/ACCF[2]
6	Cambodia	GAP	29	Niger	Gavi
7	Cameroon	GAP and Gavi demos	30	Papua New Guinea	GAP
8	Chile	National (MOH)	31	Peru	PATH and national
9	Cote d'Ivoire	Gavi	32	Philippines	Jhpiego
10	Ethiopia	Gavi	33	Rwanda	National introduction (donation and Gavi)
11	The Gambia	Gavi	34	Senegal	Gavi
12	Georgia	GAP	35	Sierra Leone	Gavi
13	Ghana	GAP and Gavi demos	36	Solomon Islands	Gavi
14	Guyana	GAP and national	37	South Africa	Donations and national
15	Haiti	GAP/PIH	38	Tanzania	GAP and Gavi
16	Honduras	GAP demos and national (MOH)	39	Thailand	Jhpiego
17	India	PATH	40	Togo	Gavi
18	Kenya	GAP and Gavi demos	41	Uganda	PATH, GAP, Merck demos and national (Gavi)
19	Kiribati	GAP/ACCF	42	Uzbekistan	GAP
20	Lao PDR	Gavi	43	Vanuatu	ACCF and national
21	Lesotho	GAP and national	44	Vietnam	PATH
22	Madagascar	Gavi	45	Zambia	GAP
23	Malawi	Gavi	46	Zimbabwe	Gavi

[1] "Donation" refers to the vaccine being donated directly to the country by the manufacturer
[2] ACCF: Australian Cervical Cancer Foundation

At least another six countries have started or are planning to start Gavi-supported demonstration projects (Table 2), but did not have data available in time for inclusion in the data review and did therefore not contribute information to this study.

Table 2. Countries starting HPV demonstration projects in December 2015 or later (evaluation results were not available in time for this study)

	Country	Sponsor	Years of planned support	Vaccine (preferred)
1	Angola	Donation	NA	NA
2	Bangladesh	Gavi	2015-16	Cervarix®
3	Benin	Gavi	2015-16	Cervarix®
4	Burundi	Gavi	2015-16	Cervarix®
5	Liberia	Gavi	Postponed	Gardasil®
6	Sao Tome	Gavi	2014-16	NA

'NA' indicates data not available

3.1.3 Countries included in the evaluation of reasons for not undertaking a HPV vaccine demonstration project

By January 2015, eight Gavi-eligible countries met the diphtheria, tetanus and pertussis vaccine third dose (DTP3) coverage threshold of >70% required for applications for support for HPV vaccine demonstration projects and also had significant cervical cancer incidence (defined as an incidence of >15/100,000 women years) according to GLOBOCAN 2012 [39], but had not yet applied for Gavi support for HPV demonstration projects (Table 3). Nigeria was also included in data collection as it had been awarded a GAP donation for an HPV demonstration project, but the project had never started. Gavi eligible countries that have not conducted HPV vaccine demonstration projects, but were excluded from data collection as they had a DTP3 coverage <70% or a low estimated cervical cancer incidence (<15/100,000 women years) are listed in Table 4.

Table 3. GAVI-eligible countries that had not yet applied for HPV funding by January 2015 included in data collection

Country*	World Bank income group[1]	DTP 3 coverage[2]	Incidence of cervical cancer (age-standardized rate per 100,000)[39]	Cervical cancer mortality rates (age-standardized rate per 100,000)[39]
Comoros	LIC	86%[3](WHO/UNICEF) 73% (HH survey)	61.3	40.3
Congo, DR	LIC	72%[3] (WHO/UNICEF) 89% (National) 62% (HH Survey 2010)	33.1	27.3
Djibouti	LMIC	81%[4](WHO/UNICEF) 81% (National) 61% (HH Survey 2006)	17.3	11.5
Eritrea	LIC	99%[3](WHO/UNICEF) 94% (National) 98% (HH Survey 2007)	17.4	13.1
Guinea-Bissau	LIC	80%[3](WHO/UNICEF) 90% (National) 81% (HH Survey 2010)	29.8	21.6
Kyrgyz Republic	LIC	96%[3](WHO/UNICEF) 96% (National) 85% (HH Survey)	23.7	11.2
Mauritania	LIC	80%[3](WHO/UNICEF) 80% (National) 57% (HH survey 2007)	29.4	18.8
Nicaragua	LMIC	98%[3](WHO/UNICEF) 108% (National) 95% (HH Survey 2006)	36.2	18.3

* Nigeria was also included in data collection despite a prior application and approval for a GAP project as the project was never started.
[1] World Bank classifications February 2014: LIC = low-income country; LMIC = lower-middle income country; UMIC = upper-middle income country
[2] 2012 estimates unless otherwise stated. Source: Gavi website; HH = Household
[3] No directly supporting data (low grade of confidence)
[4] Estimate supported by at least one data source either reported data, UNDP data or survey data,

Table 4: GAVI-eligible countries that had not yet applied for HPV funding by January 2015 and considered ineligible for data collection.

Country	World Bank income group[1]	DTP3 coverage[2]	Incidence of cervical cancer (age-standardized rate per 100,000) [39]	Cervical cancer mortality rates (age-standardized rate per 100,000) [39]	Eligible for data collection
Afghanistan	LIC	71%[3] (WHO/ UNICEF) 87% (National) 40% (HH Survey 2011)	8.8	6.9	No, incidence <15/100,000
Central African Republic	LIC	47%[3] (WHO/ UNICEF) 59% (National) 32% (HH Survey 2010)	21.0	15.3	No, DPT coverage <70%
Chad	LIC	45%[3] (WHO/ UNICEF) 72% (National) 20% (HH Survey 2010)	18.8	14.6	No, DPT coverage<70%
Guinea	LIC	59%[3] (WHO/ UNICEF) 102% (National) 50% (HH Survey)	38.4	27.9	No, DPT coverage <70%
Korea, DPR	LIC	96%[4] (WHO/ UNICEF) 96% (National) 92% (HH Survey 2008)	12.4	7.2	No, incidence <15/100,000
Pakistan	LMIC	81%[3](WHO/ UNICEF) 89% (National) 65% (HH Survey 2013)	7.9	4.7	No, incidence <15/100,000
Somalia	LIC	42%[3] (WHO/ UNICEF) 61% (National) 14% (HH Survey 2006)	33.4	20.1	No, DPT coverage <70%
South Sudan	LMIC	59% (WHO/ UNICEF) 68% (National)	30.4	20.3	No, DPT coverage <70%
Sudan	LMIC	92%[4] (WHO/ UNICEF) 92% (National) 59% (HH Survey 2010)	7.9	5.3	No, incidence <15/100,000
Tajikistan	LIC	94%[3] (WHO/ UNICEF) 93% (HH Survey 2011)	9.9	4.9	No, incidence <15/100,000
Yemen	LMIC	82%[4](WHO/ UNICEF) 82% (National) 61% (HH Survey 2006)	3.1	2.0	No, incidence <15/100,000

[1]World Bank classification of income group, February 2014: LIC = low-income country; LMIC = lower-middle income country; UMIC = upper-middle income country
[2]2012 estimates unless otherwise stated. Source: Gavi website
[3]No directly supporting data (low grade of confidence)
[4]Estimate supported by at least one data source either reported data, UNDP data or survey data,

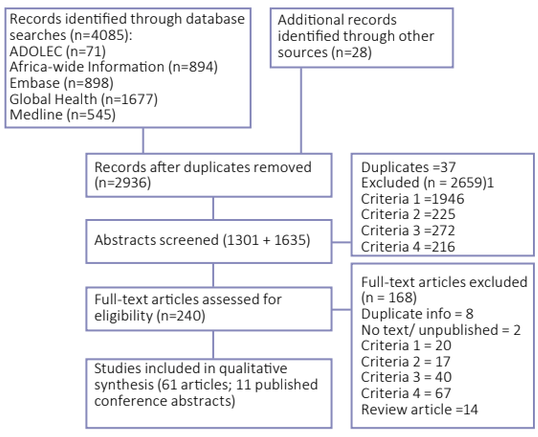
3.2 Literature review

3.2.1 Published literature search strategy

Between 4-11 December 2014, five databases were searched for references: Medline, Embase, Global Health, Africa-wide Information and ADOLEC. Search terms related to HPV, vaccine or immunization were combined with terms for countries that were included in the study (see Appendix B: Example search strategy and results from Medline). If the first year of HPV vaccine experience was known for a particular country, searches were limited to publications from that year onwards in order to reduce the number of articles retrieved that did not document actual experience during vaccine delivery e.g. hypothetical acceptance studies. No language restrictions were applied in the search. Reference lists of identified reviews were checked for papers that may have been missed by the database search. References cited in retrieved papers were also examined and one author was contacted for an unpublished manuscript and references. The search results were then combined and duplicates removed (Figure 1).

Due to a number of countries completing or initiating new demonstration projects in 2015, the search was updated on the 4th-6th April 2016. Search terms, with added country terms for the 9 countries that had started their HPV delivery in 2015, were updated and run again in all five databases. The screening processes and exclusion criteria remained the same. Appendix E summarises the data collected in each of the two grant phases (November 2014 - April 2015 and November 2015 - May 2016).

Figure 1. Published literature search flow diagram



[1]Exclusion criteria for the published literature were: 1) Not focused on HPV vaccination; 2) Not focused on one of our countries of interest; 3) Study does not include any results from after the vaccine was delivered; 4) Not focused on, or relevant to, the demonstration project or vaccine introduction.

The identified references were then screened, first using their title and abstract and then, if not excluded, using the full text. Papers were excluded if they were:

1. not focused on HPV vaccination,
2. not focused on one of the countries of interest,
3. did not include results from after the vaccine was offered, or
4. not focused on, or relevant to, the demonstration project or vaccination introduction itself.

The search strategy for this review purposefully excluded studies on 'hypothetical acceptance' i.e. acceptability studies or formative studies conducted prior to vaccine delivery. This was in order to focus on real experiences and evaluations of vaccine delivery. Modelling studies were also excluded for the same reason.

3.2.2 Grey literature search strategy

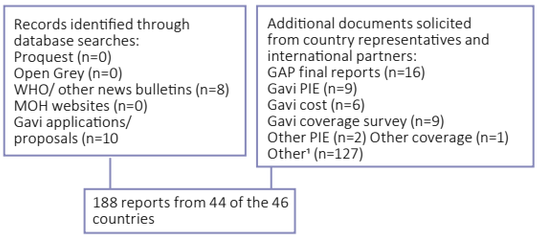
Grey literature is defined as a range of published and unpublished materials, which are not normally identifiable through conventional bibliographic methods. It can include book chapters, books, conference abstracts, reports, unpublished data, dissertations, policy documents and personal correspondence.

Grey literature searches were conducted in two electronic databases; Open Grey and ProQuest. In addition, a number of websites were searched: MOH websites for each country, Global Immunization News (GIN) publications from the WHO, Pan-American Health Organisation (PAHO) newsletters website, and scientific conferences on HPV. Databases and websites were searched using search terms for human papillomavirus or HPV vaccine (Figure 2).

Relevant grey literature was solicited from stakeholders involved in demonstration projects/ national programmes. We received Post Introduction Evaluations (PIEs), individual 'dose reports' submitted by districts after the implementation of each dose, internal evaluations and presentations, and coverage survey results directly from the countries. Axios Heathcare Development asked for permission from countries with GAP-supported demonstration projects to share final reports and, if permission was granted, we received both formal and informal evaluation reports from GAP and country representatives.

Exclusion criteria were the same as for the published literature (see 3.2.1).

Figure 2. Grey literature flow diagram



[1] 'Other' documents included internal country evaluation reports, district reports after each dose, international partner reports, presentations, excel sheets and posters.

3.3 Key Informant interviews

3.3.1 Countries with HPV experience

Overall, representatives from 44 of the 46 countries were approached for interview in order to fill gaps in the data on their HPV vaccine experience in two data collection periods (Figure 3). Countries were selected for interview if there were significant gaps in the information available from published and/ or solicited grey literature. Two countries did not have significant gaps in information (India, Vietnam). Four countries refused interviews (Figure 3). In total, 56 interviews covered experiences from 40 out of 46 countries. Interviews collected information on 59 of the 66 demonstration projects and 11 of 12 national programmes and included information on 83 of the 92 separate delivery experiences. Interviews took place by telephone or in person through country visits or at international meetings.

Interviews were sought with focal people from all projects/programmes in a country, in order to gain insight into potentially distinct experiences. If the interviewee had been involved in multiple projects/programmes, experiences from MOH-implemented projects/ programmes were prioritized and focused on during the interview. For MOH-run projects/ programmes a representative of the MOH was prioritized for interview, although on two occasions partner organisations were interviewed instead, as directed by the MOH (countries 21 and 35). For partner-run projects/programmes, representatives of that organisation were sought for interview. In one case a government representative was interviewed in addition to the focal person within the implementing organisation. Interviews focused on gaps in information and lessons learnt. Where appropriate, additional reports were requested and received. The full interview topic guide is appended in Appendix C. This was adapted for each interview to address the gaps identified by the literature review.

Ethics approval was received from the LSHTM Ethics Committee.

3.3.2 Countries that had not yet applied for support to introduce HPV vaccine

National immunization programme staff from the nine countries eligible for Gavi support for HPV vaccine demonstration projects, but that had not yet applied for support, were approached for interview by email and phone call. Five country representatives, national EPI managers or occupants of an equivalent position, agreed to be interviewed. Interviews followed a pre-defined topic guide (appendix D) and covered how decisions to introduce vaccines are made in their country, whether recent discussions had included HPV vaccine and the perceived barriers to HPV vaccine introduction/applications for support.

3.4 Data extraction from published and grey literature and interviews

In total, 61 published articles, 11 published conference abstracts and 188 grey literature papers and reports were screened and had data extracted. Four researchers completed the data extraction over seven months, from February to May 2015, and from January to April 2016.

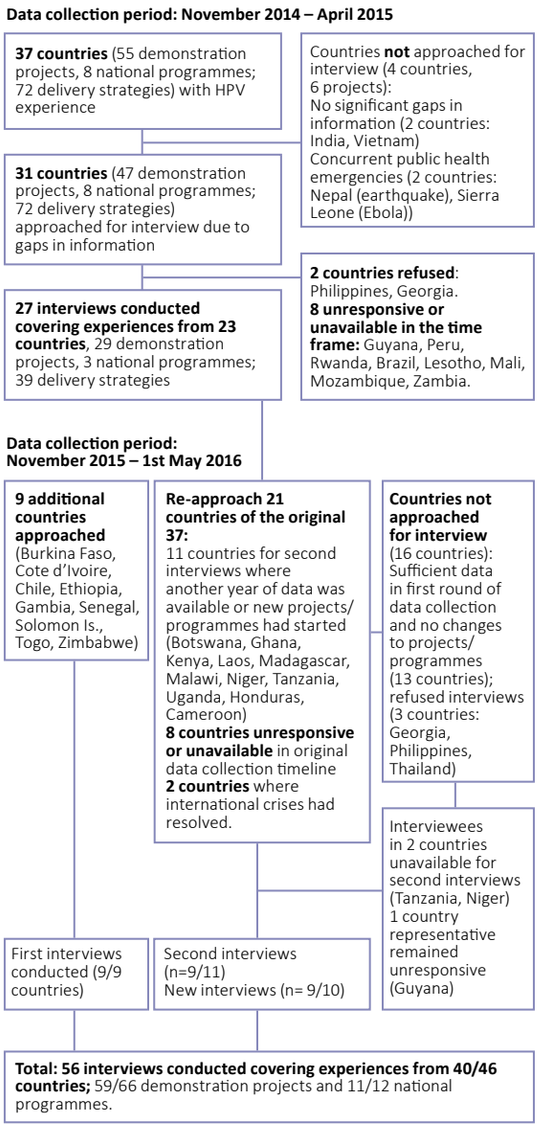
The Excel-based data extraction matrix was developed using the WHO's new vaccine introduction guidelines [40]. Topics and themes were further developed by the research team. The matrix was piloted and revised twice before being finalised. The researchers involved in data extraction conducted two checks of consistency; first the same set of ten articles were read by all researchers, data were extracted and the results were compared and discussed. The exercise was then repeated with a set of five different articles.

Data were extracted on seven thematic areas:

1. National decision making and planning,
2. Service delivery, Health workforce,
3. Monitoring and evaluation,
4. Financial support,
5. Sustainability,
6. Scale up.

The themes were further sub-divided into 18 sub-categories. Each sub-category had a set of questions that were used to extract data from published and grey literature. These questions were then used to inform key informant interview topic guides to address any gaps in available information (see Appendix C: Topic guide including full list of questions). Data from 56 interview transcripts were extracted onto the same Excel matrix.

Figure 3. Key informant interview flow



3.5 Data analysis

All country data from the literature and interviews were analysed together to produce aggregate summaries of the themes in cross-sectional thematic analysis. Themes were identified as:

- National decision making and planning,
- Service delivery,
- Health workforce,
- Monitoring and evaluation,
- Financial support,
- Sustainability,
- Scale up.

Data on sub-categories for which qualitative data was extracted, from interviews or literature, were analysed thematically. Quantitative data (e.g. coverage, adverse events) were analysed descriptively to enable presentation of frequencies and proportions. Coverage was categorised because some projects/programmes only presented a percentage coverage estimate without the numerator/denominator data. Pre-defined points of interest, as well as common themes reported in the data, were selected for cross tabulation with project/programme coverage and/or delivery strategy.

Social mobilisation methods were tabulated with coverage data and linked to acceptability data where possible.

The level at which the HPV vaccine project/ programme was integrated with the EPI/ national immunisation system was assessed across individual components of health system functions. When a parallel/separate process was created to manage the delivery and monitoring of HPV vaccine, this meant a lower degree of integration.

Country/project case studies were developed for particular challenges and/or successful strategies for each topic.

Where country data was in the public domain, countries were identified in the analysis; data from grey literature or interviews that were not in the public domain were anonymised.

4. General results

Across the 46 countries with HPV vaccine experience included in this review, data were analysed from 12 national programmes and 66 demonstration projects that had completed at least six months of implementation by May 2016. This represents 15 distinct delivery experiences in the 12 national programmes and 77 separate delivery experiences in the 66 demonstration projects (Figure 4). Among the 66 demonstration projects, 30 were supported by GAP through Axios Healthcare Development, 20 by Gavi, four by PATH (funded by the Bill & Melinda Gates Foundation, implemented by EPI with vaccine donated from either GSK or Merck & Co.), and 12 by other means (Figure 5: Map). See Appendix A for details of countries' projects/programmes and delivery experience characteristics. Appendix E has a summary of the countries and data collected in each of two data collection periods.

For all sections of the report, we have only used information from projects/programmes and delivery strategies with at least 6 months of experience. However, in addition, countries supplied some data on future plans: one country planned to start a third demonstration project in late 2016, one country planned to start national programmes in the near future and two others planned changes in their delivery strategy for the existing national programmes.

Not all projects/programmes reported target population data. Among the 69 delivery experiences that reported target population size, 1,750,000 girls were targeted with HPV vaccine. The target population was estimated for 11 delivery experiences using the number of doses received and coverage rates and/or previous years' cohort sizes (23 strategies remained with missing data).

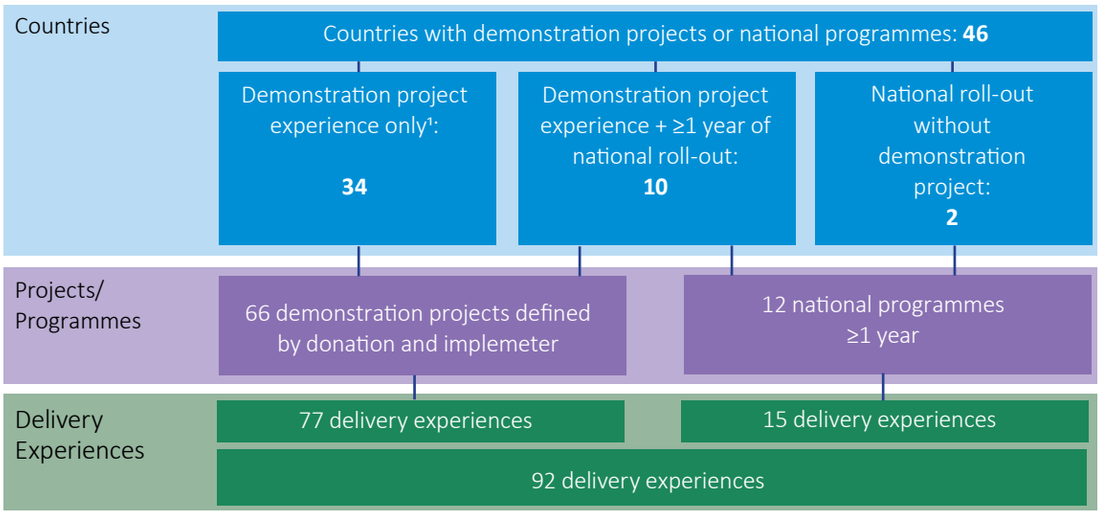
Among the 56 delivery experiences that reported the number of girls who received the final vaccine dose, 1,400,000 girls received the final dose of HPV vaccine. The number receiving the final dose was estimated for 13 further delivery experiences using coverage estimates and estimated target populations (36 experiences remained with missing data).

Twenty-one delivery experiences had implemented at least 6 months of a 2-dose HPV vaccine schedule by 1st May 2016 (0, 6 months). Only 10 of these reported two-dose coverage. All other projects/programmes implemented a 3 dose schedule. The dose schedule recommendation change in April 2014[41, 42] left insufficient time for more data on two-dose schedules to become available within this study's timeline.

The main themes are presented in the following way:

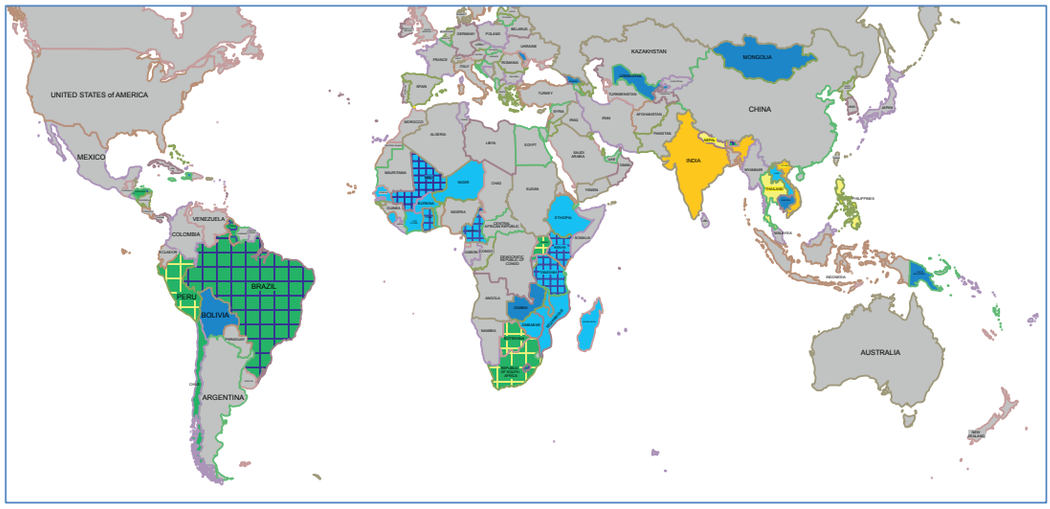
- A description of country experience and reported lessons learnt from country reports and representatives.
- Key lessons and conclusions interpreted from the data.
- Recommendations developed after independent cross-country analysis of each theme.

Figure 4. Countries, projects/programmes, delivery experiences included in the study



The number of countries and delivery experiences contributing to each topic is summarised in Table 5. A number of 2-page briefs were developed from the results of this study, for dissemination to national and international stakeholders. The information that contributed to each brief is listed in Table 6. The reported lessons learnt are frequently presented adjacent to the number of countries and/or projects/programmes that made the same, or a similar, statement. This is intended to inform, but not to govern, how we interpret the information. The number of countries, projects/programmes or delivery experiences displayed in this way is most likely an under-representation of the number of projects/programmes that could have identified the specific point or lessons because the level of reporting and available information varied greatly across countries.

Figure 5: Map of countries included by project/programme and donor type[1]



[1]Data displayed is the status as of 1st May 2016. Botswana, Uganda and Uzbekistan started or were planning to start national programmes in 2015-16; solid fill is that of most recent project/programme, hatching indicates previous projects in-country.

Table 5. Summary of the number of countries and delivery experiences with available data on each theme

Report Section	Data collection phase 1 (Nov 2014 - April 2015)			Data collection phase 2 (Nov 2015 - May 2016)		
	Countries (N=37)	Experiences[1]		Countries (N=46)	Experiences[1]	
		No.	%		No.	%
5 Preparation						
Selection of districts	26	30/72	42%	40	53/92	58%
Planning processes	33	37/72	51%	36	59/92	64%
Enumerating target population		37/72	51%	45	60/92	65%
Vaccine transport		31/72	43%	35	49/92	53%
Cold chain management		48/72	67%	35	48/92	52%
Vaccine wastage		16/72	22%	11	16/92	17%
Waste management procedures		28/72	39%	33	43/92	47%
Health workforce training	15	27/72	38%	30	42/92	46%
Training timing and duration	15	27/72	38%	27	30/92	32%
Health workforce allocation	22	22/72	31%	28	29/92	32%
Staff cadre	17	17/72	24%	19	38/92	41%
6 Communication						
Social mobilisation materials/ methods	30	47/72	65%	40	87/92	95%
Consent process	24	50/72	69%	34	71/92	77%
Acceptability	25	32/72	44%	28	37/92	40%
7 Delivery						
Delivery strategy	34	67/72	93%	43	89/92	97%
Workforce supervision	13	19/72	26%	28	33/92	36%
Workforce remuneration	17	17/72	24%	32		35%
Adverse events	34	45/72	63%	44	56/92	60%
8 Achievements						
Uptake[2]	26	42/72	58%	36	56/92	61%
Completion[2]	27	48/72	67%	30	45/92	49%
Final dose coverage[2]	30	49/72	68%	34	60/92	65%
Monitoring and evaluation	21	28/72	39%	30	42/92	46%
9 Sustainability						
Financial support	37	78/79	99%	46	92/92	100%
Scale-up to national programme	19		51%	34/44		77%

[1]Delivery experiences which had completed at least 1 year by January 2015 (phase 1) or 6 months by May 2016 (phase 2) are the denominator. [2]Uptake: proportion of the target population who received the first dose; Completion: proportion of those who received the first dose who went on to complete the dose schedule; Final dose coverage: proportion of the target population who received the final dose.

Table 6: The results sections that contribute to each 2-page brief in the study dissemination materials

2-page brief	Themes	Results sections
Preparation	Planning, including microplanning Decision-making and leadership District selection Integration with EPI Vaccine management / transport Cold chain Staff training	Section 5 Section 7.2-7.3 Section 10
Communications	Social mobilisation Communication materials Consent Rumours Acceptability	Section 6 Section 10
Delivery	Strategy (school, health facility, other) Target population Estimating target population Timing/ frequency (campaigns, routine, fixed period) Mop-up, outreach Human resources/ work load/ supervision/ remuneration Adverse events (recording, reporting)	Section 7 Section 10
Achievements	Uptake Completion Drop out (between doses) Coverage Data recording and reporting (M&E)	Section 8 Section 10
Sustainability	Costs (review of literature) Scale up to national	Section 9 Section 10
Value	Commentary on the value of demonstration projects	Section 11
Pitfalls	Summary of challenges from the above themes	Section 12

5. Preparation

5.1 Planning

5.1.1 Leadership and decision-making

Among 60 experiences in 32 countries that contributed data on leadership, no single institutional actor routinely took the lead in the decision to conduct a demonstration project. The MOH was most frequently mentioned as leading or contributing to a project, often in partnership with donors or technical advisors. The lead programme within the MOH appeared as likely to be related to cancer or sexual/reproductive health as to be EPI. In a few cases, private or teaching hospitals received funding for small pilots that were planned without government input. These appeared to be most common in earlier demonstration projects (e.g. those funded by the GAP) and were generally more ad-hoc, with government departments not always aware of them. GAVI-funded projects were led by MOH through the national immunisation programme.

Among 69 experiences in 40 countries with data on factors influencing the decision to introduce HPV vaccination, the information most commonly mentioned as influencing the decision to initiate a demonstration project was high national reported cervical cancer burden (29 countries) and availability of free vaccines and other financing (15 countries), followed by reports of successful implementation in other countries or initial formative research results (11 countries). More than one source of information was reported as influencing the decision to introduce the vaccine for most countries. Little information was found about why Rwanda, which went straight to national implementation, had not elected to conduct an initial demonstration project. Interview data indicated that decision-makers perceived no need for a demonstration project. This may have been due to a combination of high-level political support, previous positive experiences introducing other vaccines, and a sufficient supply of donated vaccine to make national implementation feasible (e.g. due to the country's relatively small population size).

Many comments related to leadership and ownership of decision-making. While most indicated that the MOH should take the leadership position, there was more debate about which department within MOH should lead (e.g. reproductive health, non-communicable disease or the national immunisation programme), in projects/programmes where this was not pre-determined by the funding partner (e.g. Gavi after 2012). The need for EPI decision-makers to feel ownership of HPV demonstration projects was stressed in several countries.

5.1.2 Selection of districts for demonstration projects

Among 53 experiences in 40 countries with data on the areas selected for demonstration projects and their characteristics in comparison to the rest of the country, selection was based on four main approaches (Table 7).

Of the 10 projects that selected areas that were convenient, i.e. close to the capital, previously used for research, and/or accessible; 2 project areas were simultaneously representative of national performance.

Table 7: District or area selection approaches for 53 demonstration projects

Selection approach	Example	Number of projects (%)
Typical	Representative of average performance when compared to national averages, e.g. DTP3 coverage, primary education rates and transport/infrastructure	15 (28%)
Convenient	Convenient for monitoring and supervising demonstration activities (e.g. were close to the capital city and/or had good transport links), or were situated close to existing partners, or had been research sites previously	10 (19%)
Variable	Variable conditions so that more than one environment/population could be tested at a time, e.g. representative of both urban and rural areas	16 (30%)
Challenging	Particular challenges that required additional testing and practice e.g. nomadic/ religious groups, hard-to-reach areas	7 (13%)
Outstanding	Better than average performance e.g. in DTP3 coverage, school attendance, cold chain facilities, infrastructure	5 (10%)

Three projects had selected areas that were convenient and attained better than average EPI performance. Hence, these 3 projects did not gain experience of HPV vaccine delivery in districts representative of the nation.

5.1.3 Planning committees and processes

Among the 59 experiences in 36 countries for which planning processes were mentioned, findings from eight Gavi-supported countries and 25 others indicated the existence of planning committees or inter-agency coordination committees, although these were rarely discussed in any detail. Gavi funding required the creation of a planning committee [6, 21] and leadership of the national immunisation programme (NIP) and therefore Gavi-supported projects were generally well integrated with EPI planning processes. Despite this, or perhaps because of assumed knowledge of EPI structures and processes, minimal information was provided on planning processes (e.g. length of planning, planning partners, technical support) in either Gavi-supported or alternatively supported projects.

The 55 experiences in 33 countries for which planning committees were explicitly mentioned, described committees at national and sub-national levels, with sub-national committees responsible for micro-planning and funding requests which were then forwarded to the national committee for approval and oversight. Examples of sub-national level committees include regional representatives forming working groups on: logistics, social mobilisation, training, monitoring and evaluation. One non-governmental implementer mentioned an internal committee but no details were provided. Among the few committees for which membership was mentioned, most had broad inter-sectoral involvement, including representatives from sexual/reproductive health, child health division (e.g. EPI), health promotion and education (school health programme), central medical stores, environmental and occupational health (injection safety), national cancer programme, MOE with international partners - particularly WHO - providing technical assistance.

The importance of timeliness (e.g. of decision-making, information and funding disbursements) was frequently mentioned, usually to indicate that insufficient time had been allowed for project development and planning such that coordination and implementation had suffered accordingly. Only one country mentioned that HPV demonstration planning created difficulties for other EPI planning activities. Several Gavi-supported countries noted that the planning timeline was lengthy, but that had this not been the case, more difficulties could have occurred (e.g. as found in smaller or non-governmental projects).

Sources indicated that to be effective, microplanning needed to involve teachers and school administrators as well as health representatives. Issues to be considered in planning included low education/literacy among parents, low awareness of risks and prevention of cervical cancer, women's health having a lower priority in some families and communities, political instability and geographical diversity.

5.1.4 Integration of planning with other sectors and programmes

Among 40 experiences in 27 countries for which any detail on planning integration was mentioned, minimal information was provided about how planning was integrated into other sectors. The most frequently mentioned way was through involvement of the education sector in planning for HPV vaccine delivery and shared planning responsibilities between the education and health sectors. In a few countries, community development/social welfare sectors were also mentioned. Four countries indicated that no integration with other sectors had occurred, mainly as the project had been a small or non-governmental pilot project.

The style of integration initiatives may have depended more on style of governance and politics than on anything particular to HPV vaccination. In most cases, if mentioned at all, it was as an ad hoc discussion. For example, five countries mentioned HPV vaccination as an addition to an existing school health programme. Although the integration with the school health programme seemed attractive, it was also noted by one country that this required a high level of engagement from MOE and a long time for negotiating partnership agreements.

Collaboration between health, education and finance sectors was noted as crucial to successful implementation. An initial lack of involvement of the MOE had, in some cases, led to difficulties in the planning and subsequent implementation phases of HPV vaccine demonstration projects (e.g. enumeration, timing of vaccination in school year). The involvement of MOE at the national level was often identified as a facilitator or pre-requisite for engaging local MOE and school authorities. When cooperation was good it was often mentioned as a critical factor for high coverage in school-based models. Collaboration with and support from the Ministry of Finance

(MOF) was noted as crucial, yet was sometimes overlooked during decision-making and planning.

Integration with national cancer programmes was mentioned by 37 experiences in 25 countries, while another three indicated that no integration had yet occurred. WHO, which provided technical support for many countries, advocates that HPV demonstration projects be implemented within the guidelines of a four-pronged national cervical cancer strategy, including prevention, promotion, screening and treatment [42]. However, capacity and development of national cancer programmes and cervical cancer strategies appeared to vary considerably, despite WHO initiatives and their development being required for all Gavi-supported countries. Details of national cervical cancer strategies were not available, although sources noted that some Gavi-supported countries were still at the stage of developing these strategies. Only one non Gavi-supported country mentioned integration with a national cancer strategy. No differences were explicitly noted over time.

5.1.5 Key lessons learnt and conclusions

Based on the findings above, lessons related to planning included:

- Political commitment from national authorities provides crucial advantages by increasing interest and support at all levels.
- Funding and technical support by development partners can be very useful during preparation and planning.
- Planning across the ministries of health, education and finance is necessary for success, including harmonizing policies, regulations and protocols to support institutional and technical sustainability.
- Planning alongside the education sector can improve vaccine acceptability and effectiveness, for example in choosing school grades with the highest female attendance (e.g. confirming sub-nationally whether this was grade 5 or 6) and coordinating vaccination with school calendars to avoid examination days or other important events.
- Agreements with national ministries (e.g. MOE) did not necessarily translate into cooperation with sub-national sectoral representatives and, in the case of local departments of education and school authorities, cooperation could often be delayed or problematic if not sought early.

5.1.6 Key recommendations

Based on findings related to planning, we recommend that:

- Strong inter-sectoral coordination is facilitated from the beginning, so that all decision-making and planning includes, at a minimum, national-level decision-makers from MOH, MOE, and MOF.
- Sufficient time must be allowed in project/ programme timelines for decision-making and planning at national and sub-national levels (e.g. this can take at least 9 months).
- While EPI does not have to lead each demonstration project/ national programme, EPI must feel ownership of the project/programme, as its active support and participation in planning and delivery phases is necessary for effective vaccine delivery.

5.2 The decision not to implement HPV vaccine

By January 2015, nine Gavi-eligible countries were eligible to apply for HPV vaccine project funding but had not (i.e. they met the DTP3 coverage threshold of >70% required and had significant cervical cancer incidence, for this study defined as >15/100,000 women years according to GLOBOCAN 2012 [39]). These countries were: Comoros, DRC, Djibouti, Eritrea, Guinea-Bissau, Kyrgyz Republic, Mauritania, Nicaragua and Nigeria. Nigeria had applied for GAP support for a demonstration project, but it had never started and no application for Gavi support had been made at the time of data collection.

Representatives from five national immunization teams were available to be interviewed. All five representatives, reported that cervical cancer was a public health problem in their country; four mentioned it as an important problem. All five representatives were aware of Gavi funding for the introduction of HPV vaccine and had experience of Gavi funding for other vaccine introductions.

In four countries, in-country data was stated as the factor which most informed the decision to introduce new vaccines. Two countries gave details about the committees which were formed to discuss new vaccine introductions. These were multi-stakeholder groups with very similar membership as to those identified by countries who have already introduced HPV vaccine.

One country stated that they used information from their last PIE to inform their decision.

"Our decision to introduce the new vaccine is based on the PIE from the past vaccines introduced, which give lessons for future vaccine introduction. The final decision is arrived at and the ICC approves for the new vaccine"

Country D representative.

Decision-making processes appeared to be very similar to countries with HPV vaccine experience. However, competing priorities were stated as the main reason for not yet applying for Gavi support. Two countries were planning to submit an application to Gavi within the next year (Nigeria and country A). Nigeria had delayed introducing the HPV vaccine, despite high-level interest in its introduction since 2010, mainly due to fears that HPV vaccination would affect coverage of other routine infant vaccination, including polio vaccine. It was felt that a vaccine targeting girls of reproductive age would exacerbate existing rumours around vaccines causing infertility and sabotage any previous gains in polio vaccine coverage.

"To go and bring a vaccine which is targeting only girls in that reproductive age group was dangerous. We felt we needed to take some time, sort out the problem of polio and proceed gradually. I think we have got to that stage now"

Nigeria representative.

One country (Country B) had discussed the addition of HPV to their schedule and was soliciting help from technical partners to discuss delivery feasibility. However, along with a second country (Country C), competing priorities with rotavirus, rubella, PCV13, meningitis A and measles second dose vaccine introductions had delayed discussions around HPV vaccine introduction. The fifth country (Country D) stated that there was insufficient funding at the moment to discuss HPV vaccine, not enough information on who would lead the introduction and monitor it and a lack of experience and support, and therefore insufficient political will to take it forward.

"The country was introducing a number of vaccines from 2012. We didn't consider cervical cancer as much of a public health importance in the country. There were sentinel sites monitoring rotavirus, and rubella, meningitis and measles instead – hence the delays in introducing the HPV vaccine."

Country C representative.

5.3 Vaccine Management

5.3.1 Transport

Information on the supply and transportation of HPV vaccines was available from 49 experiences in 35 countries. National programmes and over half of demonstration projects for which information was available used the routine immunisation programme transport system to supply health facilities with HPV vaccine. Of the seven experiences where regular EPI processes were not used, three were GAP projects not led by the MOH, one was financed directly by Merck, one by a provincial health department, one by ACCF and one was financed by GAVI. In some countries, the transport timetable of the routine vaccines did not correspond with that of the HPV vaccines and separate transport had to be arranged. In some of these projects, the implementers had originally assumed that the HPV vaccine would be transported together with other EPI vaccines, but in reality this proved problematic to organise, due in some part to the timing of the demonstration project not aligning with quarterly delivery schedules. Moreover, some demonstration projects were not planned in close coordination with the routine vaccination programme. In one instance, transport quality of the HPV vaccine was seriously compromised due to inadequate cold chain support (Country 25).

If nurses from health centres delivered the vaccine in schools, school vaccination teams generally collected the vaccine from health centres or district vaccine storage using vaccine carriers.

5.3.2 Cold storage

In total, 48 delivery experiences in 35 countries provided information about whether a cold chain assessment was completed before the HPV vaccine demonstration project was implemented. In many instances, assessment was part of a large, national cold chain assessment. Based on these assessments, additional refrigerators and cold boxes were procured in advance for several of the demonstration projects. However, some countries reported limited cold storage space at either national, regional or district cold stores. In some countries, the storage space was only gradually expanded after the first HPV dose had been delivered. In one country, some of the vaccine supply was kept at district level due to limited refrigeration storage capacity at some health facilities. This was reported to have resulted in lower than expected coverage in those facilities. The key informant attributed this to having a resultant 'pull' rather than 'push' system of vaccine supply where health

workers had to collect the vaccine when stock ran out at the health facility level.

Information on cold storage equipment used for the HPV vaccine was available from 36 demonstration projects. In 34 of these, the usual EPI cold storage equipment was used. The two projects that used separate cold storage equipment were both GAP projects. In both of these projects, new fridges were procured especially for the HPV vaccine, which were installed in project offices or project pharmacies and not in EPI central stores or health facilities. In one case this was at the request of EPI because there was no space at regional storage facilities. In the other project, it was not possible to procure vaccine carriers and therefore cardboard boxes with refrigerants were instead used when carrying the vaccine to schools. There were reports of lack of temperature monitoring in several countries, but this was not only an issue for the HPV vaccine.

Photo courtesy of D. Watson-Jones

5.3.3 Vaccine wastage

Among 16 experiences in 11 countries providing information on HPV vaccine wastage and vials (i.e. either single or two-dose vials) used, only one reported considerable wastage, due to accidental freezing of the vials. This resulted in the demonstration project being halted halfway through third dose implementation. The other 15 projects reported marginal vaccine wastage (e.g. between one and 42 doses wasted per project), as one/two dose vials reduced wastage considerably

In general, great care was taken not to waste HPV vaccines. Project teams were aware that the vaccine was relatively expensive and often only a limited amount was supplied. The HPV vaccine was often viewed as a precious commodity, with the demonstration project seen as the only chance of getting the vaccine.

5.3.4 Waste management

Information on waste management of used syringes and needles was available from 43 experiences in 33 countries. All of these reported that used syringes and needles were disposed of in a similar manner to other syringes used by the EPI programme. For most projects, it was simply stated that "usual EPI procedures were followed".

Other approaches included:

- waste kept in a secure place at the schools until collected for incineration at designated waste disposal sites;
- waste transported in sharp boxes back to the health facilities for incineration;
- private waste management companies contracted by district health management teams to collect and dispose of waste at appointed dates and times.

While no projects reported issues with waste management that were particular to HPV vaccines, it was apparent that systems for waste management were weak in many of the settings. For instance, one key informant stated:

> "Waste management was also the same. The problem is however that we have a national policy for waste management, but don't have funding to implement it. So waste is just burned in secured tanks because we don't have funding for incinerators"
>
> *Country 17 representative*.

5.3.5 Key lessons learnt and conclusions

In relation to vaccine management, key lessons included:

- Countries have introduced several new vaccines in the past decade and are accustomed to cold chain assessments and expansions.
- The HPV vaccine is sensitive to freezing and this is the greatest risk for vaccine wastage.
- If EPI systems for vaccine transport, cold storage and waste management are weak, this also affects HPV vaccine.

5.3.6 Key recommendations

In relation to vaccine management we recommend that:

- HPV vaccines should be transported together with the other EPI vaccines. This reduces the risk of temperature fluctuations by using established EPI systems and integration is cost efficient. HPV vaccine delivery timing needs to be coordinated with routine EPI vaccine delivery timings.

- Implementers of demonstration projects outside of the EPI should not assume that the EPI cold chain is adequate and working optimally, or available to be used for HPV vaccine.
- Waste management procedures should be regularly reviewed and strengthened.

5.4 Staff training

5.4.1 Training approach

In total, 42 experiences in 30 countries provided information on staff training. HPV vaccination training was commonly conducted in a cascade manner, with the national immunization team being trained initially, sometimes alongside the provincial teams. National or provincial representatives then trained district representatives, who then trained the frontline staff. In total 37 experiences in 26 countries, including six national programmes with data, reported using cascade training (e.g. Countries 3, 12, 15, 17, 21, 22, 26, 28, 30, 31, 33, 36, 37). Almost all of these projects/programmes were led by the MOH and therefore used EPI staff. The transfer of information between levels in the cascade was reported to be of variable quality by four countries, who recommended that cascade training should be monitored and evaluated by national level staff to ensure consistency of messages (Countries 2, 3, 12, 17). This was especially pertinent in one country where HPV vaccination training was combined with measles campaign training to reduce costs. Limited supervision resulted in most staff reporting only receiving training on measles and this was reported as the reason for their delay in starting to deliver the vaccine despite having it available at the health facility (Country 33; see Section 10: Integration).

Three countries used a centralized training model, where the national team trained frontline vaccinators either when visiting districts or inviting all vaccinators to train at a central venue (Countries 8, 16, 35). Just one country reported an alternative approach to training and developed a successful distance learning module to train health professionals and teachers; completion of the module took 40 hours (Country 4).

Most training sessions were developed and/or coordinated by international partners in conjunction with the MOH. Where the cost of training was a problem for countries, one country recommended cutting the number of national level team members who were trained in order to concentrate on the service delivery personnel (Country 21).

Training activities were generally focused specifically on HPV vaccination, combining knowledge about cervical cancer and the HPV vaccine with reminders about EPI standard processes. Responses from three countries indicated that HPV vaccination warranted specific training, as it involved targeting a specific age group and gender, awareness raising about cervical cancer (baseline knowledge was low), potentially new practices relating to consent, and vaccination in schools (Countries 3, 12, 15).

5.4.2 Participants

Among 38 experiences in 30 countries mentioning training participants, these included a wide range of stakeholders: national, provincial and district-level stakeholders in vaccination from both the education and health sectors, nurses, health education officers, lay counsellors, pharmacy technicians, community health workers, teachers, school health teams, hospital nurses, head teachers, hospital doctors and community mobilizers.

One country recommended that pharmacists should participate in training if they have a role in cold chain management, in order that they feel ownership and can advise on supply chain logistics if/when necessary. Non- EPI staff, e.g. reproductive health staff, were rarely mentioned as being the target of the HPV vaccine training. However, all health workers, not only those delivering HPV, were seen as needing detailed knowledge of HPV, the vaccine, HPV-associated cancer and reasons for the target age and population, in order to allow them to become consistent and reliable sources of correct information in the community (Countries 3, 12, 31, 36). Only one country stated that additional HPV vaccination training was unnecessary, because of past experience in vaccination (Country 6).

Teachers were key partners in most HPV vaccine projects/programmes; every delivery strategy accessed school-age children even if it was not utilising a school-based delivery strategy. Teachers were seen as being reliable conduits of information about the vaccination project/programme, if well-mobilised (Countries 3, 15, 18, 24). In three countries, it was reported that one day briefing of teachers was insufficient and that teachers requested more training on cervical cancer, the vaccine and the biology of HPV. In one country where no training was provided to teachers, the scope of the social mobilisation of school girls was limited.

Two countries suggested that separate training for health workers and teachers ensures the respective roles are clear. However, it was then useful to join the groups to consolidate roles and relationships and develop a micro-plan for delivery (Countries 12, 33).

5.4.3 Duration, timing, refresher sessions

Among 30 experiences in 27 countries including data on training duration or timing, the duration of HPV vaccine training sessions for health workers varied from less than a day to three days. Often duration was reported to vary as training cascaded down from national to community level, or depending on the recipient group e.g. health workers, teachers or local leaders. For health workers, one day of training was the most common, although recipients in two countries reported that this was too short. HPV vaccination training was generally conducted separately, rather than being integrated into other trainings (See Box 11; Section 10: Integration for one example where this was not the case).

The interval between the training and the start of vaccine delivery varied from just one day, to a few months. In three instances, where training occurred between one day and two weeks prior to vaccine delivery, health workers reported that the interval was too short and that this was too rushed as ideally training would have occurred before the social mobilisation campaign (Countries 3, 15, 31). If training was delayed, it impacted on how well communities were mobilized by the key influencers (health workers and teachers). The ideal interval was specified by one country as one to two months before vaccination started.

Refresher training between doses was not mentioned or not deemed necessary in most countries in the first year of their demonstration projects, but was reported as a factor to ensure good completion of the vaccine schedule in seven countries, including one implementing a national programme (Countries 8, 12, 15, 21, 26, 30, 33). One country stated that the intensity of training could decrease over time (as years of the programme passed) and perhaps just a reminder to healthcare workers and teachers prior to the second and/or third doses would be adequate after a few years of the programme (Country 33).

5.4.4 Training content and materials

Among nine experiences in seven countries that provided data on training content and/or materials, relatively little detail was included (Countries 12, 14, 18, 21, 25, 31, 33). Only four of these projects/programmes mentioned that participants were trained on adverse events (Countries 14, 21, 31, 33). Another stated that a seminar was held on handling 'minor and major incidents' (adverse events) but attendance was not mandatory (Country 25). There were insufficient data to link training on adverse events with the data on adverse events experienced. Topics covered in training generally included:

- Cervical cancer and its prevention
- HPV immunization schedule
- Target group
- Administration technique
- Stock taking
- Messages for girls and parents
- The consent process
- Information, education, communication (IEC) materials and role-play
- Handling adverse events following immunisation (AE)
- Micro-planning
- Calculating coverage and targeting efforts on low coverage areas
- Cold chain requirements and management
- Safe injection procedures

Three countries reported that training materials need to be delivered in a timely way so as not to delay training and/or social mobilisation activities, Those trained also requested materials to take away at the end of the session (Countries 3, 23, 30).

A participatory approach (demonstrations, role plays, and active learning) and the use of visual training materials were reported as being effective by three countries (Countries 12, 26, 30). One country reported that training materials developed during a previous demonstration project were useful for training for national roll-out (Country 3).

5.4.5 Key lessons learnt and conclusions

In relation to staff training the key findings included:

- Cascade training was the most common method of training staff in HPV vaccine introduction; however, a number of countries identified issues around the quality of training for frontline staff.
- All health workers, not only those delivering HPV vaccine, need knowledge of HPV, the vaccine, the cancer(s), and reasons behind the eligibility criteria, so that they are able to answer questions from the community and help to mobilise girls.
- Teachers are trusted in the community and can greatly enhance consent and acceptance rates through social mobilisation – they should be included in micro-planning and trained appropriately.
- The ideal timeframe for training is at least two months before vaccine delivery, in order that health workers and/or teachers can conduct social mobilisation activities in good time before vaccination days. Materials should be planned well in advance so their delivery does not delay the start of training.
- Novel aspects of HPV vaccine and its delivery require specific training, although training could be integrated into other EPI training for nurses and may be conducted less frequently in the future, as processes become more familiar and existing staff become more experienced.

5.4.6 Key recommendations

In relation to staff training we recommend:

- General knowledge of HPV and cervical cancer is low among healthcare workers and the community. Careful training is necessary in order to explain the efficacy of the vaccine, the eligibility criteria and appropriate social mobilisation messages.
- Adequate training is needed in order that staff can resist pressure to deviate from eligibility criteria and to ensure that coverage estimates are accurate.
- Cascade training is likely to be more efficient and less expensive than a centralized training session (where all frontline staff are trained by a national 'trainer'). However, cascade training should be monitored and evaluated to ensure consistency of messages.
- Teachers and some healthcare workers, including those not delivering the vaccine, should be included in training.
- Training should be conducted at least two months before vaccine delivery.

6. Communications

6.1 Social mobilisation

6.1.1 Formative research

Only seven countries specifically mentioned in post-delivery evaluation reports that formative research informed their mobilisation strategies (Countries 12, 22, 23, 26, 30, 31, 33). Other countries may have conducted formative research but not mentioned its influence. Formative research was used in these seven countries to identify particular social mobilisation challenges (e.g. literacy levels in Country 23), to define effective messages and to develop communication strategies. The importance of formative research or prior experience was emphasised in two countries, one of which had learnt to allow more time to develop and pre-test IEC materials, after confusion over messages during a previous vaccine introduction (Country 22).

6.1.2 Messages

For most projects/programmes, mobilisation messages were tailored for a target audience (e.g. health and education officials, teachers, communities, families, girls) and focused on providing key information about:

- Cervical cancer, including the importance of HPV vaccination in prevention;
- Vaccination logistics, including doses required, timing and venues, consent procedures;
- HPV vaccine safety and efficacy, MOH and MOE endorsement (if applicable), length of protection, potential side effects;
- Countering misinformation and rumours, including the message that HPV vaccination does not affect fertility or cause long-term adverse effects.

Messages were developed to address community concerns identified regarding HPV vaccine safety, efficacy, schedule and eligibility. Endorsement of HPV vaccination by the government and/or relevant authorities (e.g. WHO) was highlighted in messages in some countries in order to increase target audience confidence in the project/programme. Published formative research from Soweto in South Africa identified that mothers' desire to protect their daughters from sexually transmitted infections (STIs) was a major driver of acceptability, in an environment which they felt was high risk for gender-based violence and rape [43]. This was the only documented experience of increased acceptability when framing the vaccine as an STI vaccine rather than a cancer vaccine.

In general, HPV vaccine as a cancer prevention method was more frequently emphasized than its role in STI prevention. The reason for this was two-fold. The public often had little to no knowledge of HPV and were more familiar with the concept of cervical cancer. There were also concerns at the policy level that framing HPV vaccination together with STIs and reproductive health may increase stigma around the vaccine and decrease parental acceptance, or may cause confusion about HIV versus HPV prevention messages.

All reported mobilisation messages generally targeted the whole community, including boys. Messages specifically targeting girls aimed to raise awareness of the importance of protecting girls and encourage them to get the vaccine, and the lack of specific messages for boys was not mentioned by any country or project/programme as effecting community acceptance of the vaccine. Two countries stated explicitly that boys were interested in how to protect their mothers and sisters (Countries 6, 25). The media in one country criticised the exclusion of boys (Country 30); boys were sometimes included in integrated simultaneous interventions, e.g. deworming and tetanus toxoid booster administration (see Section 10: Integration). One country reported that boys requested the vaccine (Country 15).

6.1.3 Information dissemination approaches

Information on IEC materials and methods was available for 40 out of 46 countries, covering 87 out of 92 different delivery experiences. Various approaches were used to disseminate information and messages. Inclusion of an interactive approach to communication was mentioned by 46 out of 87 experiences:

Interactive approaches included:

(i) One-to-one/group meetings at schools, health facilities or outreach sites.

(ii) Direct contact with teachers, health-workers, community health-workers, and communicators.

(iii) Home visits by health-workers.

Non-interactive approaches included:

(i) Announcements on local media, including radio and television spots social media internet sites

(ii) Announcements at religious services.

(iii) Loud-speaker announcements.

(iv) Distribution of leaflets and posters

Evidence from four countries indicated that interactive approaches were more effective in increasing community acceptance and mobilising girls (Countries 26, 31, 33, 36).

Information sources were defined as the people or IEC materials delivering the messages. The top three information sources accessed by parents were reported by coverage and acceptability surveys in ten countries covering 13 delivery experiences (Countries 12, 13, 17, 18, 28, 31, 33, 36, E, G; Table 8). Meetings with health-workers and/or teachers, held in school or community locations were by far the most common information source reported. In Tanzania, parents who reported attending a teacher-parent vaccination meeting were significantly more likely to have a vaccinated daughter than those reporting not attending these meetings [44].

HPV vaccine cultural troop, Tanzania (Photo courtesy of D. Watson-Jones)

Table 8. Main sources of HPV vaccine information cited by parents

Information sources	Score[1]	Number of country surveys
Interactive meetings with teachers and/or health-workers	25	11
Radio	10	5
Local media (e.g. TV)	7	4
Posters	5	3
Pamphlets	4	2
Other verbal communication (e.g. relatives, girls, church)	4	3
Internet	1	1
Loudspeaker	1	1

[1]The most commonly reported source from each survey was given a score of 3, the second most commonly cited source of information was given a score of 2 and the third most common was given a score of 1.

Communication was most effective when delivered by 'credible influencers' within communities. Credible influencers were primarily identified as health workers and teachers/school directors (head teachers), while parents in five countries also mentioned community and religious leaders or influential family members (Countries 12, 17, 18, 33, 36). Example of prominent influential leaders included: First Ladies and royalty (Queens) (Countries 1, E, 13, 28, 31, 37), high level ministerial officials (Countries 30, E, 15, 37, I) and Media and TV celebrities (Countries 4, 30). In Tanzania, parents who first learnt about HPV vaccination from a project source were slightly more likely to have fully vaccinated daughters than those who had heard about it elsewhere [44].

Two countries identified plans to add HPV vaccine information to the school curriculum alongside existing health education sessions (Countries 25, 34). In Uganda, 63% of interviewed girls stated that they wanted HPV vaccine included in the curriculum [45].

In addition to information, an incentive such as promotion T-shirts (Country 4), bookmarks for being vaccinated (Country 11), transport refund for follow up visits (Countries 13, 19) and bracelets were given in one country in some areas to girls after each dose (Country 35). However, this was only evaluated in one country where coverage was high even in areas without the incentive and incentives were stopped after the first year (Country 35).

Countries reported very little about best practices on how to engage media. Those that did provide some information reported:

- Communication may require extensive media engagement so as to leave no room for misinterpretation (Country 1).
- Specific media sessions with journalists and pre-prepared press kits for local media were more effective than merely providing media briefs (Countries 12, 26).

Three countries mentioned using their government social media network to increase awareness of their national HPV vaccination programmes and to combat emerging rumours on social media (Countries 4, 30, B). However,

all mentioned this was challenging:

> "It is hard for the government to appear trustworthy on social media"
>
> *KI Country B.*

6.1.4 Timing and duration of social mobilisation

Timing of social mobilisation activities was reported by 19 delivery experiences and coverage data were available for 13 of these. Timing did not seem to correlate with coverage achieved and optimal timing was probably dependent on the specific local context (Table 9).

Very few experiences explicitly described the frequency of social mobilisation activities (i.e. whether social mobilisation was repeated before each dose or only conducted once at the start). Only one experience stated that mobilisation activities were carried out "before each vaccination session" (Country 5). Another stated that social mobilisation was only conducted before the first dose due to restricted funding (Country 17). The necessity for messages to be given repeatedly to counter newly-arising rumours was identified explicitly by two projects (Countries 25, 37). One country stated that the extent of social mobilisation activities decreased in the second year of the programme as the vaccine became more familiar in the community (Country 33) and another reported that the intensity of mobilisation activities in the first year could not continue due to funding gaps (Country 1).

Table 9: Timing of social mobilisation prior to vaccination and coverage achieved

Timing	Countries in which projects/ programmes reported timing data	Project/ programme coverage	Comments
1-2 weeks	Countries 18, 15	90%, 89%	Country 18: Representatives reported sensitization was "too short" due to the late disbursement of funds for the printing of materials and activities. Country 15: no comments made
2-3 weeks	Countries 3, 11, 31, 30, 12, 26, C, 13.	>90%, NA, 90%, NA, 78%, 83%, NA, 82%	Country 3: At national level, announcements started early but community-level engagement started 2-3 weeks prior to vaccination. Country 30: Delays in getting final agreement of the national education officials delayed messages being sent to schools: "it was too short a timeline".
4 weeks	Countries 4, 14, 33, E.	85%, NA, NA, 87%	Country 33: Teachers thought the notice given of vaccination activities starting was too short. Country 4: 1 month pre-vaccination day billboards and TV programmes were arranged. An Education week at school was organised 2 weeks pre-vaccination and parent meetings were held then.
8 weeks	Countries 13, 21, 28.	83%, 65%, NA	No comments reported by countries
2-4 months	Countries 6, 31.	90%, 78%	Country 31: Sensitization meetings began 2 months prior to vaccination: meeting with administrative area committees (31 meetings), meetings with teachers (one per school), meeting with parents-teams team (1 per school), 5 village council meetings. These were preceded by 36 stakeholders meeting conducted 4 months prior to vaccination.

NA indicates coverage data was not available.

6.1.5 Managing rumours

Rumours were reported in 19 of the 46 countries, and their effects could span over multiple projects/programmes. The consequences of not including measures to prevent rumours or adequately control their spread could be serious and in one instance resulted in the project stopping after just one year (Country 12). Negative media discouraged politicians from further demonstration projects or scaling up to national programme in one country (Country 21). The range of rumours reported was limited with the majority focused on the effects of HPV vaccination on fertility and/or causing adverse events (Table 10):

1. The vaccine is experimental/ being tested.
2. The vaccine leads to fertility problems.
3. The vaccine causes adverse events/long-term effects.
4. There is "another cure" for cervical cancer.

Countries mentioned that tailoring messages to these rumours (e.g. by adequately explaining the limited extent of potential side effects of the vaccine) may help minimise their impact. One country stressed that allowing the media access to accurate information from an independent government source (e.g. high-level government official, respected public health body) was vital to managing rumours (Country 37). One country found that inadequate training of staff and teachers meant that they could not answer parents' questions, which contributed to rumours about HPV causing sterility in a few schools (Country 3). Two countries found that rumours could cross national boundaries (Countries 1, 20). Two countries noted that expensive TV programmes did not seem to have the biggest impact on awareness or preventing rumours and that rumours could influence acceptance despite a well-organised and extensive mobilisation strategy (Countries 12, 21). While three countries stated that a strategy to address rumours should be part of their communications plan (Countries 1, 20, 30), none specified having a crisis communication plan for this purpose.

Three countries reported that rumours were perpetuated on social media networks and used government social media sites to combat these rumours, with limited success (Countries 4, 30, B). The use of social media by parents of children who suffered adverse events following immunisation and anti-vaccine lobbyists 'drastically affected uptake' and is difficult to reverse:

> "Recovering the trust of the target population is proving extremely challenging, despite involvement of major national figures both in the field of medicine and entertainment/social programmes"
>
> *KI Country 4.*

Strategies to manage rumours included:

- Engaging with rumours early and using technology, such as email and SMS messages, and social media to easily reach large audiences with the correct information (Countries 35, 4, 30, B).
- Holding face-to-face meetings with institutional and religious leaders who expressed concerns (Countries 12, 17, H).
- Identifying opposition groups and lobbyists and providing them with additional communication and targeted information (Country 14, F).

One experience illustrates the many different challenges that can reduce the ability of national governments to effectively manage and combat rumours:

> "[MOE] participation in social mobilisation was delayed, they had to wait for the committee's authorisation - this limited the ability to carry out social mobilisation in schools. The launch of the family planning guidelines and in particular increased information on contraceptive implants in the same period as HPV vaccine introduction negatively impacted acceptance of HPV vaccine in some communities. A televised launch by the MOH appeared to mediate some concerns but the biggest challenge was anti-vaccine lobbies on social media (facebook), email and SMS."
>
> *KI Country 30.*

Table 10: Reported rumours and responses

Rumours	Country experience and response
The vaccine is experimental/untested	Country 3: rumour generated as result of opt-in consent; consent was changed to opt-out.
	Country 6, F, I: The words 'trial' or 'demonstration' were perceived as indicating an experiment and were substituted by 'study' or 'pilot'. Fears were compounded by the use of opt-in consent.
	Country 12: government and experts should have engaged with the rumours early on. Vaccination project was stopped after 1 year.
	Country 24: social mobilisation was considered inadequate; coverage in urban areas was low (<70%).
	Country 37: the emphasis during campaign was the vaccine is also being delivered in other countries in the world.

The vaccine leads to fertility problems	Country 8: a crisis response had to be organised with a meeting with the community (reactive response) Since this occurred, a risk communication group has been set up. Country 17: a religious spokesperson spread internet rumours and only stopped after intense mobilisation. Country 21: anti-vaccine lobbyists attained media exposure despite a well-organised social mobilisation campaign. Media training was needed for MOH staff to deal with future rumours. Country 24: social mobilisation was inadequate Country 31: messages around side effects and future fertility needed to be built into parent-teacher meetings. Country 16: high-level parliamentarians "actively advocated for cervical cancer prevention and vaccination and helped to quickly reverse rumours before they got out of hand" Country 16: two vials, one of the injectable contraceptive (Depo-Provera) and one of the HPV vaccine, were shown at the public meeting for people to see the two vials are different Country 28: no information on response to rumours Country F: imams, chiefs, and community liaison officers publicised their support for the vaccine Country I: no specific responses used
The vaccine causes adverse events/long-term effects	Country 28: no information on response. Country 33: no information on response to rumours. Country 35: 2 girls reporting adverse events (AE) were visited and after investigations their mothers were reassured AE were not due to vaccination Country 26: specific sessions should involve journalists to enable them document the appropriate information and counter rumours Country H: a crisis management team was established to deal with rumours, press releases were done and question and answer sessions were organized with health workers.
There is "another cure" for cervical cancer	Country 35: rumours that seaweed cured cervical cancer were tackled immediately with an email newsletter and parent meetings.

6.2 Acceptability and consent

6.2.1 Increasing acceptability

Data on acceptance and refusal of HPV vaccine was available for 37 delivery experiences in 28 countries (34% of 92 experiences and 13% of 46 countries); 26 delivery experiences had a documented acceptance rate or numerical value associated with acceptance (e.g. 'acceptance was high, apart from one school which refused vaccination'). All acceptability studies included in the review were conducted post-vaccination. HPV vaccine refusals occurred among individual girls or parents, at the community level and at the school level, especially in private and faith-based schools (Table 11; Box 1). Some projects noted that persistent sensitization through community influencers increased vaccine acceptability, even in communities demonstrating initial reluctance (Countries 14, 35, 37). An information letter signed by MOE and/or MOH officials, inviting parents to vaccinate their daughters, allayed many parental concerns and had a significant impact on vaccine acceptance. It was clear from at least four countries that hesitancy in health workers, who were not involved in the vaccination programme (e.g. family doctors), to recommend the vaccine induced parental refusal, this supports the importance of broad education of health professionals, even in specialties not related to vaccination:

> "Some parents still refer to their paediatrician or their doctor, and when the doctor does not seem to have been informed, it does not support a favourable opinion in the parents. If the doctor says "I'll think", "I will give you information in 2 days" - it causes vaccine hesitancy. The national HPV organising committee included paediatricians so they eventually publicised their opinion and the missing girls [whose parents had initially refused] could catch up on their schedule."
>
> *KI Country H.*

It is important to note that simply measuring acceptability using dose 1 uptake, without adequate context, has major limitations; the low uptake reported in some projects could have been due to logistical issues as well as refusals e.g. vaccination teams attending sessions on

a different day from that previously planned and therefore not gaining as high attendance at vaccination as expected (see Section 8: Achievements). A longitudinal study in Kenya that ascertained baseline acceptability and subsequent HPV vaccine uptake reported a high parental consent rate of 88% but very low first dose uptake of 33%. Practical barriers to attending the first vaccination session with their daughters were mentioned as the reason for low uptake by 51% of parents of unvaccinated daughters. Parents found it difficult to leave work and/or transport themselves to the health centre to be present (as required) for the vaccination [46].

6.2.2 Reasons for HPV vaccination acceptance and refusal

In total, 29 projects/programmes reported the reasons for parental acceptance. Twelve post-vaccination acceptability studies or surveys of parents or caregivers, including questions on reasons for acceptance or refusal, were conducted in eight countries covering 17

Table 11: Countries with groups unwilling to accept HPV vaccination

Groups unwilling to accept the vaccine	Countries
Community/groups of parents	7 (Countries 1, 5, 6, 10, 14, 18, 23)
Schools (private, faith-based)	8 (Countries 23, 24, 31, 35, 37, F, H, I)
Churches and religious groups	7 (Countries 3,13, 28, 37, B, F, I)
Human rights groups, academics	2 (Countries 12, 30)
Health-workers	4 (Countries 4, 6, 23, H)

Box 1: Specific issues in 'private' or non-government schools

Issues in private/non-government schools and reported solutions:

1 **Private schools have different term-times** compared with government schools; this meant that the vaccines schedule fell on non-school days (Country 23,37).

Solution: Engage private school representatives in local planning processes and plan to avoid delivering vaccine in close proximity to holiday periods.

2 **Private school leaders or representatives were not fully aware** of the programme, became aware too late, or had heard rumours about the programme and therefore refused vaccinators to enter the premises (Country 23, 24, 35, 37, 31).

Solution: Engage private school leaders early and provide detailed information; allow school directors time to consult with parents and decided the consent process

3 **Private school representatives were afraid that they would be held responsible** for adverse events experienced after vaccination, or refused vaccination as they thought parents would not agree with it (Country 23, 31)

Solution: Information needs to be provided on the number and severity of adverse events expected and how to report adverse events to the relevant health facility. Teachers and parents should be mobilised in joint meetings to ensure that they receive the same information and to support teachers if they are challenged by parents.

4 **Private school teachers and parents require more intensive social mobilisation** than those in government schools.

Countries reported that effective mobilisation strategies included:

- Using high-level local officials, community leaders and religious leaders as effective mobilisers in meetings with community members, parents and the media (Country 31, 37)
- Holding question and answer sessions at schools, led by health workers, to address teacher and parent concerns (Country 23)
- Targeting school nurses or medical officers with detailed information so that they could become a reliable source of information for parents and teachers (Country 23)
- General increased awareness over time and successful vaccinations in schools/communities participating early in the project led to higher acceptance at subsequent vaccination sessions and increased demand for dose 1 either during a second opportunity to receive dose 1, or at the time of delivery of dose 2 (Country 23, 31)

delivery experiences. These were conducted for PIEs, international partner evaluations and/or research purposes. Parental acceptance rates were measured by consent rate, uptake, final dose coverage and willingness to recommend HPV vaccination to others. All the surveys included at least an option for an open-ended answer as to why parents accepted vaccination. Results are summarised in Table 12. The most common reasons cited by parents for accepting the vaccine were to protect their child from cancer, a belief in the benefits of vaccines and a perception that their daughters were at risk of cervical cancer.

Reasons for not starting or not completing HPV vaccination, were cited in eight of the studies/surveys from 11 countries, and are presented in Table 13. The three most common parental reasons could be categorised as 'lack of motivation', 'lack of information' and 'systems barriers'. Parents stated: fear of adverse effects and vaccine safety, lack of project/programme awareness, that their daughter was absent on vaccination day. Reasons for not starting or not completing the vaccine schedule were often presented together.

Other reasons cited in the literature and/or interviews, but not linked to an acceptability study/survey are summarised in Table 14. These include reported parental reasons for acceptance or refusal as perceived by health workers, or anecdotal evidence mentioned in reports, with no numerical information as to the frequency or relative importance of the statements.

Only two studies specifically reported reasons relating to completion separately from reasons for not starting vaccination. In Brazil, where 39 of 1377 initially vaccinated girls did not receive the final dose (3%), reasons for this included: moving away and lost to follow-up (31 girls, 79%), unexplained parental decision (3 girls, 8%), girl's refusal (one girl, 3%), pregnancy (2 girls, 5%) and non-serious adverse events reported by the family (2 girls, 5%). Completion was slightly more likely in private than public school (98.9% vs 96.7%)[47]. In Tanzania, qualitative interviews revealed the main reasons for non-completion were absenteeism, transferring schools and not knowing that the vaccine was available at nearby health centres if doses were missed at school [48]. One project assessed completion rates obtained with different delivery strategies and found that mixed delivery (i.e. both schools and health facilities) provided better completion rates (Country 23) (See Section 8: Achievements for more information on the effect of delivery strategy on uptake, completion and coverage rates).

Other reasons for non-completion cited in project/programme reports included:

- Absenteeism, transfer/withdrawal from school (Countries 20, 31, 35)
- Emergence of rumours or negative media exposure
- Logistical difficulties with travel to vaccination site or related costs

Table 12. Reasons for vaccination acceptance (12 surveys)

Top 3 parental reasons for acceptance of the HPV vaccine	Score[1]	Number of surveys[2]
Vaccine is "good for health"	31	12
Protection from cancer	30	12
Protection from infection/diseases	16	9
Perceived risk or susceptibility to cervical cancer	8	3
Have enough information/Information convincing	6	3
Vaccine is safe	5	2
Following others' advice	5	3
Informed about the programme	4	2
Vaccine is free	3	2
Perceived severity of infection and consequences	3	2
To avoid shame/ stigma of an STI infection	2	2
Expression of interest in HPV vaccine and education	2	1
Heard of cancer/ knowledge of someone with cancer	1	1
School providing to every child	1	1
The vaccine is effective	1	1

[1]Reasons were scored, '3' if they were the most common reason given by parents in the survey, '2' for the second most common reason, '1' for the third most common reason. Scores were then combined for each reason across surveys and the number of surveys in which the reason appeared as one of the top three was also noted.

[2]The number of surveys reporting the listed reason as one of the top 3 reasons cited by parents for accepting the vaccine (all surveys had at least as option of answering an open-ended question).

Table 13: Parental reasons for not starting or completing HPV vaccination doses

Top 3 parental reasons for refusal of the HPV vaccine	Scores[1]	Number of surveys[2]
Lack of motivation		
Fear of adverse effects and vaccine safety	16	9
Girls or parents do not want vaccine	8	4
May encourage early sex	6	3
Interfere with fertility	5	2
Cancer is perceived as low priority disease/low risk	5	3
Concern about vaccine effectiveness	4	2
Undisclosed reasons	3	1
Perceived low risk of infection	2	1
Not good for a child	2	2
Lack of information		
Not aware of the programme	25	10
Insufficient information	12	6
Systems barriers		
Absenteeism (girl was away during vaccination day)	21	11
Difficult to determine age eligibility (parents didn't know if girl was eligible)	9	7
Location and time not convenient	5	3
Vaccine not available or not in stock	4	3
Health provider didn't recommend	1	1

[1]Reasons were scored, '3' if they were the most common reason given by parents in the survey, '2' for the second most common reason, '1' for the third most common reason. Scores were then combined for each reason across surveys and the number of surveys in which the reason appeared as one of the top three was also noted.
[2]The number of surveys reporting the listed reason as one of the top 3 reasons cited by parents for accepting the vaccine (all surveys had at least as option of answering an open-ended question).

Table 14. Parental reasons reported in literature and interviews for acceptance or refusal of HPV vaccine

Reasons for accepting[1]	Reasons for refusing[1]
Vaccine is safe and effective	Concern about vaccine safety, AE and rumour of fatalities after immunization
Persuaded by influencers; teachers, relatives and health workers	Not having enough information about the vaccine, including not being aware of the programme
Vaccine is good for health and offer protection against infections	Fear that the vaccine can affect girl's fertility or make girls sterile
The vaccine is available at no cost	Logistic, travel and other vaccination related costs
The vaccine is a government programme and therefore safe	Vaccine is new, a trial, research, or experimental
Protection from cervical cancer	Do not believe in the vaccine
Knew someone who had cervical cancer	Advised not to vaccinate on religious grounds, advice by physician or nurses
	Questions around signing of consent e.g. accepting responsibility
	Absenteeism during HPV vaccination days
	Vaccine could make girls sexually active or promiscuous
	Parents/partners/girls refusing to be vaccinated
	Others: perceived low risk, lack of time, too many vaccines, wait until next time

[1]These were cited in the literature but not identified as originating from a survey.

- Timely/scheduled availability of vaccine and personnel ("girls lost interest if the third dose was delayed") (Countries 2, 5, 23)
- Address changes (Country 11)
- Travel, school holidays, examinations at time of final dose (Country 21)
- Administration of the 3 doses was not completed in the same academic year (7 countries)

Strategies to ensure the delivery of mop-up doses, including whether or not outreach was performed, are described in Section 7.1.6: Mop-up strategies.

Strategies employed to improve completion are in Section 8.1.4: Correlates of coverage.

6.2.3 Consent

Consent policies for HPV vaccine were generally aligned with country-specific national policies. Thus, when opt-out was an official policy for other vaccines administered to older children/adolescents, it was also the consent choice for HPV vaccination. However, several countries that did not previously cater for this age group in any vaccination programme introduced opt-in consent initially. In many cases they switched to opt-out consent in subsequent rounds due to implementation challenges and/or the emergence of rumours that the vaccine was 'experimental' or unsafe (Countries 1, 2, 11, 35). Projects/programmes generally designed new consent forms if written consent was used because this was a new target group and/or existing consent forms had not been adapted to include HPV vaccination at the time of the project.

In total, 71 out of 92 delivery experiences reported the consent procedure used (Table 15). Almost half of them reporting using opt-in, in which parents had to complete a form, or provide verbal consent in two countries (Countries 18, 24), before girls could be vaccinated (Table 15). Three countries required girls to be accompanied by their parents to be vaccinated (Countries 5, 13, 28). This was mentioned as a problem, resulting in lower uptake than expected in two countries (Countries13, 28). The use of verbal assent by girls, in conjunction with written parental consent, was not described in detail, though assent was mentioned in 12 project/programmes from six countries (Countries 12, 26, 33, 36, 31, 30).

Opt-out was used in 19 of 71 experiences (27%), as this was the routine EPI approach and in some countries there was concern that opt-in consent would lead to suspicion that this vaccine was different in some way. Opt-out consent was conducted by either requesting community agreement, through community leaders or meetings, or by educating parents about the vaccination project/programme and then advising parents to keep their daughters at home on the vaccination day or to specify to a teacher if they did not want their daughter vaccinated. Results from five demonstration projects (Countries 4, 8, 26, 31, 33) indicated that several girls chose to be vaccinated even if parents refused. Whereas other projects (Countries 13, 14, 23, 31) noted girls refusing despite parental consent (e.g. due to fear of injections). On a few occasions (Countries 4, E), school principals and chiefs signed the consent forms on behalf of parents.

Some MOHs recommended using opt-in written consent despite it not being the norm because the HPV vaccine was new and was only implemented in selected districts. However, 13 experiences reported that using opt-in consent raised suspicion that the vaccine was experimental (Countries 1, 2, 3, 8, 11, 13, 14, 21, 23, 25, 26, 30, 35). Social mobilisation teams in these countries advised that forms be simplified or the approach changed to opt-out. Seven countries changed to opt-out during or after one year of implementation (Countries 1, 3, 8, 11,

Table 15: HPV vaccine consent procedures by delivery strategy

Delivery Strategy	Number of experiences by consent process[1]				Total
	Opt-in	Opt-out	Changed from opt-in to opt-out	Mixture (opt-in and opt-out	
School-based	16	4	1	5	26
School + health facility	7	6	4	0	17
School + health facility + outreach	6	5	1	3	15
School + outreach	2	3	1	1	7
Health facility	3	0	0	0	3
Health facility + outreach	0	1	0	2	3
Total	34	19	7	11	71

[1]Consent processes divided into mutually exclusive categories.

13, 25, 35). Two countries using consent sheets for receipt of other school health interventions suggested acceptance would increase when HPV vaccine was added to this form, as the vaccine would appear to be routine and the logistics would be simplified (Countries 30, 35).

Of the 15 experiences reporting problems caused by the use of opt-in consent, five reported specific rumours around vaccine introduction (that the vaccine was experimental, caused AEs or loss of fertility). Eleven of the 15 experiences had data on uptake rates; five reported uptake between 64-70% (Countries 3, 6, 21, 30, 35), the remainder had uptake >70%. One found uptake increased from 77% to 99% when they switched from opt-in to opt-out consent, although many other programme factors also changed in this time period (Country 3). One country actively compared uptake with opt-in and opt-out strategies and switched to opt-out as it drastically increased uptake (Country 25).

Eleven experiences used a mixture of consent procedures, some private schools insisted on signing written consent forms whereas public schools used the opt-out process. In one country (Country 6), one community was comfortable signing the consent form whereas another used opt-out.

6.2.4 Reported lessons learnt by projects/programmes

Reported lessons on social mobilisation, acceptability, consent are detailed in Table 16.

Table 16: Reported lessons learnt on social mobilisation, acceptability and consent

Reported lessons
Mobilisation
Strong mass mobilisation should target specific rumours to avoid or reverse the effect of negative media coverage and anti-vaccine campaigns
Collaboration between the MOH and MOE is necessary when conducting mobilisation activities. Health care workers, teachers, and community and religious leaders are the greatest influence on parental decision-making. Teachers and community leaders should be engaged early and encouraged to mobilise girls. Girls can aid identification and mobilisation of peers.
A communication strategy should be developed to inform the mobilisation activities
Early start of mobilisation and adequate availability of funding for mobilisation is critical - early engagement of public
Messages should be appropriate, clear and concise, and translated into local languages
IEC materials are most effective when they include participatory methods, are interactive, are pretested and/or informed by formative research and/or developed with expert advice
Letters of endorsement from the government (MOH and/or MOE) or WHO, local authorities, or political and local leaders can increase acceptability.
Collaboration across regional (international geopolitical regions) and national/ local media is important to identify and address rumours. Prompt responses to criticisms/ rumours are critical and a press kit could be useful.
General knowledge of HPV vaccine among health professionals is low. Training and orientation of health workers should be intensified.
Projects/programmes should put measures in place to adequately mobilise and address institutional refusals such as schools and churches
Mobilisation is logistically easier if integrated into other community activities
Consent
A lengthy process of signing consent accounted for some girls missing an opportunity to be vaccinated
Opt-in consent can cause problems as it raises suspicions if not routinely used for other vaccines
Acceptability
Initial high refusal rates may decrease over time as the community becomes more familiar with the vaccine. Projects and programmes should take this into account and allow time for girls and parents to change their minds

6.2.5 Key lessons learnt

In relation to **social mobilisation**, the key lessons learnt included:

Preparation

- General knowledge of HPV, HPV vaccine and cervical cancer is low in communities, and among teachers and health-workers.
- Training of influential stakeholders/ spokespersons is needed at every level (i.e. national, regional, district, local).
- Problems occur if social mobilisation begins less than a month before vaccination (e.g. due to late fund disbursement or printing). Time allowed should not be underestimated when planning.
- Teachers and parents of girls attending in urban and private schools often require more information before accepting the vaccine than those elsewhere and need to be identified in a communication plan as potentially requiring more intensive messaging.

Dealing with rumours

- Rumours are generally consistent across geographical areas and projects/ programmes.
- Collaboration between MOH and MOE is necessary to tackle rumours as soon as they arise.
- Strategies to address rumours include tailoring communication messages to specific concerns, announcements by high-level officials, dissemination of letters detailing WHO or government endorsement, one-to-one or group meetings in communities and utilising social media networks to disseminate clear, accurate information (e.g. Facebook).

Messages

- Key messages need to focus on cervical cancer prevention, safety and efficacy of the vaccine, government endorsement, vaccination timing and venues, the need to return for a second dose, the vaccine does not affect fertility, lack of long-term adverse effects.

Delivery

- Face-to-face interaction remains the most effective way of mobilising parents and communities, especially among groups likely to refuse vaccination. Effective influencers are teachers, health-workers, and community leaders (e.g. religious spokespeople).
- Letters of endorsement from the MOH, MOE and WHO can increase community confidence.

Timing

- Social mobilisation should be continuous or repeated to counter newly emerging rumours.
- It is likely that social mobilisation activities can be reduced after the first few years of a national programme as the vaccine becomes 'normalized'.
- If social mobilisation is delayed due to fund disbursement or bureaucracy, activities can be implemented in a stepped approach so that the first schools targeted are the first to receive social mobilisation.

In relation to **acceptability**, lessons learnt included:

- The most commonly cited reasons for vaccine acceptance were protecting daughters from cancer, general benefits of vaccines, and perceived cervical cancer risks.
- The most commonly cited reasons for vaccine refusal were fear of adverse effects, vaccine safety, lack of awareness and absence on vaccination day.
- Reasons for non-completion were largely absenteeism and/or logistical reasons.

In relation to **consent**, lessons learnt included:

- While many tested opt-in consent with or without child assent, this was noted to cause logistical problems and increase rumours if different from EPI norms.
- Complicated consent procedures can decrease consent and thus uptake. The most successful opt-in approach appeared to be sending forms home with girls, which could be coordinated by teachers.
- No problems were reported with opt-out consent, but most projects/programmes testing opt-out processes were government-run, with high EPI involvement. Additional procedures may be necessary in private schools or where parents expect more information and autonomy over their child's health.

6.2.6 Recommendations

In relation to social mobilisation, acceptability and consent, we recommend:

- A communication plan should be developed during preparation, to include specific strategies to ensure messages are delivered to out-of-school and hard-to-reach girls and their parents and communities.

- Teachers, health-workers, and community leaders should be trained to mobilise girls. Social mobilisation training should occur well before vaccination.
- Face-to-face mobilisation meetings should be prioritised where possible.
- Social mobilisation in communities should begin at least one month before vaccination, earlier if possible, especially for new projects/programmes. Time required (e.g. funds disbursement, printing) should not be underestimated.
- Specific strategies to prevent and manage rumours should be outlined in the communication plan.
- High-level officials from MOH and MOE should address rumours as quickly as possible.
- Schools, health-workers, community groups and media should be engaged with in the early stages of planning, as knowledge about HPV and vaccination may be low. If feasible, press kits and media sessions can be useful to engage the media.
- Additional formative research may not be needed to identify key messages due to the consistency in the use of messages across projects/programmes that attained high coverage.
- Message development should focus on: cervical cancer prevention; safety and efficacy, including lack of fertility impact or long-term adverse effects, government endorsement, delivery timing and venues and the need to return for a second dose.
- Consent should be opt-out where feasible, ensuring consistency with existing EPI consent policy. If opt-in consent is chosen for HPV vaccination, processes should be streamlined and reasons clearly explained to parents and communities. An example of a streamlined process might be to implement a school health programme consent form at enrolment for all interventions delivered in schools.
- Countries may want to consider whether the use of different consent processes in public and private schools may cause confusion and potential future concerns in the community around equity of information and choice.
- Intensity of social mobilisation should be assessed after the first year and potentially reduced, if high acceptance has been achieved in targeted communities.

7. Delivery

7.1 Delivery experiences

7.1.1 Country experience of HPV vaccine delivery

The 46 countries implementing HPV vaccination between 2007 and May 2016 accumulated 120 years of implementation experience. As of May 2016, 39% of the countries (N=18) had 2-3 years of experience while 35% (N=16) had one year of experience (Table 17). Twelve countries had four or more years of experience.

Experience with two-dose schedules is increasing, with 19 countries completing at least one year of this by May 2016 (21 2-dose delivery experiences).

Accurate detail on which delivery strategy was used was available for 89 of the 92 delivery experiences known to have completed at least 6 months of implementation by May 2016. School-based delivery and a combination of school and health facility delivery with or without outreach were the most common strategies (78/89=87.6%; Table 17). In almost all of these experiences, the predominant delivery sites were reportedly schools and vaccine supply in health facilities and/or during community outreach was designed to increase vaccination coverage of school absentees or out-of-school girls. Eleven experiences were reportedly health facility-only strategies or health facility based strategies with some routine outreach to community (and sometimes school) sites. At the national level it was unclear whether the relative mix of outreach and health facility delivery was truly known. In some cases the national team simply set the coverage targets and left the districts to decide feasible strategies.

Six countries (3 national programmes in countries 1, 4, 33) and three demonstration projects (countries 22, 31, H)) stated that their delivery strategy included a mixture of school, facility and outreach sites; however, the choice of strategy and planning was decentralised to the district, municipality or facility level. Facilities chose the strategy most feasible in their locality but the central team did not specify, or necessarily know, whether this was predominantly school or facility based delivery. None of these experiences had evaluated the mix of delivery strategies used and the differences in cost, time, or coverage achieved. One country representative explicitly stated they avoided specifying school delivery to avoid requests for extra per diems (Country 33). One demonstration project stated this allowed teams in districts with greater vaccine hesitancy to conduct more outreach compared to fixed delivery sites (Country 22). Another country, which had well-established health infrastructure and human resources, stated simply that facilities knew the most effective strategy and the decentralised approach achieved good coverage:

> "[The choice of delivery strategy] was left to the municipalities to organise… The Ministry of Health was supportive but not directive in terms of making the vaccine available in schools, which should only occur provided adequate emergency measures are in place at these schools [to deal with adverse events]"
>
> *KI Country 4.*

7.1.2 Target population

Among the 75 delivery experiences with information on their school-based component, 52% (39/75) of experiences vaccinated a specific age group of girls and 31% (23/75) selected a school grade(s). A further 17% (13/75) selected a school grade but only vaccinated girls of a certain age within that grade (Table 17). In out-of-school delivery, the eligibility criterion was always age.

Determining girls' age was a problem in many countries where birth records had not been routinely available or kept by the parent (almost all countries in sub-Saharan Africa), or where school registers were inaccurate (Countries 8, 31). In one country registers were inaccurate due to a government incentive to report that all girls in the primary school were below 13 years of age. Parent/ guardian interviews with the use of peer group comparisons and significant historical events were reportedly used in 7 countries to estimate year of birth (Countries C, E, F, H, 29, 31, 33).

Only one country stated specifically targeting HIV positive girls and women aged 9-45 years old in their national programme and specifically delivering 3 doses to this group (Country 4).

Targeting different populations in school and out of school e.g. a grade in school and an age cohort out of school, although potentially logistically quicker during delivery, created substantial problems in target population

enumeration and coverage calculations in almost all countries that did it. For example, one national programme estimated the target population of 10 year olds using census data; for ease of delivery the vaccination teams then vaccinated all of grade 4 in school (of which an estimated 90% are 10 years old) and targeted age 10 out of school. Administrative coverage estimates of doses delivered divided by the estimated target population were therefore overestimates of the coverage within 10 year old girls; and given the reports that girls who were in other grades who wanted the vaccine went to out of school vaccination sites with no validation of age, the age range that was vaccinated in reality is unclear. The coverage and the equity of delivery is also uncertain (Country 33). This is reiterated in Section 8: Achievements.

> "Girls in other grades could decide to present at community outreach sites or the health facility to get their vaccine"
>
> *KI Country 33.*

7.1.3 Strategies to access out-of-school girls

Among the 89 experiences with data, 24 (27%) did not have a strategy in place to reach out-of-school girls (Table 17). Strategies to reach out-of-school girls most commonly relied on girls attending health facilities for vaccination (35%), with varying intensities of activities to mobilise out-of-school girls. Three countries reported low uptake of vaccine at the health facility.

Outreach is defined by WHO as any type of health service that mobilizes health workers to provide services to the population or to other health workers, away from the location where they usually work and live [49]. Some vaccination during outreach into the community was included in 34/89 experiences (38%) in 28 countries (Box 2: Examples of outreach). Thirteen projects/programmes reported the use of community leaders and community health workers to identify, mobilise and trace out-of-school girls and bring or direct them to the health facility or fixed outreach sites, or to aid door-to-door vaccination activities. Community health volunteers and community leaders were reported to be incredibly important in identification of out of school girls and to increase coverage in this group. However, active tracing and outreach are resource-intensive strategies.

Table 17. HPV vaccination delivery strategy experiences

Country experience	Description	Number of countries (N=46)	%
Total number of years of experience as of May 2016	1 year	16	38%
	2 - 3 years	18	41%
	4 or more years	12	22%
Delivery strategy[1]		**Number of experiences examined2 (N=89)**	
Delivery strategy combining strategy for in-school and out-of-school girls (Total 72 experiences; 5 missing data)	School only	24	33%
	School + health facility	21	30%
	School + health facility + outreach	25	16%
	School + outreach	8	7%
	Health facility only	6	8%
	Health facility + outreach	5	4%
Strategies for in-school girls		**N=75**	
Target population in school (if schools were included in the delivery strategy)	Age	39	47%
	Grade	23	35%
	Age within a school grade(s)	13	18%
Strategies to access out-of-school girls		**N=89**	
Delivery strategy for out-of-school girls	None	24	33%
	Vaccine supplied at local health facility (with active tracing of girls and bringing them to health facility (n=5))	31	37%
	Health facility + outreach	26	13%
	Outreach only	4	10%
	Vaccine available at school, health facility + outreach	4	6%
Changes in delivery experience		**N=46**	
Countries in which the national (MOH) implementer changed or tested >1 delivery venue or target population[3] (N=37)	Change in delivery venue	11	22%
	Test of >1 delivery venue	2	5%
	Change in target population	12	22%
	Test of >1 target population	2	5%

[1] Distinct delivery experiences were defined by target population or delivery venue or both within a particular implementer/funder demonstration project or programme
[2] 92 delivery experiences had sompleted 6 months of implementation by May 2016; 89 had accurate and complete data on delivery strategy, 3 were missing data.
[3] Countries where the MOH was involved in the project/programme, which tested >1 delivery venue or target group (either simultaneously or sequentially). Two countries both changed target population and tested different target populations so appear in both categories.

Box 2: Examples of outreach during HPV vaccine delivery

- Active search for eligible girls using community health workers (CAWs). CHWs then brought girls to the health facility (5 countries: Country 1, 17, 22, 26, 28).
- Mobile Clinics, churches, fixed community sites and gathering points, especially in areas without health facilities or schools, to access eligible girls who used mobile vaccine sites (Countries 2, 7); eight used permanent vaccination sites in the community in addition to mobile clinics (Country 4, 6, 9, 11, 29, 31, 33, 35).
- Health workers conducted door-to-door home visits in previously identified communities known to have out-of-school girls. Girls were vaccinated at the house or sent to fixed vaccination sites in the community that were open during school vaccination times (Country 21, 24, D, E).

Table 18. Changes in vaccination venues with reported reasons

Original strategy	Change in strategy	Countries	Reasons for changes
School	Health facility	Country 1	High level of resources required for outreach visits to schools.
Health facility	School	Country 1	HPV coverage was low in health facility delivery.
School + health facility + outreach	School + health facility	Country 28	Outreach had proven resource intensive, with logistical difficulties and only incremental gains in coverage.
School	School + health facility +/- outreach	Countries 3, 23, 8, 35	To increase equity of HPV vaccination by including out-of-school girls.
Health facility	Health facility + outreach	Country 7	To increase HPV vaccination coverage.
School + health facility	Health facilities and integrated into routine outreach	Countries 13, 31, 33	High level of resources required for school-based strategy & concern over sustainability.
School + health facility + outreach	School	Country 26	Difficult and costly to identify out of school girls and calculate the denominator, simpler to vaccinate grades at school as most girls in school

7.1.4 Changing delivery strategy - vaccination venues

MOH representatives in eleven countries were involved in decisions to change strategies based on evaluation reports. This did not include countries with distinct pilots implemented by different groups (Table 18). MOH representatives in two countries tested different delivery strategies simultaneously (Uganda and Vietnam [50]).

There are a number of reasons why countries changed vaccination venues within their delivery strategies (Table 18). Four countries changed from school-based delivery to integration of HPV vaccine into the routine immunisation schedule at health facilities, due to the high level of resources required for outreach visits to schools. In one of these countries, the health facility strategy was tested for three years. When it became apparent that coverage had decreased from >90% to 60-70%, school delivery was re-instated and coverage increased (Country 1). The strategy is pending evaluation in the other three countries (Countries 13, 31, 33). Plans stipulated that if coverage is low at the health facility, visits to schools would be integrated with routine monthly outreach activities, and supervised during quarterly visits from district supervisors.

After initially only utilising a school-based strategy, four countries added a strategy to reach out-of-school girls. This was done by offering vaccinations at health facilities (Countries 3, 23), outreach sessions (Country 35), or both (Country 8). An outreach strategy was also added to a routine health facility-based delivery model. The rationale for this is not known, but may be due to the low coverage achieved in the first year (Country 7). The relative success of these strategies is difficult to evaluate as coverage was either maintained at >90% (Country 23, 28) or data are not yet available after the strategy change was implemented (Countries 8, 26, 35, 7). One country reported increased coverage after adding a strategy for vaccinating out-of-school girls at the health facility (Country 3).

In Vietnam, where school enrolment and healthcare utilisation is high, a school-based strategy and a health facility-based strategy tested simultaneously in different geographical areas both attained >90% coverage with no apparent difference [50].

Four countries stated that they planned to change from a school-based strategy to a health facility based strategy in the future, due to:

- The high level of resources required for school visits, specifically the transport and staff per diem costs. HPV vaccine will be integrated into the routine immunisation schedule and delivered at health facilities and routine community outreach visits (Countries 8, 33, 31).
- The low acceptability of the school-based strategy; health workers and the community did not accept schools as a vaccination venue (Country 20).

One country stated that, in the future, they would try to 'normalize' HPV vaccine outreach activities to be part of health workers' routine outreach activities in order to reduce the cost of per diems (Country 18)(Section 7.5: Staff remuneration).

Table 19. Changes in target populations and reported reasons (12 countries)

Original target population	Change to target population	Countries	Reasons for changes
Age	Grade	Countries 1, 2, 24, 31, 33	Identifying eligible girls by age was difficult if exact birth date/year was not known or documented.
Grade	Age	Country 31, 33	It was thought to be unacceptable to separate some girls from their class-mates and select them to receive the vaccine while other class members were not vaccinated (Country 24).
Grade	Age	Country 8	It is easier to explain to the community and aligns with routine EPI, which used age cohorts
Grade	More appropriate grade	Countries 8, 3, 33, 31	To purposely assess a different strategy in the second year of the project.
Age 10 out-of-school	Age 9-13 out-of-school	Country 18	A higher concentration of eligible girls were in a higher/lower grade
Wide age range	Narrowed age range	Countries, 4, 16, B	As part of the national programme a wide age range was eligible at first, like a catch up campaign up to 13 and this was then reduced to a single age cohort
Age within a grade	Age	Country 26	Easier to estimate the denominator/ target population even if girls are spread in different grades

7.1.5 Changing delivery strategy - target population

Eight countries changed target population (vaccine eligibility criteria) (Table 19). In addition, two countries simultaneously tested age and grade eligibility criteria (Tanzania [51], Uganda [50]); one other country changed eligibility criteria after one year in order to purposefully test a different approach (Country 8). Changes in eligibility criteria were not necessarily a result of a change in the vaccination venue.

An age-based criterion for the target population for vaccination was changed to grade-based in two countries, and a further two countries which tested both approaches subsequently adopted a grade-based approach. Grade-based identification was preferred because identifying eligible girls by age was difficult and time consuming when the exact birth date/year was not known or documented and/or school enrolment meant that one age group stretched across multiple school grades (Countries 1, 2, 31, 33).

> "Age-based delivery was messy; we switched to just vaccinating one grade as it is easier and quicker"
>
> *KI Country 1.*
>
> "Grade-based vaccination was more practical"
>
> *KI Country 33.*

Although grade-based delivery was tested and found to be logistically simpler and quicker to implement by some countries, a subsequent demonstration project used the grade criterion for just one year (Country 31). Country representatives stated that the project was planning to change to an age-based strategy in year 2 because it was easier to explain and more acceptable to the community. In areas where the range of ages within each grade was high, they reported that communities did not agree with one grade receiving vaccination if girls were ≥9 years old in that grade, with ≥9 year olds in other grades having no opportunity to get vaccinated.

In contrast, one country that initially planned to use an age-based approach, both in school and out-of-school, found that in the initial phases of the demonstration project it was unacceptable and difficult to explain to teachers and parents that some girls in a class would be selected for vaccination and others in the same class would not be vaccinated. The eligibility criterion was therefore changed to the school grade that had the majority of 11 year old girls. A different grade was selected for urban and rural areas because girls in rural areas generally enrolled in school later (Country 24).

Three countries conducting national programmes opted to start with an age range of 9-13 years in the first year and systematically reduce it year on year afterwards to age 9 only. This provided an effective small catch-up campaign up to age 13 (Countries 4, 16, B).

7.1.6 Duration of activity to deliver each dose

HPV vaccine was delivered in a 'campaign style' in almost all projects/programmes included in this review, i.e. there were specific days of HPV vaccine activity which were simultaneously timed across all the involved geographical areas, rather than the vaccine being incorporated into routine services and being always available. Only 31 out of 92 delivery experiences had data on the duration of delivery for each dose; this ranged from 2-3 days to 1 month for campaign style delivery. The majority of experiences delivered each dose over the course of one week (Table 20) and activity was synchronized/carried out in the same calendar week across the area/district/country. Two delivery experiences allowed health workers a window of a month in order to deliver each dose, vaccine delivery essentially remained a campaign but the specific campaign days for visiting schools were spread over a longer time period than 1 week (Countries 11, 30). Two other delivery experiences allowed health workers 6 months to deliver each vaccine dose at health facilities, not in a campaign, through 'routine delivery' i.e. vaccine was technically available every day at the health facility (Countries 31, 33).

HPV vaccine delivery to primary schoolgirls, Tanzania (photo courtesy of Deborah Watson-Jones)

Among school-based delivery strategies, the time allowed for delivery of each dose ranged from 2-3 days to 1 month (Table 20). The duration of activity for each dose was stated to vary and depended on the distance to the schools, the size of the schools and the number of schools allocated to each vaccination team. The average number of schools reached per vaccination team was only reported by 4 projects/programmes and ranged between 2 and 10 (Countries 3, 13, and 31[48]); most projects/programmes simply stated that the number of schools per vaccination team varied. The number of eligible girls within each school was also highly variable and reported by 2 countries as anything between 2 and >100 (Countries 1, 31). One national programme noted that the time required to deliver vaccine in a school varied from a few hours per school to 2-3 days per school, but on average each dose was delivered by each vaccination team to all the schools allocated to them over 2-3 days (Country 1). A further 2 demonstration projects allowed one full working week for each vaccination team to deliver each dose to all of the sites in their catchment area, including mop-up activities (Countries 8, 14). Two national programmes conducted a school-based campaign over 20 days for each dose. This allowed health workers to fit vaccination activities around their routine activities and aimed to minimise the impact on other routine services (Countries 11, 30).

Among delivery strategies which utilised both school and health facilities with/without outreach, in five delivery activities for each dose took one week including mop-up (Country 3, 17, 28, 31) and took 1-2 weeks for six other projects/programmes (Countries 3, 6, 19, 37, 89, 90). Generally school delivery was completed in the first week and part or all of the second week was used for mop-up doses.

Only one health facility delivery strategy, a small project with little EPI involvement, had data on time allocated to deliver each dose and administered each dose for a period of a week at the health facility (Country 5). Two further projects delivered each dose integrated into 'routine' delivery of other EPI vaccines at the health facility and during routine outreach services over 6 months for each dose (Countries 31, 33).

Table 20. Time allocated to deliver each dose

Time per dose	Number of delivery experiences with data (final dose coverage estimate for each delivery strategy)			Total
	School only +/- outreach	School + Health facility +/- outreach	Health facility only	
2-3 days	1 (>90%)			1
4 days – 1 week	6 (52%, 81%, 82%; NA)	5 (69%, 80%, 93%, 94%, 96%, 99%; NA)	1 (NA)	12
1-2 weeks	3 (84%, 93%; NA)	6 (59%, 65%, 79%, 79%, 97%, NA)		9
20 days - 1 month	2 (91%, 99%)			2
6 months - routine delivery			2 (NA)	2

Coverage data were available for some projects/programmes that provided information on the time allocated to deliver each dose. There was no obvious relationship between delivery strategy, duration of vaccine delivery activities per dose and HPV coverage.

Three projects offered doses at more than one distinct time point in 'staged delivery' (Countries 31, 12, 30) (detailed in Section: 7.1.6: Mop-up). For details on the effect of introducing HPV vaccination on the staff workload and routine services see Section 7.3.3: Staff workload.

The delivery of two doses rather than three doses was reported as logistically easier to fit in to the school year and cheaper by all countries that had changed vaccine schedule (10 countries had some experience of both two- and three-dose schedules by May 2016 out of 19 countries with 2-dose delivery experience). One country used an extended interval of 12 months between doses and reported this made enumeration and delivery in a single campaign each year easier:

> "It is much easier to go to one grade one year and the following one the next year"
>
> *KI Country B.*

Concern was raised in one country by health workers who had delivered three doses in a previous demonstration project and were now asked to deliver only two doses to girls. Vaccination stopped whilst health worker concerns that girls would not be protected were addressed. Official letters of communication from the MOH rectified the issue (Country 33). One country explicitly stated that two doses were more acceptable than three (Country 18).

Only one of the 19 countries that had implemented two dose schedules had a specific strategy for HIV positive girls (Country 4), who are currently recommended to remain with the three-dose schedule[42]. Other key informants either did not realise or had forgotten that HIV positive girls needed 3 doses or simply did not see how they could practically implement the different schedules. There was concern identification of HIV positive girls during vaccination would stigmatise them or induce rumours around the vaccine being linked to HIV:

> "HIV positives are vaccinated with 2 doses alongside all other girls – we can't separate them"
>
> *KI Country 16.*

7.1.7 Mop-up strategies

Strategies to follow up girls who were absent on vaccination day were described for 37 countries (44 delivery experiences). 'Mop-up' doses were delivered in a number of ways (Table 21):

- Vaccine was provided at return visits to the schools and/or other vaccination sites 1-2 days after the first vaccination day. In some countries the vaccine was also available at the health facility (Countries 3, 18, 23, 26, 31, 37, A, E, G, H); however, this was not always the case e.g. Country 29 vaccine was stored at the district due to health facility space constraints, other countries only operated school-based campaigns (Countries 8, 13, 14, 25, 30).
- Vaccine was made available at the local health facility only with no reminders, outreach, or active search (Countries 5, 6, 33, 34, B).
- Active search' by CHWs identified girls who had missed doses and girls were either given reminders to go to the health facility for their dose, or they were taken to the local health facility for vaccination by the CHWs (6 countries: 3, 5, 17, 19, 26, 35) or girls were vaccinated on home visits (4 countries: Country 21, 22, D, F).
- Three countries explicitly stated they did not perform mop-up vaccination activities in order to save funds; all 3 of these countries performed outreach activities in the community during the initial vaccination days (Countries 24, C, I).

In addition, some countries gave opportunities to receive the vaccine to girls who had missed the first or second dose in a staged delivery where vaccinators returned to schools 1 month or more after the first vaccination day:

- Vaccine was provided at a second visit to the schools the following month after the first visit, in a 2-stage planned delivery of either just the first dose or every dose of a 3 dose series) (Tanzania[48], Countries 12, 30)
- Dose 1 was provided during dose 2 delivery at schools for those girls who had missed the first dose (Countries 18, 22, 31, 21).

Table 21: Mop-up strategies and the coverage and completion rates achieved

Mop up Strategies	Number of experiences	Coverage (%)	Completion (%)
Return visits to schools only	6	81, 82, NA, NA, 85, 91	94, NA, NA, NA, 100, 100
Return visits to schools +/- vaccine was available at health facility	14	72, 90, 105, 94, 99, 72, 79, 59, 80 NA, 79, NA, NA, NA	83, 90, 100, 99, 97, NA, 88, 91, 70, 87, NA, NA, NA, NA
Available at health facility only (no reminders or outreach)	7	65, 88, 61, 90, 100, 83, NA	88, 100, 94, 87, 88, NA, NA
Available at health facility and some outreach activities	3	66, 94, 100	73, 96, 100
Active search and reminders to go to health facility	3	98, NA, NA	97, NA, NA
Active search by CHWs who brought girls to health facility	4	69, NA, 87, 85	85, NA, 90, 93
Active search + door-door vaccination	4	65, NA, NA, 79	84, NA, NA, NA
None	3	52, NA, NA	71, NA, NA

NA indicates coverage or completion data was not available for the project/programme. Completion is the proportion of girls who received the final dose, having initiated vaccination and received dose 1.

The duration of time allowed for return visits for mop-up activities was reported by just 4 projects, all reported return visits were conducted over 1-2 days after the main vaccination activities were concluded (Countries 8, 14, 28, 31). The number of return visits to any particular school was reported by 3 projects and varied from a policy limiting activity to just one return visit (Country 30), returning 2-3 times if schools were easily accessible or urban (Country 25), to health workers returning up to 4 times if necessary (Country 26). The number of return visits depended on the need (e.g. school absenteeism rates) and resources to finance the transport and staff costs. Only one project in Tanzania mentioned the duration of time that the vaccine was available at the health facility for mop-up doses. In this case, vaccine supply was available for 2-4 weeks after the dose was delivered in school due to constraints with the cold chain capacity [51].

One country reported that provision of vaccine doses at the health facility was more efficient than return visits to schools, and that active tracing of defaulters was resource intensive and unsustainable for the incremental gains in coverage (Country 26). However, 4 countries reported that uptake of mop-up doses at health facilities was low (Tanzania [51], Countries 15, 33, 21). Six projects/programmes reported a two-stage delivery of doses (purposefully returning to schools a month or more later), or delivery of dose 1 to girls who missed it during dose 2 delivery, allowed girls and parents to change their mind(s) and accept vaccination after witnessing no major adverse events in girls' peers. This was particularly important in the first year of project/programme (evidence from 6 projects/programmes: Countries 18, 22, 31, 30, 21). In Tanzania, offering each dose on 2 occasions at schools achieved higher gains in coverage than making the vaccine available at the health facility [51]. Two countries recommended that return visits to schools should only be completed if coverage was low (e.g <80% at that school) (Countries 30, 18).

In some countries, dose 1 was supplied during the delivery of dose 2, not only to girls who had been missing during dose 1 but also to girls who had become eligible in the intervening period of time, e.g. had turned 9 years old. This created some issues in calculating yearly coverage and in coordinating supply of vaccine the following year to a target population which then bridged multiple year groups or grades (e.g. Country 31). In one country, offering a second cohort vaccine in the same year may have altered the denominator and artificially lowered that year's coverage rates by not accounting for the fact that some girls would only complete their schedule the following year (Country 1).

One programme sent SMS reminders to girls if they had missed doses or were due doses at the nearest health facilities; no formal evaluation data were available (Country 35). Another two projects commented that girls who were vaccinated could be instrumental in tracing their absent peers (Countries 6, E).

There was no correlation between mop-up strategies and reported coverage or completion (Table 21).

7.1.8 Catch-up campaigns

Three national programmes conducted catch-up vaccination in older age groups (Bhutan,

Rwanda, Vanuatu); details were not well reported. One country delivered vaccine to girls up to the age of 15, another country up to the age of 18. The third country vaccinated the second and third grades of secondary school in addition to the delivery to 9-13 year olds in primary schools. All catch up strategies lasted for just the first 1-2 years. No evaluation results were available.

As detailed previously in section 7.1.5, a number of countries chose to start national programmes with a wide age range of eligibility (e.g. 9-13 year old girls) and then narrow vaccine delivery down to target a single age cohort. This was reportedly logistically easier in situations where some girls did not know their exact age, but also acted as a small catch up campaign in these countries e.g. Countries 3, 4.

7.1.9 Reported lessons learnt

Lessons that were documented by projects/programmes are summarised in Table 22.

School-based delivery was reported as simpler to implement than any other delivery; a large numbers of girls in the eligible target group could be accessed and coordination with teachers was helpful (evidence from 13 projects/programmes, 13 countries). Schools that have not yet been officially registered and new schools should be included in micro planning as well as registered schools.

All ten of the nineteen countries that had experience delivering both 3-dose and 2-dose schedules reported that the two-dose schedule was easier and cheaper to implement than the three-dose schedule. Almost all countries implementing a 2-dose schedule reported some confusion over how to vaccinate HIV+ girls (18/19 countries).

Table 22: Reported lessons on vaccine delivery

Reported Lessons	Denominator (N)	Delivery experiences reporting the lesson	%
Delivery strategy – vaccination venue			
School-based delivery can take advantage of high school attendance and good coordination with teachers which can lead to help in mobilisation and registration, preparation of vaccination areas, crowd control, assistance with paper work, monitoring adverse events and following up absent girls.	Experiences with any school component (75)	20	27%
Vaccination campaigns through schools require extensive resources, especially in rural areas.	Experiences with any school-based approach (75)	14	19%
There are some advantages of using a health facility delivery strategy e.g. availability of cold chain, EPI and other staff, and ability to respond to AE if they occur.	Experiences with any HF component (57)	2	4%
Accessing out-of-school girls			
Vaccine delivery through outreach (alongside community sensitization) could increase HPV vaccination coverage in areas of poor school enrolment	All that did outreach (38)	11	29%
Accessing hard-to-reach areas, and tracing of out-of-school girls or defaulters, required more intensive planning and increased budget per girl compared to that for in-school girls.	All that did outreach (38)	13	34%
Eligibility criteria/ target population			
Among projects/programmes which used age as an eligibility criterion, it was difficult to determine girls' age, especially in communities where age was not routinely documented or where age was not accurately documented on school registers.	Age and age in grade criteria (52)	17	33%
Grade based criteria were simpler to implement than age criteria.	Grade criteria (23)	3	13%
Planning and timing			
To achieve good vaccine completion rates, projects/programmes should aim to deliver all doses in one school year. This often depends on timely availability of vaccine and funding for mobilisation activities.	Experiences with any school-based approach (75)	17	24%

7.1.10 Key lessons learnt and conclusions

In relation to delivery strategy, key lessons included:

- HPV vaccine delivery strategies including a school-based component were most common and were reported as being an efficient way to capture most 9-13 year old girls. However, many countries found the costs associated with repeat visits to schools prohibitive and potentially unsustainable.
- The selection of delivery strategy often had to balance the feasibility of high coverage with country specific operational challenges: the human resources and vaccine transport available, accessibility of vaccination sites, school enrolment and attendance rates, project/programme cost and sustainability.
- There is limited data on health facility only delivery strategies and no coverage data from 'routine delivery' strategies where responsibility for the vaccine delivery is decentralised to health centres to deliver in situ or during routine outreach.
- Strategies to reach out-of-school girls are difficult to evaluate without specific coverage data for this sub-group. A specific mobilisation strategy for out-of-school girls to encourage them to attend vaccination days or the nearest health centre was generally important. It cannot be assumed that out-of-school girls will attend health centres without targeting them with specific information on the importance of HPV vaccine beforehand. However, if being 'out-of-school' is illegal, strategies to identify girls must avoid stigmatisation, house-to-house visits are expensive unless volunteers can conduct them.
- Although different mop-up strategies were conducted, there is not sufficient information/evidence to ascertain particular best practices. The scope of activities is generally governed by country-specific factors, e.g. school absenteeism, perceived 'adequate' coverage, and the resources available. A two-stage delivery of each dose can be successful in reaching those girls who initially refused vaccination, especially when implementation of HPV vaccination is in its first year. Countries with low school enrolment could choose to not conduct mop-up activities in order to focus resources on extensive outreach during the initial vaccination dates.
- Providing the first dose to unvaccinated girls at the time of the second dose delivery, and establishing a 'rolling eligibility criteria' where girls can become eligible for the vaccine as soon as they turn 9 years of age can create challenges in yearly reporting if this has not been planned. Delivery the subsequent year when a greater number of vaccine doses are needed and vaccination has to stretch over two age groups or grades can be challenging if strategies are not clear before the project/programme starts.
- Drop out between doses can be minimised if all doses are completed within one school year.
- Given the workload and funding required for HPV vaccination programmes and the limited nature of existing services for this age group, multiple countries questioned the feasibility of adding another new intervention to deliver alongside HPV vaccine.
- Countries need to be aware that although the recommendations for most girls now state that 2 doses are enough for protection against HPV, HIV infected girls require 3 doses. Country representatives find this impractical and vaccinators often do not know a girl's HIV status. Health workers are generally providing 2 doses for this reason or to avoid stigmatisation of HIV positive girls.

7.1.11 Key recommendations

In relation to delivery strategies, we recommend:

- Countries should select a delivery strategy based on a combination of country specific factors: the proportion of the target group enrolled in school, absenteeism, operational costs, desired/adequate coverage, and sustainability.
- Including a component of school-based delivery can yield high coverage.
- Projects/programmes should be evaluated periodically in order to monitor the performance of the chosen delivery strategy and test different approaches in terms of coverage and cost.
- A combination of delivery strategies rather than a single strategy alone is essential to achieve high coverage if school enrolment is low. Conversely, countries with high school enrolment and limited resources may decide to minimise outreach if it does not give significant additional impact.
- If school-based delivery is planned, microplanning should include an exercise to enumerate all schools including non-registered schools. Vaccination should be planned to coincide with school calendars and harvest times.

- A specific mobilisation strategy for out-of-school girls to encourage them to attend vaccination days at schools, outreach sites or the nearest health centre should be implemented.
- If resources allow, active follow up of girls who missed doses can yield high coverage and successfully use mobile phones or utilise teachers and CHWs. However, during planning, the expense and time required must be realised.
- Poorly executed mop-up activities can cost more than their incremental benefit justifies. When planning with limited resources, the cost-effectiveness of mop-up activities should be assessed; a threshold of coverage is a transparent strategy in which to limit mop-up activities to those areas where they will be the most efficient e.g. only conducting a return visit to a school if <80% of girls received the dose on the first day. However, an opportunity for all girls who have missed doses to obtain vaccine should be provided – social mobilisation should include messages on the nearest health centre where the vaccine can be accessed.
- Staff should be trained on how to deal with the presentation of newly eligible girls at the vaccination site when returning to deliver the second/ third dose.
- If resources allow, planning a two-stage delivery of each dose can be successful in reaching those girls who initially refused vaccination, especially if implementation of HPV vaccination is in its first year.
- Countries need to be aware that HIV infected girls require 3 doses and should develop specific strategies to offer them the 3-dose regimen.
- Whilst funding from international partners is available it may be worthwhile to maintain a wide age range of eligibility criteria for the first few years of national programmes e.g. 9-13 year old girls. The first few years of implementation can act as a small catch up campaign; subsequent years would then reduce to a single age cohort of 9 year olds.

7.2 Enumerating target populations and vaccine needs

Information on enumeration methods used and challenges encountered was available from 43 demonstration projects and ten national programmes in 45 countries.

7.2.1 Country evidence - Demonstration projects

For the large majority of demonstration projects, the estimation of the target population (number of girls targeted to receive the vaccine) to produce a denominator for vaccine provision and coverage, was a major challenge. This was the case for all delivery strategies; school-based, health facility-based and outreach. In some of the early GAP projects, no attempts were made to determine the size of the target group. Instead, a certain number of vaccines were procured and these were delivered until the stock was used up.

For some of the projects, a census was undertaken in advance to determine the number of girls to be targeted. However, it was reported that these censuses demanded considerable time and resources, which might have been better spend on implementing the demonstration project.

Three different methods were most commonly used to determine the number of girls targeted *in schools:*

1. School registers
2. Data from the MOE on children enrolled in different schools
3. Combining data from the most recent population census with data on school enrolment rates

A few projects undertook a specific census in advance of vaccination to determine the number of girls to be targeted. However, it was reported that these censuses demanded considerable time and resources, which might have been better spend on implementing the demonstration project (Country 22).

Estimates of the population of out-of-school girls were most commonly estimated from the most recent census, combined with estimated school attendance rates. In these cases the census and enrolment data were not disaggregated by district but national averages were used which could not be validated. Four countries reported using local NGOs or literate community leaders or social workers to advise on where out-of-school girls reside (Countries 3, 6, E, F). Eleven demonstration projects reported using community volunteers (Countries A, D, F), community health workers (Countries 17, 18, H) or other agents including health workers themselves (Countries C, E, I, 19, 29) to conduct house-to-house visits to enumerate out-of-school girls. This strategy proved expensive, formed a large proportion of delivery costs and had often not been budgeted. See section 9.1 for further details on financing.

In almost all settings, none of these sources for in-school or out-of-school girls gave accurate estimates or ineligible groups were vaccinated leading vaccination teams uncertain as to whether the target group was larger than estimated (despite a house to house census in one country, Country C) or eligibility criteria were just not systematically implemented. Eligibility criteria were often difficult to assess given the lack of birth certificates, or they were not understood, or implementation was variable and not supervised leading to vaccination of ineligible populations:

> There was no way of verifying age so many more could present on vaccination day and were vaccinated than were actually eligible"
>
> *KI Country H.*

The example summarised in Box 3 shows the difficulties encountered in one of the projects.

Thirteen demonstration projects reported significant shortages of vaccine; examples included:

- The discovery of unregistered schools, many of them private schools, led to the addition of schools to the vaccine delivery schedule during the first dose delivery (Countries 29, 37). In addition, the extent of urbanisation of the population since the last census was underestimated and due to a decline in amenities such as electricity supply in the rural areas the population of the district capital was almost double that estimated (Country 29). The subsequent headcount of the population proved to be just within the buffer stock ordered.
- WHO/UNESCO, Education Management System, and census estimates proved to underestimate the target population by almost half in 3 countries. Stock-outs were only avoided due to the fact that vaccine orders were based on a 3-dose schedule and recommendation changes allowed a 2-dose schedule by the time of delivery (Countries 6, 13, E). One government had to procure extra vaccine doses (Country 13). Target populations proved to be 141-157% of that initially estimated.

Two projects reported excess vaccine e.g. Country D which identified and vaccinated 92% of their estimated target population but were unable to find out-of-school girls despite a house-to-house census.

In almost all settings during implementation of the first dose, girls in targeted schools and those identified to be out-of-school were counted and numbers were adjusted in preparation for delivery of the second and/or third dose.

In most countries, this count was done a few weeks before vaccine delivery was scheduled and again during the delivery.

In one country where the Gavi demonstration project was led by the reproductive health (RH) department, the EPI teams could not get the estimates of school target populations in advance of vaccination day. The inexperience of coordination between the MOE and RH at national level significantly impacted the distribution of correct numbers of vaccine doses at district level (Country 6).

Three demonstration projects reported enumerating urban areas was more difficult than rural areas as children could live in a different district to that which they attended school (Countries A, 26, 37). This was a particular problem for demonstration projects where district boundaries were not distinct. Additionally one project mentioned street children could not be enumerated at school or at home and that some teachers had counted 9 year old boys and girls during the headcount in schools due to misunderstanding eligibility criteria and inadequate training (Country 37).

Box 3: Example of challenges incurred when estimating the number of vaccine doses needed for a demonstration project in 'Country 18'

Experience from Country 18 (sub-Sarahan Africa):

- When the application to Gavi was prepared, the latest census was used to estimate target population, adjusted for the percentage of girls in school
- When reviewing the implementation plans, districts were asked to develop registers of eligible girls
- Numbers found in the community (out-of-school) were far below those expected. In schools, registration numbers were higher than the census estimate. Fewer doses than needed had therefore been requested from Gavi.
- Three options were proposed to Gavi
  - Increase the number of doses
  - Allow implementation in one district only (not ideal as the plans purposefully included different districts and the comparison would be lost)
  - Allow vaccine delivery to the rural district and only to the urban centre within the second district (experience would still be obtained in urban and rural delivery
- Gavi agreed the third option
- The registered numbers were not correct when it came to implementation
  - Some teachers had enumerated the whole class, including boys, or counted unisex names as girls
- A new headcount was required to get definitive numbers. For this, the coordination team talked to teachers directly, not just to the district education officer. The final number of vaccines required was only confirmed after this headcount, just prior to delivery
- The number needed for the second dose was informed by the first dose

7.2.2 Country evidence and challenges - National programmes

The ten national programmes with information available used different enumeration methods:

- In three countries, data from the most recent census were used. However, forecasting was compromised due to the census being delayed in one country, whereas in the second it gave accurate numbers. Another used an estimate of 2.2% of the total population from the census. This percentage estimate was arrived at from experiences in a demonstration project; however, there were stock-outs of vaccine during the delivery of dose 1. There could be a number of explanations for the stock-out: there was no way of verifying a girls age at delivery and many ineligible girls could have presented for vaccination; it was reported as difficult to estimate how to distribute the vaccine across districts and this could have been inaccurate; or poor calculation of target population (2.2% is an underestimate).
- Three countries used data from school registers, two countries used school only strategies therefore these estimates proved accurate, the third country utilised a mixed delivery strategy of schools and health facilities for which local influential community members and NGOs helped to identify out of school girls in each district.
- Two countries used MOE statistics to estimate the number of girls enrolled in the particular grade, coupled with visits to schools to verify numbers. One country added a 10% buffer stock to account for potential discrepancies in these data and this was successful in preventing stock-outs.
- One further country combined educational statistics and provincial estimates. However, the EPI coordinator tended to distribute vaccines based on the provincial estimates rather than the educational statistics.
- The final country combined census and enrolment data in a school based strategy and has reported this has been accurate and the target population is decreasing as 9-13 year olds have been vaccinated and the new cohorts of unvaccinated girls are only 9 year olds.

7.2.3 Key lessons learnt and conclusions

In relation to enumerating the target population, key lessons included:

- In almost all demonstration projects, estimation of vaccine supply needs for the first dose of HPV vaccine has been a considerable challenge.
- School registries from schools themselves or the MOE, existing population censuses, and surveys of school enrolment rates have all been unreliable data sources.
- Planning and implementation of a census to determine the size of the target population for demonstration projects requires substantial resources and is likely to delay vaccine delivery if not adequately planned.
- Pre-registration of out-of-school girls is important to ensure their identification and vaccination; however, house-to-house activities to enumerate and pre-register out-of-school girls are expensive. If volunteers are available this could be more feasible than census or health workers. Peer tracing or use of local civil society groups are other strategies to identify girls, all need to be budgeted for during planning.
- Accurate determination of the number of eligible girls is more of a challenge for demonstration projects that implement in specific districts and may require specific activities such as school pupil enumeration.
- For demonstration projects, enumeration in urban settings has been more difficult than rural areas due to more mobile populations, and less distinct district boundaries.
- Several countries have implemented reliable registries for numbers of eligible girls after the delivery of the first dose.
- National programmes which have started delivery to 9-13 year olds have experienced decreasing target populations year after year as the target group decreases to a single age cohort of 9 year olds.
- Census data may be more accurate and useful when enumerating the national target population than when attempting to enumerate girls in a demonstration project; however, additional data from school registries is still needed to aid distribution of the correct amounts of vaccine at the sub-national level to the districts and health facilities.

7.2.4 Key recommendations

In relation to enumerating the target population we recommend:

- Given the data difficulties, it should be accepted that there are considerable uncertainties with the number of doses needed. If good records are kept for the

first dose and there are clear, well-utilised eligibility criteria, vaccine needs can be adjusted for the second dose and for future cohorts.

- Countries should allow for a buffer stock when ordering vaccines so that underestimation of eligible girls does not result in restricted access to vaccine.
- As many schools are not registered by the MOE, local validation of the number of schools and the number of pupils is needed.
- A system of pre-registration of girls at school is useful a few weeks before vaccine delivery to ensure that the vaccination team brings the appropriate number of doses.
- Pre-registration of out of school girls may be important in order to identify and vaccinate them; however, this can be expensive if there are no available volunteers to conduct house-to-house visits and needs to be budgeted for accordingly.
- If teachers or CHWs are asked to count girls, clear instructions need to be given to them on the eligibility criteria.
- School absenteeism rates should be accounted for in the estimates of vaccine doses required.
- Enumeration is easier if the target population in and out of school is the same i.e. an age cohort.

7.3 Availability of staff for vaccine delivery

7.3.1 Team size

During vaccine delivery outside health facilities, vaccination team size varied between 1-6 persons. Among 28 countries (29 projects/ programmes) with any data on human resource allocation, the most commonly used vaccination team size was 3-4 persons (18 countries), generally comprising two healthcare workers, one crowd controller/ mobiliser and/or one teacher/ school/ community representative. Only two countries stated that this team size would be difficult to maintain during national implementation (Countries 3, 33) and one country stated that vaccination team size would need to increase in the future to deal with the multiple other interventions that will be delivered in outreach sessions (Country 14). One country stated using teams of 4-6 people, including two vaccinators, minimised disruption at large schools (Country 21). Six countries stated that team size depended on school size (Countries 1, 15, 21,15, 35, 37) and it was reported as important to vary team size depending on school size or the number of schools necessary for each team to visit in order to maintain efficiency (Countries 15, 21, 25).

7.3.2 Staff cadre

In almost all projects/programmes with MOH involvement and data on staff, the healthcare workers who delivered HPV vaccine were those already employed by the MOH who delivered routine immunisations. Only one country used a different strategy. Here the HPV vaccination workforce was comprised of trainee nurses and vaccinators who were specifically recruited for the demonstration project from medical/ health colleges. This was done because of a severe shortage of existing trained staff (Country 24). Among 19 countries with information on the cadre of staff used to deliver the vaccine, only one country used community health workers (CHWs) (Country 18), one used auxiliary nurses (Country 12) and the remaining 15 used fully qualified nurses or unspecified 'nurse vaccinators'. In some countries it was necessary to use qualified nurses to ensure trust in the delivery of a new vaccine. Countries utilised CHWs in vaccine delivery, to aid the smooth-running of the vaccination day, to follow up missing girls, or to reach out-of-school girls, and countries stated the positive outcomes of the strategy included ease of access to hard-to-reach areas and nomadic groups and lower health worker workload (Countries 13, 16, 18, 28, 1, 17, 22, 26, D).

7.3.3 Workload

The school-based 'campaign' approach, the level The school-based 'campaign' approach, the travel to schools, additional visits to schools for 'mop-up' activities or for staged delivery of each dose and the level of social mobilisation necessary were all reported to lead to high workload for health workers.

Of 31 delivery experiences that had data on the duration of activity for each dose; the majority of experiences delivered each dose over one week; the range of the time allowed for delivery of each dose ranged from 2-3 days to 20 days (See Section 7.1.6 Duration of activity for each dose). Health worker workload depended on the number of schools per vaccination team (reported by 3 projects and ranged between 2 and 10) and the number of eligible girls within each school (highly variable and reported by 2 countries as anything between 2 and >100 (Tanzania, Country 1)). Actual workload was difficult to quantify but anecdotal evidence suggested that smaller schools were quick to vaccinate. Teams vaccinating multiple small schools and attending 1-2 schools per day

may have conducted vaccination activities for a shorter time per day but over more days, compared to a team which was allocated one or two large schools:

> "The campaign took 5-7 days normally but some facilities took longer as there were limited team members, health workers, and they had to cover a wide area"
>
> *KI Country E.*

Among 20 countries with any data on the impact of HPV vaccine activity on routine health service provision, no impact was reported by 10 countries (2 national programmes, 8 demonstration projects). However; 5 of the 10 countries reporting no impact had planned and implemented strategies to mitigate impact in advance of delivery (examples of strategies are listed below). One of the demonstration projects conducted HPV vaccination as a vertical programme with a specific workforce within the MOH but separated from the routine health systems, so by nature it did not disrupt the routine activities (Country 11). Another demonstration project reported that all health workers were routinely trained in immunization so that they could rotate when to conduct outreach and therefore this mitigated the impact of new vaccine introductions on other services (Country 26). In addition, the experience within a country was not homogenous: in one country which reported overall no disruption of routine services, a third of health centres reported disrupted activity and two-thirds did not (Country 33):

> "Disruption of services was reported at about 25 - 27% of the facilities, some areas reported new temporary hire (to mitigate impact)"
>
> *Country 33 report.*

Ten countries (3 national programmes, 7 demonstration projects) reported that HPV vaccine activities did affect daily routine services due to a shortage of manpower, especially in remote health centres with only 1-2 full time staff (Countries 3, 6, 11, 12, 13, 14, 18, 28 33, H)

> "60% of auxiliary nurse midwives said their routine work was affected, 23% said it was affected to a large extent. Activities affected included antenatal care and postnatal care, monthly reporting etc."
>
> *KI Country 12.*

> "The low capacity of health workers is a matter of concern, even before the vaccination starts. Most health facilities and reproductive health units are understaffed. Therefore, supplying staff for the outreaches to schools can be overwhelming to the workers"
>
> *KI Country 31.*

> "Capacity is a challenge - the same HWs need to do all the jobs. Districts form teams assigned to 3-4 schools and that nurse on the team is not able to do any other activities at the health centre. At health posts (staffed by only 2 nurses) if 1 nurse is out it leaves just 1 staff to do everything."
>
> *KI Country 3.*

> "A shortage of staff at the health facilities was noticed on the vaccination day, some facilities remained closed, but it's just a week"
>
> *KI Country 13.*

A number of strategies were described by 13 of the 46 countries to minimise the impact of the HPV vaccine outreach activities on health centre activities (Countries 12, 15, 18, 24, 26, 28, 30, 33, 36, 37, A, C, I). These were reported whether the country reported any data on the impact of the vaccine activities on routine services or not:

- Integration into existing outreach days or community visits reduced delivery costs, increased project/programme sustainability and utilised staff more efficiently (evidence from 6 countries).
- Longer working days were implemented to help deal with workload and prevent delays to other community activities or staff having to work additional days (4 countries).
- Redeployment of staff from other areas of the country and/or other services (e.g., antenatal care) (7 countries), or employment of temporary, trainee or previously retired staff (3 countries) increased the workforce available during HPV vaccine delivery.
- Task shifting to CHWs to aid with routine activities/ campaign vaccinations helped to manage the high workload and lack of human resources (3 countries).
- Delivering HPV vaccine doses over a longer time period enabled planning of outreach days around existing workloads (2 countries).

Two countries reported that, although the initial workload was heavy in part due to intensive social mobilisation and work to identify eligible girls, workload decreased over

time due to greater familiarity with procedures and fewer communications activities (Country 23, 36). Despite the heavy workload, 3 projects implementing a school and health facility delivery model reported that the introduction of HPV vaccination had improved their routine EPI programme, awareness of cervical cancer and enhanced the relationship between health workers and the community in implementation areas (Countries 6, 15, G).

The impact of HPV vaccination projects/ programmes on school activities was rarely reported. Five countries noted some negative impact on school activities (Countries 13, 30, 33, 36, I), but two of these countries reported the disruption had been worthwhile to get the girls vaccinated (Countries 33, 36). Some school staff suggested arrangement of vaccination days before holidays or during out-of-school hours may reduce the impact of vaccination programmes on school lessons (Country 36). In one country 75% of teachers reported disruption to the school day, 6% said it was severe, and the next demonstration project will test routine style delivery at health centres during school holidays (Country 13).

7.3.4 Key lessons learnt and conclusions

In relation to the availability of staff key lessons included:

- If school size is large, large teams can complete vaccination activities very rapidly, minimizing the disruption at the school; however, with small school sizes or house-to-house outreach activities it becomes inefficient and expensive to send large teams.
- The level of workload generated by HPV vaccination activities was variable; the effect on routine services was difficult to estimate as many demonstration projects were small-scale, resource intensive and were not fully integrated into EPI services.
- Countries concerned about the impact on routine services can test strategies to mitigate this during demonstration projects but should be aware that some of the strategies are unlikely to be possible during national roll-out unless a staggered vaccine delivery is planned e.g. using staff from other regions or employing temporary staff. Trainee health workers may prove useful to fill some gaps in capacity.
- There was no evidence that changing from a 3-dose to a 2-dose schedule has changed the proportion of experiences that report an impact of campaign activities on routine health services.
- One strategy to mitigate impact on routine services is to extend the time period of HPV vaccine delivery to transform a campaign-like strategy into a phased delivery over a number of months or a more 'routine approach' integrated with existing outreach services. There is limited experience of this (Countries 30, 12, 31, 33) and no available evaluation data on the impact on staff workload or HPV coverage.
- Coincidental introduction of multiple new vaccines can exacerbate capacity issues at all levels (national, regional, district and local).

7.3.5 Key recommendations

In relation to the availability of staff we recommend that:

- Vaccination team size should be decided during microplanning, after a human resources capacity assessment in each area. Team size should vary depending on the size of schools in the catchment population, or the number of schools necessary for each team to visit, in order to maintain efficiency.
- Teams can include teachers, CHWs and trainee health workers in order to decrease the number of qualified nurses needed for vaccine delivery sessions.
- Integration with other outreach activities, spreading HPV vaccine activities over a longer time period, task shifting to lower cadre staff, and/or allowing for longer working days could minimize the impact of HPV vaccine activities on other routine services if human resources are thought to be limited in country. These strategies and/ or other strategies should be tested and evaluated.

7.4 Staff supervision

7.4.1 Country experience

Only 28 countries mentioned any detail around supervision during any of their delivery experiences. Of these, 21 countries representing 26 delivery experiences reported whether supervision followed a cascade or centralized approach. A cascade approach, where the national level supervises the provincial/ district level and the district level supervises the health workers, was employed by 11 countries implementing 16 delivery experiences (Countries 1, 3, 12, 13, 14, 15, 17, 30, 33, 37, A). Experience from 3 countries questioned the relative merits of the cascade approach (Countries 3, 37, A) and called for the capacity of all district/ regional supervisors to be strengthened. Checklists and logbooks were

mentioned by 15 countries as being useful to keep track of whether supervisory visits had been completed (Countries 1, 3, 15, 12, 17, 18, 21, 30, 37, 26, 28, 31, 33, 36, I).

A centralized approach, where national teams visited the districts during HPV vaccination activities, was conducted in different projects/programmes in 10 countries implementing 11 delivery experiences (Countries 3, 21, 24, 29, 31, 33, D, E, F, H). This was reported as an expensive activity during vaccine introduction due to the need for additional transport and per diems and seven countries eventually opted for cascade supervision to reduce costs (Countries 3, 8, 22, 28, 29, 31, 33). HPV vaccination was incorporated into routine EPI supervision visits in four countries by the second year of the project/programme (Countries 3, 8, 31, 33). Supervision specific to HPV vaccine delivery was largely done only for the first year of demonstration projects due to the focus on monitoring and evaluation at this stage and reporting requirements.

Overall, supervision followed routine practice, although five projects/programmes reported that they had started with more intensive supervision with higher cadre supervisors than routine supervision because of the novelty of the vaccine and media attention (Countries 11, 14,18, 28, E). Two countries reported the level of supervision "decreased to normal" after the first year of introduction (Countries 3, 28). Two countries with projects/programmes run by the MOH decreased the level of supervision for the final dose of their first year due to expense and funding constraints (Countries 24, 31). The impact on data quality and completion of the vaccination activities was not assessed.

In cases where the demonstration project was implemented more as a research project, supervision was kept completely separate from routine EPI supervision (Countries 5, 6, 19) or was completed as a joint exercise between the MOH and research team (Country 31).

Four countries stated explicitly that supervision was necessary to encourage staff to perform the outreach and motivate them to continue to serve their community despite heavy workloads (Countries 3, 6, 14, 29). A further two countries stated that supervision was useful to build capacity (Countries 8, 33). Just one programme deemed supervision unnecessary due to logistical challenges in travelling to vaccination sites, the expense involved and the experience of the vaccinators (Country 35). One country called for the MOE to become involved in HPV vaccine supervision at schools in order to provide support and reassurance to teachers (Country 6).

7.4.2 Key lessons learnt and conclusions

In relation to staff supervision key lessons learnt included:

- Supervision is necessary when adding another activity like HPV vaccine introduction to health workers' workload. It can be motivational, can ensure successful implementation and high quality data collection.
- Supervision was usually carried out in a cascade from national level to frontline staff.
- Checklists and logbooks can help to ensure supervision activities are completed if these are audited by higher level supervisors.
- Supervision using national level representatives was found to be expensive, primarily due to transport and per diems. Non-integrated national level supervision of every new vaccine introduction is not sustainable long-term and use of national level supervisors may not be a realistic option if implementation is scaled up across many districts or nationally.

7.4.3 Key recommendations

In relation to staff supervision we recommend:

- Supervision is recommended for HPV vaccine projects/programmes although the intensity could decrease to routine levels over time
- Supervision could be integrated with routine EPI supervision to decrease costs.
- New vaccine introduction should be used as an opportunity to strengthen the capacity of supervisors at the national, regional and district levels.

7.5 Staff remuneration

7.5.1 Country experience

The use of per diems to pay health workers for outreach activities was widespread; of 32 projects/programmes run by the MOH, 29 reported having paid per diems; only 3 did not. Policy ranged from just reimbursing a lunch allowance, to varying levels of reimbursement depending on distance travelled or whether the health worker had to stay overnight. Of the three MOH implemented projects/programmes that did not pay per diems, one was a health facility model (Country 13), and the two others viewed the work as "part of the nurses day-to-day job" (Countries 6, 30).

The vast majority of countries that reported remuneration information said that

remuneration was aligned with existing EPI levels of reimbursement for outreach or campaign activities (13 countries:1, 3, 4, 6, 11, 13, 14, 15, 21, 28, 30, 31, 35). One country reported paying an increased allowance to health workers, reflecting more intense activities such as the unusual outreach to schools (Country 18). When it was considered more as a stand-alone project with lower EPI involvement, reports indicate that additional payment was expected and amounts were higher than routine EPI per diems (2 countries: Countries 5; 25.)

Four countries reported they had tried or would try in the future to reduce the cost of per diems and allowances to health workers and supervisors during intensive outreach campaigns. Three countries outlined that specific allowances paid within the demonstration project would not be sustainable as part of a national programme and suggested, a health facility based delivery model is planned in the future (Countries 8, 31, 33). One country reported it would try to normalize HPV vaccination activities into the health workers routine day-to-day job (Country 18).

Only two countries mentioned giving allowances to teachers in compensation for the extra workload in enumerating the target population and marshalling girls on vaccination days (Countries 8, 31).

7.5.2 Key lessons learnt and conclusions

In relation to staff remuneration key lessons included:

- The use of per diems for outreach activities or any activity which involves the health worker leaving their station is widespread.
- Per diems are a major consideration when countries assess the sustainability of a programme and have a significant financial impact on cost per vaccinated girl.
- Per diems may be a particular challenge in demonstration projects which can be seen as 'special' and 'non-routine' and may become less of an issue with national roll-out when delivering the vaccine should be normalized into health workers routine responsibilities, especially if they routinely conduct outreach for other services.

7.5.3 Key recommendations

In relation to staff remuneration we recommend:

- The cost impact of staff per diems should not be overlooked when planning HPV vaccine introduction. Making HPV vaccination part of routine activities for health workers may avoid or reduce per diem payments for delivery of 'special' interventions.
- Minimising the number of health centre staff needed at the vaccination sites could minimise cost, if other community workers regularly conduct outreach activities as part of their day-to-day job and HPV can be integrated into those activities.
- Integration with other existing outreach activities or school health programmes could allow the cost of per diems to be shared across multiple different programmes/ health interventions.

7.6 Adverse events and safe injection procedures

7.6.1 Adverse events monitoring and reporting

Most countries appeared to have standard reporting mechanisms for adverse and serious adverse events (AE/SAEs), though these mechanisms were generally not well described. Reported AEs and SAEs appeared to be below 1% in the 44 countries (representing 56 delivery experiences that provided data (Table 23).

AE/SAEs were generally recorded on standardised forms at the vaccination site, although some countries had girls report to health facilities. Most AE were minor and temporary, requiring observation but no or minimal treatment. Spokespeople and/or communication materials were used to dispel community fears and misinformation. Some country discussions indicated that the very low numbers of AE reported at some sites suggested that forms were not being completed properly and that more training/monitoring was necessary. However, the reporting process was generally considered acceptable.

7.6.2 Injection safety training and procedures

Of 17 countries for which health-worker injection safety was discussed, most indicated availability of guidelines and/or training, while 3-4 mentioned there were no standard national guidelines though safe practices were 'generally adhered to'. One country indicated that despite effective national guidelines, auto-disposal syringes were not available. Another issue reported was cleaning of injection punctures with tap-water in one site of another country, leading to abscesses.

Most did not mention availability of emergency kits outside facilities or whether safe-injection

procedures were outlined to health-workers, assessed, and followed. However, several indicated that emergency kits were not always available or could not be brought to all vaccine sites. While no problems were reported as a result of this, it was particularly noted that medications and instruction to manage anaphylactic reactions should be made available at vaccination sites.

7.6.3 Differences from routine practice

Overall, monitoring and response procedures were consistent with those of other EPI vaccines. In terms of differences from standard EPI training and reporting, the main difference noted was greater rigour and monitoring of training and implementation with emphasis on handling and reporting AE. One difference noted was that teachers and parents were also involved in monitoring AE, which was particularly important.

Table 23. Reported adverse events and severe adverse events by country

Country	(Experience)	AEs per dose (%)	SAEs (%)	Details (Number of events or %)
1	(2N)	246/132,407 (0.2)	0 (0)	Frequent AEs were headache, nausea and vomiting, fever, shivering, pain, giddiness, fainting.
2	(4D)	10/84,429 (0)	0 (0)	Immediate reactions after vaccination as pain, redness at the vaccination site, or mild headache that did not need medical treatment.
	(4D)	35/3,888 (0)	1 (0)	Reported AEs were headache (3), slight pain (24), redness or some bleeding at vaccination point (6), those who'd not eaten breakfast, felt nauseated (2); SAE was fainting/chills/low BP, resolved after 4hrs in hospital.
3	(5D)	NA	NA	NA
	(6D)	3/6542 (0)	0 (0)	Reported AEs were pulled muscle (1), shortness of breath (1), dizziness (1).
	(7N)	NA	NA	NA
4	(8D)	NA	NA	An additional AEs survey was conducted among 1,000 girls followed up to 96hrs after injection. Common (>10%): irritability/pain, pyrexia, erythema, local oedema; Less Common (>1%, <10%): diarrhoea, vomiting, myalgia, upper respiratory tract infection, cough, toothache, fever <38.9C, fever >38.9C, malaise, arthralgia, nasal congestion, insomnia; SAEs (>0.01%, <0.1%) were pelvic inflammatory disease, headache, appendicitis and gastroenteritis.
	(9D)	36/4074 (0)	0 (0)	Reported AEs were lipothymia with skin paleness or sudoresis (11), fever (7), vomiting and nausea (5), pain and oedema at injection site (5), transient tremors (3), facial oedema (2), skin rash (2), headache (2), facial flushing (1), skin spots (1), sleepiness (1). No SAEs reported.
	(10N)	1,007 nationally	29	SAEs were 9 cases of anaphylaxis according to WHO definition and the rest indeterminate/ unrelated. Local injection site pain and panic attacks were also reported nationwide.
5	(11D)	95/4,117 (0)	0 (0)	AEs were fever, pain at injection site, swelling, headache, fainting, rash, urticaria, erythema.
	(12D)	724/23,788	NA	AEs were fever, urticaria, pain at injection site.
6	(13D)	1/19,164 (0)	0 (0)	AE was swelling at injection site.
6	(19)	249/1191 (21%)	0 (0)	21% of those receiving the first dose reported that there was some AEs after vaccination; However, they were reported as minor not necessitating any treatment: pain at administration (31%), Fever (23%), headaches (19%) and tiredness (14%)
8	(16D)	NA/15,940	NA	NA
	(17D)	24/87,042 (0)	0 (0)	NA
9	(18D)	3/20,732 (0)	0 (0)	AEs were fainting and slight headaches.

10	(20D)	NA/2,884	NA	The most common AEs were pain at injection site (49% dose 1, 52% dose 2 and 46% dose 3), headache (11%), syncope (2 cases), generalized rash (1 case).
11	(22D)	0/9492 (0)	0 (0)	None reported.
	(23D)	3/25,016 (0)	0 (0)	NA
12	(24D)	121/30,809 (0)	4 (0)	Common AEs were headache and dizziness. SAEs were 2 neurogenic reactions (i.e. giddiness, jerky movements) and 2 deaths later attributed to snakebite and malaria (in total 7 deaths were temporarily associated with HPV vaccine but all later found to have a clear alternative cause e.g. snakebite, malaria).
	(25D)	NA	NA	NA
13	(26D)	7/9050 (0)	0 (0)	AEs were dizziness/fainting/headaches (4), abdominal pain/ nausea (3).
	(27D)	NA	NA	NA
14	(28D)	1/1,490 (0)	0 (0)	AE was numbness.
15	(29D)	1/NA	1	SAE was an unrelated death.
16	(30D)	NA	NA	2 girls reported a minor rash
	(31D)	NA	NA	NA
	(32N)	NA	NA	NA
17	(33D)	NA/4,822	NA	No AEs in 2 years
18	(34D)	2/3,169 (0)	1	AEs were vomiting; SAE was unrelated to vaccine.
19	(35D)	NA	NA	427 AEs in total across 3 doses most injection site reactions; no SAEs.
20	(36D)	0/20,722 (0)	0 (0)	None reported.
21	(37D)	551/30,591 (0)	NA	Frequent AEs were sore arms, fever, fainting.
	(38D)	2/5,904 (0)	0 (0)	AEs were mild swelling.
22	(39D)	0/NA (0)	0 (0)	AEs monitoring system may not have been effectively implemented, according to country representatives, as no AEs reports were captured.
23	(40D)	34/NA (0.11)	NA	Frequent AEs were dizziness (13), fainting (7). 12 AEs occurred in round 1.
	(41D)	7/9,566 (0)	0 (0)	AEs were fainting (3), dizziness (1), vomiting (1), stomach-ache (1), bleeding from injection site (1).
	(42D)	5/24,047 (0)	0 (0)	AEs were dizziness (3), vomiting (1), fever (1).
	(42D)	12/29,946 (0)	0 (0)	AEs were dizziness (6), fainting (4), vomiting (1), bleeding (1) Fainting/bleeding associated with lack of breakfast and nervousness.
24	(43D)	NA	0 (0)	NA
25	(44D)	0/17,220	0 (0)	None reported.
26	(45D)	252/4,344 (0)	NA	NA
	(46D)	195/26,798 (0)	0 (0)	Frequent AEs were dizziness.
	(47D)	NA	NA	NA
28	(49N)	5/278,756 (0)	0 (0)	NA, except 'reports of hysterical reaction in one region'.
30	(53D)	NA	NA	NA
	(54D)	0/5,346	0 (0)	None reported.
	(55N)	10/340,000 girls	0 (0)	AEs were abscess, rash, nausea, fainting, raised temp, dizziness, abdominal pain.

Country (Experience)		AEs per dose (%)	SAEs (%)	Details (Number of events or %)
31	(56D)	11/5,055	3 (0)	Some sites reported 0, suggesting forms weren't used appropriately. SAEs were 1 generalised rash, 2 unspecified.
	(57D)	NA	NA	NA
	(58D)	0/52,566 (0)	0 (0)	None reported.
	(59D)	NA	NA	Approximately 5% of parents reported their daughters experienced AE: pain at injection sites (38%), fever (22%) and 41% reported AE resolving without management.
33	(61D)	6/9,725	0 (0)	AEs were girls delivering babies after dose 2 (2), undescribed (4).
	(62D)	NA	NA	An additional survey indicated that 23% of parents reported AE, e.g. pain or swelling at injection site (64%), fever (22%), headache (7%).
	(63D)	NA	NA	NA
	(64D)	NA	NA	NA
	(65N)	NA	NA	NA
34	(66D)	NA	NA	NA
35	(68D)	NA/2,718	NA	6% had fever and 27% had pain in their arm for 1-3 days after the first dose. After the third dose, 26% had pain in the arm and 5% had fever. Other recorded side effects were headache, itchiness, stomach ache, swollen arms, general body pain (1) and chest pain (1).
	(69N)	NA	NA	NA.
36	(70D)	231/1,998 (11.6)	0 (0)	A survey indicated AE included pain/swelling at site (108), fever (62), tiredness (18), headache (17), dizziness (16), other (10).
	(71D)	64/19,145 (0.3)	0 (0)	AE: headache, dizziness, vomiting, which dissipated shortly after vaccination.
	(71D)	32/10,273 (0.3)	0 (0)	AE: dizziness, headache (18), sick and nausea (16), fainting (1).
37	(72D)	0/24,541 (0)	0 (0)	NA
A			0 (0)	Minor redness or injection site pain
B		NA/6000	0 (0)	Only a few incidents of pain in injection site reported, 6 girls fainted and had to sit for a while
D				No AEs observed
F			0 (0)	No AEs observed
G		NA/NA (18%)	0 (0)	Among these 42 parents reporting AEs: three-quarters were swelling or soreness at injection site - all parents did nothing or treated the child at home; fever (8 events); headache (8 events); dizziness (4 events); nausea (2 events), and rash (3 events). The rates of reported events per dose was estimated at 1.25 per 100,000 doses in HCC and 0.7 per 100,000 doses in Isabel.
H		21/NA	0 (0)	21 cases of minor AE: fever or swelling at the injection site

7.6.4 Key lessons learnt

In relation to adverse events key lessons included:

- Non-EPI stakeholders, particularly teachers and parents, were a useful resource in monitoring and reporting AE.
- Training and equipment supplied to support AE reporting and response varied among projects/programmes.
- There were noticeable differences among projects/programmes in AE reporting procedures.

7.6.5 Key recommendations

Based on findings related to adverse events monitoring, we recommend:

- Non-EPI stakeholders, such as teachers and parents, should be involved in monitoring and reporting AE.
- All countries should have standardized national guidelines and training procedures for reporting and responding to AE/SAEs.
- AE reporting should be standardised globally (e.g. always reported with denominators) for the sake of comparability.

8. Achievements

8.1 Coverage achievements

8.1.1 Data quality

Final dose coverage estimates are available for 60/92 delivery experiences. Only 17 delivery experiences in 13 countries had available data from coverage surveys; the remainder reported administrative coverage estimates (47 delivery experiences) or were missing data (32 delivery experiences). Requirements for coverage data collection differed by funder and coverage data were not required for country or external partner programme evaluations, e.g. in GAP projects. Gavi-supported projects were required to conduct coverage surveys within 6 weeks of the final dose using the WHO cluster survey methodology[6, 23]. However, results from 9 Gavi coverage surveys were received for this study of 10 known to have been completed. Others had either not been completed or the results were not authorised for release.

Interpreting administrative coverage data was challenging since these often used estimated target population sizes from planning phases, despite the fact that these had been proven inaccurate during implementation. Reports did not always explain which denominator was used, whether they had included out-of-school girls within it, or how exactly the eligibility criteria for vaccination were enforced on the ground. Coverage of >100% was sometimes recorded due to vaccination of a larger than expected target population, or vaccination of ineligible populations.

The administrative coverage estimates presented in this report have a number of caveats and limitations:

- The numerator, or number of girls receiving a dose, should be interpreted in conjunction with the reported eligibility criteria (usually geographic and age/grade-based criteria). The 'accuracy of the numerator estimate was influenced by:
  a. How well the eligibility criteria were communicated to, understood and implemented by vaccinators and teachers/communities. This influenced both the messages delivered to communities about eligibility and what happened on vaccination days.
  b. How easy it was for health workers, parents and girls to determine eligibility and therefore the accuracy by which they determined whether a girl should be put forward for vaccination and consent given, if required.
  c. How well eligibility criteria were enforced on vaccination day, despite clear and concise messages that were well understood by both vaccinators and recipients. Three separate projects stated ineligible girls petitioned vaccinators for the vaccine on vaccination day.
  d. The quality of data collection at vaccine delivery for each dose.
- The denominator, or total population targeted to receive the vaccine, was estimated using:
  a. Census data.

  These could be at least a few years old, so had to be modified based on estimated population growth. There may not have been a sub-category of 9-13 year olds, so this was sometimes estimated as a proportion of 10-15 year olds.

  b. National school enrolment data.

  These could be used with projections of the proportion of in-school and out-of-school girls, but accuracy of these projections were often uncertain and/or the data had not been recently validated.

  c. Other target population estimates as calculated prior to vaccination day (see Section 7.2: enumerating target populations).

  These could be the most accurate, although accuracy was difficult to determine and often there was still a challenge in enumerating out-of-school girls. Combinations of data were sometimes used, e.g. a headcount of in-school girls as well as census/national school enrolment data to project the expected number of out-of-school girls.

Data were missing from 32 delivery experiences (11 Gavi and 21 non Gavi-supported projects/programmes) because the denominator was not recorded, the eligibility criteria were never fully defined or adhered to, the coverage surveys were not completed or the 2014/15 data were yet to be released.

8.1.2 Country experience

Coverage was assessed as the number of girls receiving the final dose among the total identified target population. It is worth noting that in delivery strategies that only

targeted schools, administrative coverage estimates measured vaccination coverage in the school-going population only; only coverage surveys took account of the out-of-school population in these scenarios. Among the 92 delivery experiences with at least 6 months of experience, 60 (65%) had data on final dose coverage. For some experiences, this was a reported percentage; others reported the target population and number of final doses received. Among the 60 experiences with data, 50 (83%) reported HPV vaccine final dose coverage of 70% or above (range between 51% to >100%). No experiences reported coverage below 50% (Table 24). These coverage estimates included ten experiences with data on a two-dose schedule; the remaining 50 experiences implemented a three-dose schedule. The dose schedule recommendation change in April 2014[41, 42] left insufficient time for more data on two-dose schedules to become available within this review's timeline. Among the 35 experiences which reported raw data on target population and final doses administered, mean final dose coverage was 88%.

Uptake was defined as the number of girls receiving the first dose among the identified target population. Estimates of uptake were available for 56/92 experiences and ranged from 64% to >100%. Among the 33 experiences which reported raw data on their target populations and first doses, mean uptake was 93%.

Completion rates, defined as the proportion of girls who received the final dose among those who started the schedule, were available for 54 experiences. Reported completion ranged from 70% to 99%. All four two-dose experiences with data achieved >85% completion. Mean completion rates among the 35 experiences with raw data for the number of girls who received the first dose and final dose was 89%.

The estimates of average (mean) uptake, completion and final dose coverage rely on the availability of numerical data for target population and dose delivery. Among the experiences which reported a percentage coverage estimate but no raw data, 9 reported >90% final dose coverage, 5 reported 70-90% and 2 reported <70%. Numerical data did not seem to have been reported more often for those experiences achieving high coverage.

8.1.3 Case Studies

Boxes 4, 5, 6, 7 and 8 illustrate the multiple factors that contributed to the final dose coverage achieved in each country for HPV vaccination.

Box 4: Case study – institutional refusals resulted in low coverage

Country 37: Implementation challenges and institutional refusal (coverage 50-60%)
Eligibility criteria were not well understood by health workers, which led to inconsistent and variable adherence to these eg. some staff only vaccinated 10 year olds in the selected school grade while others vaccinated the whole school grade. This could have resulted in an overestimate of the true coverage of 10 year old girls. A grade-based approach needed to be adapted in private school where girls were enrolled at a younger age on average. Late distribution of funds resulted in delayed production of IEC materials. Rumours that the vaccine affected fertility led to a whole school-level refusal. Despite the participation of high profile champions, school head refused to allow vaccinators access in a number of urban and private religious schools. Furthermore, there was no clear strategy of how to allow girls to be vaccinated if they changed their minds after they had initially refused. Inadequate transport to implement a predominantly school-based delivery strategy led to health workers walking to outreach sites and may have limited mop-up activities. The high drop-out of girls before receipt of the final dose was reportedly due to the vaccine schedule coinciding with examinations or holidays The low uptake and completion among out-of-school girls, who could access vaccination services at health centres and community outreach venues, was attributed to the lack of a clear strategy to identify and mobilise out-of school girls prior to implementation. The country identified recommendations for future delivery: 1. Microplanning of vaccine supply needs, transport, and sensitization (including identified challenging groups in urban areas) needs to take place in good time and take events in the school calendar into account 2. Strong collaboration between regional and district medical and educations officers could result in more effective microplanning and the development of a strategy to mobilise urban private schools with potentially low rates of consent and acceptance before vaccine delivery.

Box 5: Case study – challenges in urban areas and low coverage

Country 21: Urban challenges and low coverage (coverage category 60-70%)

In the first year of HPV vaccine delivery in schools, health facilities and through outreach activities, average coverage was lowered by the low coverage attained in just one urban area. This had a high concentration of private schools and was more affected by negative media exposure. Within this urban area, private schools attained much lower coverage in comparison to public schools. The areas of higher coverage attributed to their success to good collaboration with the education sector at every level (regional, district and local). Where the project was implemented in rural areas and another urban area, it achieved good coverage (>80%). However, in urban private schools, coverage was only 51%. Despite an intensive social mobilisation strategy which was well targeted and organised, anti-vaccine lobbyists received media exposure.

Box 6: Case study – low completion

Country 24: The problem of low completion (survey: 50-70%)
Administrative coverage estimates:
Urban: coverage: 68%; completion: 78% | Rural: coverage 86%, completion 93%
Coverage survey estimates:
Total: Dose 1 coverage 73%, Dose 2 coverage 52%, Completion 71%

During a predominantly school-based strategy with some community outreach sessions, first dose coverage was high in all areas. However, final dose coverage was almost 20% lower in urban areas compared to rural areas. It was felt that insufficient time had been allowed for planning. Vaccination venues were not notified of vaccine activities sufficiently in advance. The first dose was delivered late in the school calendar year, which meant that the final dose was offered during the school holidays. This was likely to be a major cause of the low completion, particularly in urban areas where school children often migrate to rural villages during the school holiday season.

Rumours that the vaccine was 'experimental' and/or a contraceptive, alongside inadequate social mobilisation with late delivery of IEC materials, may have affected urban areas more than rural areas.

Inconsistent adherence to eligibility criteria, uncertainty of the eligibility criteria for out-of-school girls and variable use of reporting tools decreased the level of confidence in the accuracy of administrative coverage estimates.

The country identified recommendations for future implementation:

1. Planning should start sufficiently in advance of vaccination activities in order that schools and vaccination sites can be notified prior to visits from health workers and teachers can play a full and active part in social mobilisation activities.
2. Early planning can ensure doses are administered in one school calendar year, which will allow higher completion rates.
3. Communication with parents and involvement of community leaders may help to lessen the impact of rumours.
4. Retraining in the use of reporting tools is necessary to improve data quality.

Box 7: Examples of high coverage experiences

High coverage in two different settings (coverage category ≥90%)

Country 18: The application for HPV vaccine support was led by the non-communicable disease department within the MOH, due to limited capacity within EPI. However, both the EPI and reproductive health department attended planning meetings and were involved in technical working groups. All three departments held responsibility over different aspects of implementation. Vaccine activities were well integrated within EPI. A predominantly school-based strategy was used for all girls in grade 4 and out-of-school girls between 9-13 years were invited to health facilities. A single grade was easy and quick to identify in schools and the wide eligibility age range enabled easier identification of eligible girls in the community setting in comparison to using a single year of age. Social mobilisation had a dedicated budget and included using drama groups, community leaders holding meetings within villages and CHW motivational talks in schools, although most parents reported they had heard information directly from a health worker. Some information was repeated before each dose. Vaccine delivery was completed in teams of CHWs and nurses and this lessened the workload for full time nurses and allowed good coverage of hard-to-reach areas.

Country 2: Collaboration with the media was vital in raising awareness alongside a comprehensive social mobilisation strategy with messages focusing on several cervical cancer presented in meeting, videos, brochures, posters, banners, flipcharts, frequently-asked-questions guides, CDs, training workshops. Timely sensitisation and maintaining scheduled vaccination dates was important at schools, clinics and mobile clinic outreach.

Box 8: Case study – a country with a high proportion of out-of-school girls

Country 24: Delivery with a high proportion of out-of-school girls

In this setting school enrolement was between 60-70%. The strategy selected was to organise three mass campaigns in schools and at specific sites for girls not attending school. The aim of the strategy was to ensure high uptake in out-of-school girls. Out of the total target population, the proportion of girls vaccinated at school was between 57% and 69% for the urban areas and 35% for the rural areas. The majority of girls, especially in rural areas, had to be vaccinated out of school. This led to an intensive set of activities that included working with village leaders to locate girls, communication with parents to confirm ages and, in some cases, door-to-door vaccination.

This complex set of activities was demanding in terms of planning and funding resources. Specific challenges encountered included issues with determining the number of girls, challenges in following up girls that had missed the first dose and pressure of operational costs that led to insufficient funding in year 2, notably in terms of social mobilisation activities.

8.1.4 Analysis of the correlates of uptake, completion and final-dose coverage across delivery experiences

A number of programme characteristics were analysed in relation to the uptake, completion (or dropout) and coverage rates achieved. The full list of characteristics can be seen in Tables 24, 25, 26.

Among experiences that had data on coverage, seven LIC experiences (37%) achieved 90% coverage or more, compared to 50% of the experiences in LMICs and 33% of the experiences in UMICs (Table 24). The experiences in UMICs with lower coverage were generally small, run by external groups or researchers, with limited EPI involvement. The rates of vaccine uptake followed a similar pattern across LAMIC groups. However, a smaller proportion of experiences in LICs (47%) attained high completion compared to those in UMICs (73%; Table 25).

The majority of data are from demonstration projects; only 9 national programmes shared coverage data. National programmes seemed to attain better final dose coverage (67% attained coverage ≥90%, compared to 37% of demonstration projects attaining ≥90% coverage); however, the number of national programmes is small and four had completed prior demonstration projects, potentially allowing them to modify their strategies to gain higher coverage.

There is substantial evidence that delivery strategies including schools as vaccination sites achieve high coverage. Among the 55

experiences that involved schools and had data, only 15% attained coverage below 70%. Health facility-only strategies were more likely than mixed or school-based strategies to attain <70% coverage; however, there remains very little evaluation data. We remain unable to conclude the feasibility of high coverage in health facility only strategies.

A slightly higher number of MOH-led experiences attained high uptake, completion and final dose coverage when compared with external partner-led experiences.

A slightly higher number of MOH-led experiences attained high uptake, completion and final dose coverage when compared with external partner-led experiences.

The level of EPI and school sector involvement was classified as follows:

- High: the sector was involved in both the planning and implementation of the programme;
- Moderate: the sector was involved in the implementation but not the planning
- Minimal to none: the sector did not play a mentionable part in the planning or the implementation of the programme.

Over four fifths of the experiences were classed as having high EPI involvement. Those with moderate-low EPI involvement were run parallel to EPI by NGOs or, rarely, the non-communicable disease department/ reproductive health department within the MOH. A larger proportion (47%) of those with high EPI involvement attained 90% coverage or more, compared to only 20% of those with minimal or no EPI involvement. The pattern was very similar for uptake and completion rates.

Experiences that involved the MOE and schools in the planning and implementation of the programme attained a greater proportion of high coverage results than those with less school involvement (37% attained high coverage compared to 0% of those with minimal-no MOE involvement). Patterns were similar for uptake and completion rates. These findings correlate with the lessons identified by countries themselves in the next section.

High coverage was attained in 43% of experiences that implemented an out-of-school strategy compared to 40% of those that did not. However, this must be interpreted with caution given the reported low accuracy of coverage estimates for out-of-school girls. Some interviewees indicated that out-of-school girls were excluded from the coverage estimates but this was not always reported. There were low numbers of out-of-school girls and reportedly low uptake within this group even if there was a strategy to reach them. Estimates of the target population for out-of-school girls were largely unverified. As discussed in Section 7.1: Delivery, the majority of out-of-school strategies simply supplied the vaccine in health facilities, with few additional activities to identify and mobilise out-of-school girls. The data suggest that experiences with no out-of-school component may attain higher rates of completion than experiences with an out-of-school component, perhaps due to the concentration of resources on school mop-up activities; however, the numbers of experiences contributing data are small. The projects/programmes to date have generally been in countries with high primary school enrolment figures (Appendix A). It is difficult to draw specific lessons from localities with low school enrolment; one country with experience in areas with low school enrolment is described in Box 8.

Only 6 delivery experiences offered another service to the same target group at the same time as HPV vaccine and reported coverage data by Q1 2016. These achieved good coverage in comparison with other experiences that did not simultaneously offer another service alongside HPV vaccination (The group of 'other experiences' included 2 experiences that offered mothers cervical cancer screening services at the same time as offering daughters HPV vaccine; one of these experiences attained very good coverage and one experience was missing coverage data (See Section 10: Integration)). However, the differences in uptake and completion rates could be due to chance as the numbers are small.

Estimates of final dose coverage were available from 10 of the 21 experiences that implemented a 2-dose schedule (from 10 countries). There was clear evidence 2-dose schedules achieved high coverage.

There were limited data on the duration of time each dose took to deliver, and as stated in Section 7.3.3 it differed by vaccination team within countries. The small amount of data we have suggests three quarters of the strategies taking 2 weeks or more to deliver each dose gained high coverage, compared to 5/9 (just under 60%) of the strategies that concentrated activity on just a few days of an intensive campaign. Data are too limited to draw conclusions at this stage; all 3 strategies that gained very high coverage with an extended schedule over 2 weeks or more had an existing well-established health infrastructure.

Table 24. HPV vaccination final-dose coverage by experience, project/programme and country characteristics

Characteristic	Experiences with data[1] (92 total)	Number (%) experiences[2]		
		Final dose coverage ≥90%	Final dose coverage 70-89%	Final dose coverage 50-69%
All experiences	60	25 (42)	25 (42)	10 (17)
Country income group[3]				
LIC	19	7 (37)	9 (47)	3 (16)
LMIC	28	14 (50)	9 (32)	5 (18)
UMIC	12	4 (33)	6 (50)	2 (17)
HIC	1	0	1	0
Type of project/programme				
Demonstration project	51	19 (37)	23 (45)	9 (18)
National	9	6 (67)	2 (22)	1 (11)
Type of support for demonstration projects				
GAP/Merck[4]	22	11 (50)	8 (36)	3 (14)
Gavi	12	3 (25)	6 (50)	3 (25)
Other[5]	17	5 (29)	9 (53)	3 (18)
Delivery strategy[6]				
School-based	20	8 (40)	11 (55)	1 (5)
Health facility +/- outreach	5	2 (40)	1 (20)	2 (40)
School + health facility/ outreach	35	15 (43)	13 (37)	7 (20)
Ownership of programme[7]				
MOH	43	20 (47)	16 (37)	7 (16)
Non-governmental partner	16	5 (31)	9 (57)	2 (12)
EPI involvement[8]				
High	49	23 (47)	20 (41)	6 (12)
Moderate	4	0	2 (50)	2 (50)
Minimal-none	5	1 (20)	3 (60)	1 (20)
Education sector involvement[9]				
High	35	13 (37)	16 (46)	6 (17)
Moderate	15	7 (47)	6 (40)	2 (13)
Minimal-none	2	0	1 (25)	1 (25)
Out-of-school strategy[10]				
Implemented	40	17 (43)	14 (35)	9 (23)
Not implemented	20	8 (40)	11 (55)	1 (5)
Delivery with other interventions				
Concurrent delivery[11]	6	4 (67)	0	2 (33)
None	46	17 (37)	23 (50)	6 (13)
Dose schedule				
2-dose	10	3 (30)	6 (60)	1 (10)
3-dose	50	22 (44)	21 (42)	9 (18)
Days spent on dose delivery				
1-6	9	5 (56)	3 (33)	1 (11)
7-13	6	1 (17)	2 (33)	3 (50)
14-28	4	3 (75)	1 (25)	0

[1]Excludes projects/programmes that started in 2016. [2]Coverage of a 2 or 3 dose regimen (only 10 experiences had coverage data on 2-dose regimen). [3]World Bank definition 2014. [4]One demonstration project was funded directly through Merck & Co rather than being administered through GAP and Axios Healthcare Development. [5]'Other' includes other NGOs, the World Bank, national governments and research groups. [7]One programme with missing information on ownership attained 50-70% coverage. [8]Two experiences were missing information on EPI involvement: one attained >90%, one <70%. [9]Eight experiences were missing information on education sector involvement: 6 attained >90% coverage, 2 70-90% and 1 50-70%. [11]Eight experiences were missing data on delivery with other interventions: 4 attained >90%, 2 70-90% and 2 50-70% coverage. This includes experiences that delivered a service at the same time as HPV vaccine (to any age group).

Table 25. HPV vaccination uptake and completion rates by experience, project/programme and country characteristics

Characteristic	Experiences with data[1] (n=92)	Number (%)			Experiences with data	Number (%)	
		Dose 1 uptake >90%	Dose 1 uptake 70-89%	Dose 1 uptake 50-69%		Completion >90%	Completion 70-89%
All experiences	56	31 (55)	23 (41)	2 (4)	54	31 (57)	23 (43)
Country income group[2]							
LIC	18	10 (56)	7 (39)	1 (6)	17	8 (47)	9 (53)
LMIC	25	14 (56)	11 (44)	0	26	15 (58)	11 (42)
UMIC	12	7 (58)	4 (33)	1 (8)	11	8 (73)	3 (27)
HIC	1	0	1	0	0		
Type of programme							
Demonstration project	47	26 (56)	19 (40)	2 (4)	48	26 (54)	22 (46)
National	9	5 (56)	4 (44)	0	6	5 (83)	1 (17)
Delivery strategy							
School-based	18	9 (50)	7 (39)	2 (11)	19	13 (68)	6 (32)
Health facility +/- outreach	5	3 (60)	2 (40)	0	5	1 (20)	4 (80)
School + health facility/outreach	33	19 (58)	14 (42)	0	30	17 (57)	13 (43)
Ownership of programme							
MOH	41	24 (59)	16 (39)	1 (2)	36	23 (64)	13 (36)
Non-governmental partner	14	7 (50)	5 (36)	2 (14)	17	8 (47)	9 (53)
EPI involvement							
High	43	26 (60)	17 (40)	0	42	28 (67)	14 (33)
Moderate	5	1 (20)	2 (40)	2 (40)	4	0	4 (100)
Minimal-none	6	3 (50)	3 (50)	0	5	2 (40)	3 (60)
Education sector involvement							
High	31	17 (55)	14 (45)	0	29	18 (62)	11 (38)
Moderate	15	8 (53)	5 (33)	2 (14)	13	9 (69)	6 (46)
Minimal-none	3	2 (66)	1 (33)	0	2	0	2 (100)
Out-of-school strategy							
Implemented	37	22 (59)	15 (41)	0	35	18 (51)	17 (49)
Not implemented	18	9 (50)	7 (39)	2 (11)	19	13 (68)	6 (32)
Delivery with other interventions							
Concurrent delivery[3]	7	4 (57)	3 (43)	0	6	3 (50)	3 (50)
None	44	24 (54)	18 (41)	2 (5)	40	25 (63)	15 (37)
Dose schedule							
2-dose	13	8 (62)	5 (38)	0	4	2 (50)	2 (50)
3-dose	43	23 (53)	18 (42)	2 (5)	50	29 (57)	21 (43)

[1]Excludes projects/programmes that started in 2016 or later
[2]World Bank definition
[3]This includes experiences that delivered a service at the same time as HPV vaccine (to any age group).

Table 26. HPV vaccination dropout rates by experience, project/programme and country characteristics

Characteristic	Experiences with data[1]	Number (%)			
		Dropout <5%	Dropout 6-10%	Dropout 11-20%	Dropout 21-30%
All experiences	54	22 (41)	9 (17)	18 (33)	5 (9)
Country income group[2]					
LIC	17	5 (29)	3 (18)	6 (35)	3 (18)
LMIC	26	12 (46)	3 (12)	10 (38)	1 (4)
UMIC	11	5 (45)	3 (27)	2 (18)	1 (9)
HIC	0				
Type of programme					
Demonstration project	48	17 (35)	9 (19)	18 (33)	5 (9)
National	6	5 (83)	0	1 (17)	0
Delivery strategy					
School-based	19	10 (53)	3 (16)	4 (21)	2 (11)
Health facility +/- outreach	5	1 (20)	0	4 (80)	0
School + health facility/ outreach	30	11 (37)	6 (20)	10 (33)	3 (10)
Ownership of programme					
MOH	36	17 (47)	6 (17)	10 (28)	3 (8)
Non-governmental partner	17	5 (29)	3 (18)	7 (41)	2 (12)
EPI involvement					
High	42	20 (48)	8 (19)	11 (26)	3 (7)
Moderate	4	0	0	3 (75)	1 (25)
Minimal-none	5	1 (20)	1 (20)	2 (40)	1 (20)
Education sector involvement					
High	29	10 (34)	8 (28)	9 (31)	2 (7)
Moderate	15	8 (53)	1 (7)	3 (20)	3 (20)
Minimal-none	2	0	0	2 (100)	0
Out-of-school strategy					
Implemented	35	12 (34)	6 (17)	14 (40)	3 (9)
Not implemented	19	10 (53)	3 (16)	4 (21)	2 (11)
Delivery with other interventions					
Concurrent delivery[3]	6	3 (50)	0	3 (50)	0
None	40	16 (40)	9 (23)	12 (30)	3 (7.5)
Dose schedule					
2-dose	4	2 (50)	0	2 (0)	0
3-dose	50	20 (40)	9 (18)	16 (32)	5 (10)

[1]Excludes projects/programmes that started in 2016 or later
[2]World Bank definition
[3]This includes experiences that delivered a service at the same time as HPV vaccine (to any age group).

8.1.5 Trends in coverage over time

Among the seven countries with over a year's experience and data on coverage in the same target group over time, four had increasing coverage. They mentioned that this occurred simultaneously to increasing EPI involvement (Country 3), better organisation of social mobilisation and increasing familiarity with the vaccine in the community over time (Country 16, Countries 23 and 36). One country implementing a national programme increased its focus on outreach for out-of-school girls over the years, although it is uncertain whether this resulted in an increase in coverage as school enrolment was high across the country and HPV vaccine coverage maintained at ≥90% (Country 28). One country had a small decrease in coverage due to changes in coordinating staff and collaboration difficulties between the MOH and MOE (Country 2). One country's national programme had oscillating coverage estimates as different delivery strategies were piloted. Within this country the school-based strategy achieved the most reliable high coverage compared to a health facility-based strategy (Country 1).

8.1.6 Reported lessons learnt in attaining good coverage

A wide range of factors were reported in the literature and interviews in relation to their effect on HPV vaccine coverage. Statements and recommendations have been summarised in Tables 26a, 26b and 26c.

- **Good coordination between the MOH and the MOE** at an early stage was the most frequently mentioned factor governing whether high coverage was achieved across the 37 countries. This agrees with the analysis of the correlates of coverage in Table 24 where countries with high MOE and EPI involvement seem to be more likely to attain high coverage compared to those with low EPI and MOE involvement. The next most frequently mentioned 'lessons' were the need to respond rapidly to rumours and negative media exposure and the difficulty in estimating target population using census projections.
- **School-based delivery** appeared to appeared to attain high coverage and this was specifically stated as a lesson in 4 countries, although one country stated there was no difference in coverage in districts implementing school based and those implementing health facility based delivery. Three experiences reported that drop out between doses was higher if the vaccination was not conducted on the scheduled date(s). Often this occurred if a programme experienced delays in disbursement of funds for mobilisation activities or training, or had difficulties with customs and transport of the vaccine to sites. However, consistent availability of the vaccine at facilities helped to ensure more girls were vaccinated even if they were absent from school on the vaccination days.
- **Enumeration of the target population** was a challenge especially in urban centres (reported by 9 countries). Management of registration lists of eligible girls was mentioned as a key factor in gaining good coverage (Section 7.2: Enumerating vaccine needs).
- **Calculating coverage** was found to be difficult if different eligibility criteria were applied to in school and out-of-school girls (two countries). If a grade based delivery approach was completed in school, age data would also need to be collected in order to assess coverage by age. Grades often spanned multiple age ranges and use of census data for 9-13 year olds to calculate coverage could result in an overestimation of coverage. It was very difficult to calculate coverage in out-of-school girls without an accurate target population or if eligibility criteria were unclear. The planning of monitoring and evaluation systems should take this into account and record age on all forms.
- **Resistance from health care workers** could have affected the coverage achieved in certain areas, despite these areas being accessible (not remote rural areas) (two countries). These countries recommended that the medical community should not be ignored during social mobilisation and needs some special attention as they can harbour reservations about new vaccines which hinder coverage (until HPV vaccine becomes routine).
- **Various strategies were mentioned by projects/programmes with the aim of increasing completion** (other than mop-up strategies detailed in Section 7.1.6; Box 9)

Box 9: Strategies to increase completion

Country 3: >90% completion

- Registration of all schoolgirls and out-of-school girls for vaccination and the use of an attendance register to check dose receipt.
- The close involvement of headmasters and teachers in the process of registration and monitoring coverage of each girl
- Reminders to girls about return dates for the next doses, at the delivery of the first dose, in church announcements and within vaccination cards.

Country 8: 81% completion

- Vaccinators spent time explaining the importance of completion and it was included in mobilisation messages.

Country 11: 98% completion

- Names, addresses, phone numbers of girls/parents were listed to facilitate follow up for the second and third dose if absent on the vaccination day.

Country 35: 95% completion

- Wristbands with the reminder "Don't forget to come back for your next shot" in local language and SMS reminders (uncertain effect on completion as rates did not differ in areas with and without the incentive).

Table 27: Reported correlates of coverage from delivery experiences with high coverage

The top 10 reported correlates for high coverage from delivery experiences with >90% coverage		Number of delivery experiences
1	**Coordination between MOH and MOE** early in the planning process was essential. This was particularly important to ensure that: • the planned timing of the vaccination accounted for school closing, holidays, exams, religious festivals, seasons; • there was good communication and engagement of actors at the provincial and ground levels; • teachers and health workers mobilised for the delivery of each dose efficiently with optimal use of resources. A review meeting after the implementation of each round contributed to improved coordination between health and education officials. Involvement of district heads in health and education in the review meetings strengthen their understanding of their roles in social mobilisation and supervision of HPV vaccination resulting in fewer refusals at schools. Strong political commitment was instrumental to programme success - national level stakeholders need to be engaged as early as possible. Endorsement of the programme by national, provincial and district officials can increase acceptance at every level of society.	8
2	For school-based immunization in areas with variable age at enrolment to primary school (and therefore a wide range of ages within each grade), **eligibility criteria based on age** were often logistically more difficult to implement than class/ grade based immunisation as it involved visiting multiple grades within the school. The relevant grades to vaccinate may be lower grades in rural areas where girls start school later in comparison to urban areas.	5
3	In mixed delivery models (school & health facility), presentation of **out-of-school girls** at health facilities for vaccination was rare; specific mobilisation was needed to encourage girls to present for vaccination at health facilities or outreach activities were used.	5
4	**Negative media exposure** could have affected coverage; preparations were made before vaccination day to address rumours and potential anti-vaccine lobbyists. **Rumours**, often centred on fertility fears, were tackled when they first arose to prevent them gaining a following, strategies to address rumours included: tailored communication messages, announcements by high level officials, dissemination of letters detailing WHO or government endorsement for the vaccine, one to one or group meetings with the community.	4
5	Strong **community commitment** in identifying, sensitising and following up girls increased vaccination uptake rates. Engagement of **community health workers** increased community acceptance, increased coverage, aided identification of out-of-school girls and girls who missed doses.	3

6	**Adherence to the scheduled dates of vaccination** minimized drop out between doses. Transport of vaccines and personnel to vaccination sites was well planned and timely.	3
7	**School-based delivery** gave better coverage than a routine Health facility delivery model. Long walking distances to clinics in rural areas is a challenge.	3
8	**Rural areas attained higher coverage than urban areas.** Urban parents and those with daughters in private schools required a larger amount of information for acceptance than those in rural regions. Coverage in private schools was increased with proof of government endorsement for the vaccine.	3
9	**Complete vaccine schedule in one school calendar year** to enable good completion rates.	2
10	General knowledge about cervical cancer was low in the community; good **social mobilisation** was key to gaining good coverage. "Credible influencers" of community opinion, health workers and/or teachers were used to communicate messages about the vaccination programme. Teachers and local community and religious leaders were specifically trained to mobilise girls in their communities with accurate messages about the HPV vaccine programme.	2

Table 28: Top 10 reported lessons learnt in delivery experiences with average coverage

Top 10 lessons learnt from delivery experiences which attained average coverage (>70%,<90%)		Number of delivery experiences
1	**Negative media exposure** affected coverage; strategies to address rumours and anti-vaccine groups were not always in place before vaccination day. **Rumours** were not always tackled when they first arose, leading them to gain ground in the media and within the community. Negative media exposure **from a neighbouring geopolitical region** affected acceptance in one country, despite few rumours nationally. Policy makers should be aware this could happen and plan a response accordingly.	3
2	If the vaccination days occur outside the school calendar, girls had to be invited back to school or door to door follow up was required to complete the three doses, this was resource intensive. Moving away/migration during school breaks or between school years contributed to low completion. All vaccine doses should be delivered in the same **school calendar year** to achieve good **completion**.	3
3	Good **social mobilisation** was key to gaining good coverage. "Credible influencers" of community opinion, teachers and/or community leaders, were trained sufficiently in social mobilisation and HPV vaccine at least 1 month in advance.	3
4	Engagement of **community health workers** increased community acceptance, increased coverage, helped to identify out-of-school girls or girls who had missed doses.	3
5	Making doses available after the main vaccination day at the health centre or at schools (mop-up doses) increased coverage and was a good alternative to active follow up and tracing of individuals who missed the dose if resources are limited.	3
6	**MOE involvement** in vaccine delivery led to good uptake and completion of the series. A review meeting after the implementation of each round contributed to improved coordination between health and education officials. Involvement of district heads in health and education in the review meetings strengthen their understanding of their roles in social mobilisation and supervision of HPV vaccination and resulted in fewer refusals at schools.	2
7	Rural areas can attain higher coverage than urban areas. Urban parents required a larger amount of information for acceptance than those in rural and mountainous regions. **It was more difficult to attain good coverage in private schools in comparison to government schools** due to internal decision-making processes. Private schools required more time and social mobilisation than government schools. Coverage in private schools can be increased with proof of government endorsement for the vaccine.	2
8	For school-based immunization in areas with variable age at enrolment to primary school (and therefore a wide range of ages within each grade), **eligibility criteria based on age** was logistically more difficult than class based immunisation as it involved visiting multiple grades within the school. Grade based vaccination maybe easier to implement and conduct follow up doses. The relevant grades to vaccinate to get good coverage were lower grades in rural areas where girls started school later in comparison to urban areas.	1
9	**Endorsement of the programme** by national, provincial and district officials increased acceptance at every level of society.	1
10	**School-based delivery** gave better coverage than a routine health facility delivery model. However; if school enrolment is very low, especially in the rural areas, community/ health facility-based projects/programmes should be prioritised as the HPV vaccine delivery approach.	1

Table 29: Top 5 reported pitfalls to avoid from countries with low coverage

	The top 5 reported pitfalls to avoid Reported from countries with <70% coverage (8 delivery experiences)[1]
1	**The power of negative media exposure was under-estimated**. Countries were not prepared before vaccination day to address rumours and anti-vaccine lobbyists which meant that rumours, were not tackled when they first arose and gained a lot of media exposure leading to low coverage.
2	**Poor coordination between the MOH and MOE and delays in the planning processes led to vaccination schedules falling on days which were outside the school calendar (school holidays), exams, festivals; this led to low completion as girls moved away or were too busy to receive the final dose**. Some schools were not notified by the MOE which led to some schools refusing to allow vaccinators entry to vaccinate girls. Teachers did not know enough detail about the programme to mobilise girls or address parents' questions. Teachers were not engaged in the programme to help to follow up girls who missed doses.
3	**High level political commitment was not in place leading to delays in vaccine importation and fund disbursement**. This led to delayed preparations e.g. printing of training materials and IEC materials, leading to poor social mobilisation and rushed vaccine delivery.
4	**Miscommunication and alienation of community leaders reversed efforts in social mobilisation and caused some community leaders to advise against vaccination**. Community leaders and teachers were not trained or educated about the programme contributing to high refusal rates by parents and girls. Training of national stakeholders (e.g. religious leaders) did not necessarily cascade down to local level.
5	**Private schools were not engaged early enough in social mobilisation activities**. Private schools required more information and time to communicate with parents than government schools.

[1]Each lesson was reported by 2 delivery experiences that attained 50-69% coverage.

8.1.7 Key lessons learnt and conclusions

In relation to coverage achievements, key lessons included:

- High HPV vaccine coverage is feasible in L&MICs
- It is difficult to obtain meaningful data on vaccine coverage without a well-designed coverage survey.
- Limitations in administrative data need to be realised by national and international agencies.
- Delivery strategies including a school-based component are likely to achieve high uptake, completion and final dose coverage, due to the relative ease of capturing a large number of girls in one place, gaining consent if required and following up girls. However, these strategies are resource intensive. Data on health facility only strategies is limited and the coverage achievements to date have been highly variable.
- Urban areas may be more exposed to negative media, contain more mobile populations and be harder to enumerate than rural areas; it may be harder to achieve high coverage in urban centres for these reasons.
- High-level political commitment and the involvement of the EPI team or national immunisation programme and the MOE early in the planning process is critical to obtain good coverage.
- Early collaboration between EPI and education representatives at lower levels (provincial, regional or district) can ensure efficient microplanning, i.e. the vaccine schedule is planned to fit into the school calendar, can aid in enumerating school-based target populations, can coordinate an effective response to vaccine rumours within the community and can help to follow up girls who missed doses – all of these functions can help to ensure high coverage. They can also more efficiently identify potentially problematic groups within the target communities e.g. private schools or vocal anti-vaccination groups.
- EPI/national immunisation team involvement can ensure timely vaccine delivery which is important to maintain interest in vaccination in the community and to reduce drop-out.
- Specific strategies are needed to identify and mobilise out-of-school girls; the absence of specific strategies can result in low uptake if the vaccine is simply made available at the health centre.
- We cannot yet draw conclusions on the effect of the change to a 2-dose schedule on completion and coverage rates.
- The 2-dose schedule achieved high coverage, uptake and completion and was reportedly easier and cheaper to implement when compared to the 3-dose schedule. Only one country attempted a 12 month interval between the 2 doses, rather than 6 months, and stated an annual campaign was easier to implement.
- Delivery of HPV vaccine simultaneously with another intervention to the same target

group did not seem to affect HPV vaccine coverage rates. However, few countries attempted to deliver other services with HPV vaccine. Coverage data from experiences which tested delivery of other interventions were only available for 6 countries.

8.1.8 Key recommendations

In relation to coverage achievements we recommend:

- Strategies including a school-based component achieve high coverage. If school enrolment is low, a mixture of strategies could be important in order to attain good coverage. There is limited data on how to deliver a health facility based strategy successfully.
- The grade based eligibility criteria in a school programme is the easiest and quickest strategy to implement; however, we recommend taking into account country specific factors of acceptability to the target group and school enrolment statistics. Grade based eligibility criteria can make target population enumeration and coverage calculations challenging; these processes are easier when eligibility criteria are the same for in-school and out-of-school girls.
- If countries decide to change delivery strategy, the effects on coverage should be carefully monitored and evaluated.
- Good relationships between the MOH and MOE should be developed. Coordination should begin at an early stage of the planning process, and collaboration should continue during implementation in the districts to ensure the vaccine delivery is planned and carried out within school timetables, efficiently, and achieves high coverage.
- Planning should allow sufficient time for fund disbursement, customs clearance and preparation activities including planning transport requirements to ensure that scheduled vaccination dates are adhered to and that all vaccine doses are delivered in the same school year.
- Encourage high-level political commitment to the programme in order to reduce bureaucratic hurdles, to secure ring-fenced funding and ensure timely delivery of the vaccine.
- Engage the community and community health workers in order to increase acceptance and uptake of the vaccine and aid identification of out-of-school girls or girls missing doses.
- More intense social mobilisation (e.g. more information and over a longer period) should be planned for urban areas and private schools as these groups are potentially more exposed to negative media exposure and rumours and more likely to refuse vaccination.
- Out-of-school girls should be specifically targeted with social mobilisation messages and provided with an opportunity to access the vaccine either at schools, during vaccination days, health facilities or outreach sessions.
- An opportunity for girls who missed doses to receive the vaccine should be supplied, either at return visits to schools or referral to health facility or outreach sites, depending on the resources available.
- Staff may need retraining or refresher training in the use of data collection forms in order to ensure adequate quality administrative data.
- Different strategies and target populations and integration with other services should be tested in order to gain experience for later implementation.

8.2 Monitoring and evaluation

8.2.1 Data collection and reporting

Data on reporting were available from 42 experiences in 30 countries. HPV demonstration projects were frequently organised so that reporting followed the system used in campaigns (e.g. daily reporting) and could not be tallied with routine reporting structures and timelines. Particular challenges were associated with the complexity of HPV vaccine reporting, including how to trace girls for doses 2 and 3, insufficient space within reporting tools to write girls names, confusion about who should keep vaccination cards between doses, and grade-based vaccination approaches that still needed to report nationally by age. The reporting requirements placed heavy and often confusing burdens on vaccinators, compared with other vaccinations. In some cases there were separate HPV vaccination cards and reporting tools; separate databases were developed in 4 countries.

Data reporting tended to be separate from routine EPI reporting, especially during initial phases of demonstration projects. Countries with more experience noted that they planned to gradually integrate HPV data collection into routine reporting processes. For example, two countries that had scaled-up nationally now capture HPV data in the Health Management Information System (HMIS) system and HPV vaccine specific tools have been incorporated

so that each month every health facility reports how many doses have been delivered (Countries 3, 33).

Minimal discussion of monitoring and evaluation (M&E) was found, primarily because it seemed to be assumed that countries had some functional means of monitoring implementation. Gavi-supported countries adapted EPI monitoring forms and reporting while several other countries developed new forms and procedures. Sometimes monitoring tools were provided by international partners. All who answered indicated HPV monitoring was more intensive for the demonstration period than would be anticipated for routine immunisation. Data collection at implementation sites was recorded on forms or in register books daily and generally entered into a database at district level for electronic transmission to national level.

8.2.2 Quality assessment and supervision

Data quality-checking and supervision were rarely mentioned, except to indicate they had been done. However, a few countries conducted evaluation research to determine programme quality and effectiveness, sometimes implemented by international partners. One concern noted in a few countries was whether schools, girls or health facilities should keep vaccination cards, particularly for girls who switched schools. One programme addressed this by having schools keep cards until all three doses were completed and then returning them to girls. Another programme was advised by the regional EPI team to ask the health facility serving the schools to keep vaccination cards and to issue a second card to girls when they completed the vaccine course (Country 31).

8.2.3 Integration with EPI systems

Discussions on integration of HPV vaccination reporting with EPI reporting systems indicated that countries expected to integrate it within EPI systems, though this was noted as challenging by some countries due to differences between HPV vaccination and routine EPI vaccines in terms of age of the target group, gender specificity of the HPV vaccine and different vaccination schedules. One country noted that, while standard HMIS tools were not used, existing EPI forms were modified and approved by the MOH for use with HPV vaccine (Country 10). Another country questioned the effectiveness of HMIS standard tools (Country 22).

8.2.4 Key lessons learnt and conclusions

In relation to monitoring and evaluation, key lessons included:

- Use of electronic monitoring and reporting systems appeared to reduce errors and, in some cases, simplified the process of data recording. For example, at least two countries created a database of girls to be vaccinated in advance so that all forms already had names on them, thus simplifying and speeding data recording (Country 30, 31). Other projects noted logistical difficulties with paper forms (e.g. insufficient space on forms, difficulty in following-up girls who missed vaccinations).
- Vaccinating girls by school grade may have been easier logistically, but had implications for reporting and follow-up if the HMIS was organised by age. If one form per class or school was used, all vaccines - even if given on different dates - were entered on the same form making it difficult to document vaccination of all three doses per individual and complicating registration in summary forms if mistakes were made.
- Early and thorough training of health-workers in correct and timely recording, reporting, and monitoring procedures was not always given enough attention, which caused later difficulties in timeliness and accuracy of reporting.
- More discussion appears warranted on who should hold vaccination cards (e.g. whether this should be health-workers, schools, or girls).
- Reporting workload was not often mentioned, despite the probability that it may have been an issue in some countries.

8.2.5 Key recommendations

Based on findings related to monitoring and evaluation, we recommend:

- HPV demonstration projects must include discussion and agreement with EPI personnel at the planning phase about how HPV vaccination will be integrated within EPI structures.
- Monitoring and reporting systems should be standardised, so that issues such as who is responsible for holding vaccination cards can be agreed. Where feasible, electronic systems should be used to improve data collection and tracking.
- Reporting should be consistent with target group selection, i.e. if vaccinating girls by school grade, reporting should also be by school grade and by age if necessary.

9. Sustainability

9.1 Financing and costs

9.1.1 Financing of demonstration projects

Financial sources of the 66 demonstration projects undertaken in 44 different countries are summarised in Table 30 (2 countries did not complete a demonstration projects and went straight to national implementation).

The GAP financed the vaccine in 30 (45%) of the projects. The GAP provided free vaccine but a wide range of organisations and ministries of health implementing the demonstration projects were responsible for procuring injection supplies, paying customs duties for the vaccine and for financing all delivery costs e.g. Partners in Health (Haiti), ACCF (Kiribati and Nepal), Moi University (Kenya), MOH (Georgia, Moldova, Mongolia) [18, 19].

Gavi funded 20 (30%) of the demonstration projects included in this study. Gavi covered the entire cost of vaccines and injection equipment until port of entry. In addition, countries could receive funding to partially finance delivery costs for two years. The amount given depended on the size of the targeted population. For the first year of the Gavi projects, Gavi offered US$ 4.80 per girl, or US$ 50,000, whichever amount was greater. During the second year of implementation, Gavi financed US$ 2.40 per girl, or US$ 25,000, whichever amount was greater. Funding was greater in the first year to account for start-up costs, such as training and social mobilization. In addition, projects could apply for a maximum of US$ 95,000 for evaluation and strategy development, and a maximum of US$ 25,000 for implementation of joint delivery of HPV vaccine with another adolescent health intervention.

PATH co-ordinated four of the non-Gavi non-GAP supported demonstration projects in four countries; each country tested 2 different delivery strategies. Merck & Co. or GSK donated the vaccine to PATH and PATH received funding from the Bill and Melinda Gates Foundation to implement the projects. Project implementation costs were paid according to budgets negotiated with governments in the four countries.

The Australian Cervical Cancer Foundation (ACCF) funded three demonstration projects during 2008-2014. Jhpiego, an international, non-profit health organisation affiliated with the Johns Hopkins University, implemented two projects with funding from the Cancer Institute Foundation in the Philippines. Merck & Co. and GSK funded two projects directly in South Africa through the University of Stellenbosch and Uganda through the MOH. Five different organisations funded one project each in their respective countries (Table 30)

Table 30: Financing of HPV demonstration projects 2007-2016

Name of funder[1]	Number of demonstration projects
GARDASIL® Access Program (GAP)	30
Gavi	20
PATH	4
Australian Cervical Cancer Foundation (ACCF)	3
Merck & Co. (Uganda); GSK/ University of Stellenbosch (South Africa)	2
Cancer Institute Foundation/Jhpiego (Philippines and Thailand)	2
World Bank, National AIDS Programme, Botswana	1
MOH, Botswana	1
University of Cape Town, South Africa	1
KwaZulu Natal Provincial Department of Health, South Africa	1
Municipal immunization programme, Brazil	1
Partners in Health, Haiti	1
Total	**66**

[1] Many projects were in fact funded through a variety of sources; however, these listed organisations formed the primary point of contact for the project or programme. These organisations had varying roles in implementation. E.g. Four projects were implemented by EPI but primarily supported by PATH who were funded by the Bill & Melinda Gates Foundation and obtained vaccine as a donation from either GSK or Merck & Co.

Table 31: Financing sources of national HPV programmes

Country	Year of national introduction	Primary funding source
Bhutan	2010	ACCF (2010-15), Merck & Co. (2015-)
Botswana	2015	Government
Brazil	2014	Government
Chile	2014	Government
Guyana	2014	Government
Honduras	2016	Government
Lesotho	2012	Government
Peru	2013	Government
Rwanda	2011	Merck & Co. (2011-13), Gavi (2014-)
South Africa	2014	Government
Uganda	2015	Gavi
Uzbekistan	2016 (planned)	Gavi
Vanuatu	2013	ACCF

9.1.2 Financing of national HPV vaccine programmes

Twelve national HPV programmes were included in the analysis and had completed at least 6 months of implementation by 1st May 2016. We received data on a further 1 national programme planned to start in 2016 or later. Funding for these 13 programmes are listed in Table 31. The national government is funding national implementation in seven middle-income countries; Botswana, Brazil, Chile, Guyana, Lesotho, Peru and South Africa.

9.1.3 Key lessons learnt and conclusions

Our data showed that several projects found it challenging to secure funds for implementation. The largest proportion of delivery costs was reported to be transportation and per diem costs for health workers and supervisors to travel to schools; in many demonstration projects this was done for both enumeration activities e.g. to register eligible girls, as well as vaccine delivery. Despite Gavi contributing funding towards operational costs of the demonstration projects, several countries had extinguished funding after one year of the project and had to look for additional funding for the second year of delivery. They argued that mobilisation costs, transport and staff costs (including costs related to enumeration of girls) had been higher than anticipated (Countries 22, 24, 29, I).

Several countries found it difficult to finance these operational expenses, which were regarded as the main barrier to scaling up to a national programme. Reported financing issues are summarised in Table 32.

Of note, one country (country D) stated that they had declined additional support from partners other than Gavi as they did not wanted to implement an expensive programme and thus not have a chance of achieving sustainability.

Table 32: Examples of financing issues reported

Topic	Financing issue
High delivery costs	Although the vaccines may be donated, the start-up costs are perceived prohibitive for countries to manage.
	School based + facility based + outreach proved too costly and unsustainable. Campaign mode requires more financial resources. Costs to pay staff meals and lodging could make delivery costs very high.
	Although vaccines are offered free of charge, custom clearance may be required. Furthermore, administrative charges, especially where NGOs are involved, are still high.
	Because of logistical difficulties, costs tended to be higher in rural than urban areas. The delivery costs through on-going outreaches was much lower.
	Costs vary a lot with transport costs. Once it is integrated into the school health system and if it is delivered with other vaccines in school, there are no increased costs for implementation. "Additional costs are in remote locations - that is where it is difficult to sustain."
	Delivery is too expensive, mainly because cars were needed plus allow-ances for nurses.
	Enumeration costs are high, notably where house to house enumeration is carried out
	There was inadequate funding for implementation of activities, such as budget for training of teachers and waste management. There was a shortfall to implement the second and third dose in some districts. There were no funds to print monitoring tools, tally sheets and registers for the second co-hort.
Financing challenges	Because of Ministerial changes, the financial commitment to procure syringes was not honoured.
	Routine budgeting for transportation (car hire) and personnel to travel to schools is difficult to sustain.
	Funds were not transferred in time
	The initial budget was under estimated leading to disruption of some activities especially social mobilisation activities.
General financing comments	Additional resources should be included to sensitize teachers.
	Local resource mobilisation is key to bridge the funding gap.
	Advocate for allowing the reallocation of certain budget lines to better reflect certain realities (allocation of more resources for the enumeration), given that the project is in the demonstration phase.
	When designing HPV vaccine demonstration projects, country governments and partners should consider including different delivery models that vary in the resources required to implement them. For example, demonstration projects could test whether a lower-cost option of integrating HPV vaccination as part of the routine EPI delivery system is effective.
	The vaccine co-financing is not a problem – it is easy for the government to commit to financing the vaccine. But routine operation costs are difficult to fund. We need to develop a routine programme of visits to schools so that we don't need to pay lunch allowances and per diems for supervisors. It is difficult as Gavi finances some operational cost during the demonstration project, but then expect the government to take these on when scaling up to national - it is a big jump.

9.1.4 Future plans for financing HPV vaccine

Comments and opinions about future funding for HPV vaccine were available from 28 countries. Only eight countries had certainty about future financing and tended to be the countries that had already scaled up nationally and fully integrated the HPV vaccine into their EPI or national school health programmes. In the remaining 20 countries, there was considerable uncertainty about future financing, in particular with regard to introducing the vaccine nationally.

> "Affordability will be the main focus (in future decisions around HPV vaccine delivery) as it is possible that some vaccines will have to be dropped from the schedule when the country graduates from Gavi"
>
> *KI Country 8 after 2 years of HPV vaccine experience.*

Two approaches were reported to facilitate HPV vaccine introduction; seek additional donor funding and/or lobby national government (n=17), and change the vaccine delivery strategy to reduce costs (n=3). Several of the countries suggested specific strategies (tobacco tax, lobbying of parliamentarians, a specific budget line for vaccines in the national budget) to increase government funding not only for HPV vaccine financing but to sustain EPI financing more generally. One country noted that they were planning to domestically produce HPV vaccine to reduce costs. At least 3 countries

expressed considerable concerns as to how to finance a national programme such that it may not be done.

9.1.5 Evidence on costs per dose delivered

The costs of HPV vaccine delivery in demonstration projects have been published in two papers. In a 2012 paper by Quentin et al. [52], the costs of HPV vaccine delivery were estimated for two different school strategies; one targeted a certain age and another vaccinated a specific school grade. Levin et al.[37] reported the costs of HPV vaccine delivery in PATH demonstration projects in Peru, Uganda and Vietnam. Another paper reviewed evidence of HPV vaccine delivery costs [38].

In addition to the above studies, costs estimates from the PATH demonstration projects in India were included in this study. However, as the objective of this analysis was to provide evidence to support the Gavi introduction grants, only recurrent, financial costs were reported. A paper by Ladner et al. reported financial cost per dose and full girl vaccinated for 7 of the original GAP funded demonstration project[18, 28]. Finally, we collected costing studies of 5 Gavi demonstration projects.

Some of the published cost estimates are summarized in Table 33. These estimates exclude the vaccine costs. The difference between economic and financial costs is that opportunity costs, such as staff salaries, are included as economic costs. Financial costs are only the expenses that need to be budgeted for in a new budget, such as per diems.

Table 33: Published evidence of the costs per dose of the costs per dose of HPV vaccine delivery

Country	Delivery strategy	Financial delivery costs per dose (US$)	Economic delivery costs per dose (US$)
Tanzania	Grade-based		3.09
Peru	School	2.03	3.88
Uganda	School	2.10	3.15
Uganda	Integrated outreach	1.11	1.44
Vietnam	School	1.62	2.08
Vietnam	Health centre	1.55	1.92

There was some consistency across the early pilot programmes with financial cost per dose generally around $2 per dose (Table 33). A further 7 GAP projects reported a mean cost per dose of $2.74 (range 1.35-2.34)[18, 28]. However, financial costs tended to be higher in the 5 Gavi demonstration projects that provided data (Table 34). All five estimates of the cost of delivery from Gavi countries were in experiences predominantly using a school delivery model with some vaccine available in health facilities and during community outreach (although this was reported to be utilised variably). Reporting financial cost of delivery per dose ranged from $6.04, $6.90, $6.42 and $9.21 to $3.1.

Table 34: Financial costs of delivery in five Gavi-supported demonstration project costing reports

Cost category (% of financial costs)	Country 6	Country E	Country 22	Country 17	Country F
Start-up	**37%**	**21%**	**23%**	**74%**	**71%**
Microplanning	2%	5%	46%	12%	19%
Training (cascade)	58%	18%	22%	12%	38%
Social Mobilisation	40%	77%	32%	76%	43%
Sub-total	100%	100%	100%	100%	100%
Recurrent costs	**63%**	**79%**	**77%**	**26%**	**29%**
Vaccine and injection materials	13%		34%	33%	25%
Service delivery (e.g. staff per diems and transport)	57%	71%	23%	24%	18%
Supervision and evaluation	17%	5%	42%	41%	47%
Other (e.g. waste management)	13%	24%*	1%	2%	10%
Sub-total	100%	100%	100%	100%	100%
Cost per dose delivered (USD)	**3.1**	**9.2**	**6.02**	**6.9**	**6.42**
Final dose coverage	**69%**	**73%**	**66%**	**62%**	**NA**

Table does not include investment costs e.g. cold chain equipment; NA: not available; all USD estimates were made in 2015.
*'Other' included evaluation for this costing report.

Non-recurrent costs reported for these Gavi demonstration projects varied form 37% to 74% of total financial costs for the demonstration projects. On average, social mobilisation activities were the largest proportion of start-up costs. Service delivery, including per diems to staff and transport costs, was the largest proportion of recurrent costs, followed by supervision costs. These findings are consistent with the perceived cost drivers described in key informant interviews. Implementers additionally mentioned enumeration activities, included here in the microplanning category, as an unexpected and often unbudgeted, expense. The cost of delivery per dose did not necessarily correlate with coverage achievements, which were governed by many other factors. Despite high levels of investment in social mobilisation key informants suggested that this did not always translate into the delivery of communication materials/messages in adequate time prior to vaccination day, and the prevention of rumours.

Three costing studies estimated a projection of the possible cost per dose for a national programme and these ranged from 1.99 USD to 2.39 USD. These projections were made using the WHO C4P costing tool, assuming integration into routine EPI systems, with a declining level of investment needed in social mobilisation activities as the programme progresses, but a step increase in the necessary investment in training when preparing to roll-out nationally. Despite limitations in the way the cost per dose is calculated and the expectation that national scale up would provide economies of scale, these costs were reported to contribute to raising concerns on the affordability of HPV vaccination scale up.

9.2 Implementation of scale-up compared to demonstration projects

9.2.1 Factors influencing scale-up decision

Data from 34 of 44 countries contributed to this section (2 countries went straight to national introduction). Ten of these countries had already scaled-up from demonstration project(s) to national programmes, 11 countries reported not planning to scale-up in the foreseeable future (33%) and 13 countries reported planning to apply to Gavi for a national HPV vaccine introduction grant.

Among the 10 countries with experience of scaling up from a demonstration project to national programme, 6 stated the project guided the planning and/or design of the national programme (4 LIC/LMIC, 2 UMIC), three stated the demonstration project did not influence the national programme (1 LMIC, 2 UMIC) and one did not provide any information (LMIC). However, among the 6 that stated the demonstration project was useful in planning their national programme, one stated they would have gone straight to national if funding had been available and three reported that although the demonstration projects were important to demonstrate acceptability and encourage political support, they had learnt substantial, far-reaching lessons when rolling out nationally:

> "The demo didn't influence [national] HPV introduction, but it did cause some changes to the routine immunisation system. We would have gone straight to national implementation if it had been possible."
>
> *KI Country 11.*

Key informants across the 11 countries not planning to scale up cited the considerable uncertainty around future funding for the vaccine and delivery costs as the predominant/only reason for hesitancy. Four country representatives noted that not, or no longer, qualifying for Gavi support was a major barrier and concerns were not limited to HPV vaccine but included the funding of other recently introduced antigens also. One indicated their country intended to implement a direct agreement with Merck but delivery costs remained a barrier. Demonstration projects were still predominantly cited as useful to indicate the demand and acceptability of the vaccine in the community, which influenced political will to continue the programme, but obviously did not govern the decision to scale. Of note, two of the 11 countries indicated that the demonstration projects had actually deterred policy makers from continuing HPV vaccine delivery in national programmes due to the negative media stimulated by anti-vaccine lobbyist groups (Countries 12, 21) and delivery costs (Country 21 only).

Among the 13 countries planning to apply for Gavi support for national programmes, 6 indicated remaining uncertainty over funding for delivery expenses and would be testing a 'routine' health facility based delivery strategy in their planned national programmes for the first time. A phased national roll-out over 3-5 years was stated as preferable in these countries.

Regarding the extent to which experiences from demonstration projects were useful in

scale-up discussions in countries that had scaled or were planning scale-up, several indicated that the demonstration had given them additional confidence and that they had learnt useful lessons (See section 11: Value). If done well, demonstration projects could provide vital information for national roll-out (e.g. addressing issues around consent, rumours, population enumeration). One country source indicated that discovering that the school-based strategy exceeded their 80% vaccination goal convinced policy-makers that it was the appropriate approach (Country 4). However, six countries stated they would embark on national programmes with completely new, untested delivery strategies as their demonstration projects had proved expensive and had not tested sustainable delivery strategies.

Two of the 34 country representatives suggested that given the option they could have gone straight to national introduction instead of completing demonstration projects (Countries 11, 16). However, at least three countries that had not yet scaled up from their demonstration projects indicated that they felt they could not have gone straight to national introduction (Countries 17, 37, I).

A few others expressed concern that quality and effectiveness of delivery would deteriorate in national programmes without the additional support and intense interest/participation provided by pilot projects. Integration of planning, communication and social mobilisation was important to ensure the programme was accepted and owned as a 'public health' programme, rather than being seen as a vertical EPI or education initiative.

Previous small-scale demonstration projects were not well-cited in subsequent applications for Gavi demonstration projects. Some were likely too small or countries chose a different delivery strategy than the one previously tested. However, many applications referred to previous experience of school-based delivery during campaigns and TT vaccinations (Table 34).

Table 35: Mentioned 'lessons learnt' from previous HPV vaccine projects within applications for Gavi-supported demonstration projects or national programmes

Country ID	Any mention of previous project	Key lessons learnt from previous pilot	Other lessons learnt from vaccination programmes
Cameroon	Yes	Mentions coverage of previous demonstration project (GAP) but does not clearly identify lessons learnt. Gavi application proposes a different strategy (school-based versus mothers/ daughters). Mentions success of peer-search strategy used in the previous pilot. Mentions no record of severe AEFI.	Mentions measles campaign implemented in schools in 2012.
Ghana	No		Mentions communication strategy for tetanus vaccination.
Kenya	No	Report of limited experience with HPV vaccination through various research settings.	Success with vaccination of adolescent girls using TT through a school-based programme covering several counties in the eastern part of the country. Lessons learnt from the programme included the need for community engagement and male involvement. HPV demonstration can be integrated with ongoing school health programmes to leverage resources and strengthen current projects. This will be an inclusive programme carried out in collaboration with the different departments and partners.
Mali	No		Mentions experience with other campaigns (MenA, measles)
Nepal	Yes	Very brief comment acknowledging previous experience	Mentions the measles-rubella (MR) campaign conducted in schools for 9 months for 15 year-olds
Rwanda	No	No lessons learnt highlighted despite 3 years national programme.	
Tanzania	Yes	Quite detailed, lessons learnt include the need to organise mop-up days to increase coverage; feasibility and effectiveness of school-based delivery; need for comprehensive community sensitization incorporate messaging to explain the target population for vaccination, benefits to this population, and the reasons for vaccination of girls only.	Mentions experience in explaining sex-specific vaccination through their efforts to vaccinate women of reproductive age against tetanus toxoid.
Uganda	Yes	Comprehensive: Importance of formative research in identifying the key issues for HPV vaccine delivery such as delivery strategy elements, communication and advocacy strategy, training needs, identification of stakeholders, assessment of the health and education systems among others and these needed to be addressed before introduction. Detailed operational lessons learnt about planning, implementation and communication.	
Uzbekistan	No		Long-standing experience in implementing school-based vaccination programme (Booster doses of Td vaccine to adolescents administered at the age of 7 and 16 years) Previously, BCG booster were administered at schools at the ages of 7 and 15 until removal from the immunization schedule.

9.2.2 Planning in advance of scale-up

Changes made during the pilot or to EPI in advance of scale-up were very contextual among the 8 experiences in 7 countries for which this was mentioned (Countries 1, 4, 8, 26, 33, 34, 35). One source noted government plans should not be too rigid, giving the example of using an abattoir to store HPV vaccine when the cold chain failed. Some commented on the costliness of school-based approaches, one suggesting revising the vaccination schedule to an annual approach if this was feasible, while several indicated the mixed approach of schools and facilities was preferable (e.g. particularly for harder-to-reach remote areas). Six countries cited plans to change from a school-based strategy to a health facility based strategy due to the costs required for school-based delivery. These issues thus need to be explored further prior to scale-up.

9.2.3 Key lessons learnt from scale-up

In relation to scale-up, key lessons included:

- Demonstration projects appeared most useful for countries with less experience of rolling-out new vaccines or of vaccinating older children; however, substantial lessons have been learnt during scale-up and national programmes also.
- Some countries indicated they could have gone straight to national or phased national programmes rather than spent time on demonstration projects if funding had been available.
- Demonstration projects did not appear to be particularly useful in influencing the decision of whether to scale to national HPV introduction, which was sometimes already decided or was governed by the availability of funding. However, demonstration projects did appear useful in influencing plans for future implementation (e.g. consent, enumeration processes, delivery strategies).
- Continuity of access to Gavi funding was a major concern when considering scale-up and longer-term sustainability.
- A number of sources appeared unaware of the relative flexibility of the HPV vaccine dosing schedule (e.g. several did not know it could be given in two doses one year apart), which could have potential logistical and cost implications.
- While Gavi sources indicated that Gavi will continue to offer vaccine at a subsidised price to countries after they graduate from Gavi support, for some countries that currently no longer qualify for funding, exploration of alternative sustainable funding options could encourage more countries to scale-up HPV vaccination.

9.2.4 Key Recommendations

Based on findings related to scale-up plans and experiences, it is recommended that:

- More case study research should be conducted on scale-up experiences.
- Where feasible (e.g. in terms of funding and country experience with introducing vaccines), consider phased national implementation rather than demonstration projects.
- Further research should be conducted on the costs versus benefits of school-based delivery approaches within national scale-up.
- Further exploration of sustainable funding alternatives should be conducted and disseminated, to encourage more countries to scale-up demonstration projects.

10. Integration with routine immunisation and the health system

10.1 Combining delivery with other interventions

Targeted campaign-style delivery provided some opportunities to combine the vaccination with other interventions, which a minority of countries took up. The analysis below was conducted for 38 countries that provided information on whether or not they considered combining the vaccine delivery with any other type of intervention (Table 35). The same countries may have provided combined interventions in multiple programmes or delivery experiences.

Only five countries mentioned they had an established school health programme but some admitted that the programme may not have been very operational (Countries 3, 4, 8, 30, 34).

> "There is a School Health Education Programme (SHEP) where community health nurses and other public health officers embark on scheduled visits to all schools for integrated health education; physical examination of pupils/students and treatment of minor ailments undertaken. The coordinators of SHEP are teachers; they participate in all immunization and other health activities in the district."
>
> *KI Country 8.*

The strategy to integrate activities changed over time; countries would tend to add combined interventions in subsequent rounds of vaccination, having presumably felt more confident in HPV vaccine delivery. Additionally some countries mentioned they intended to test combined delivery of services or health education interventions in the future (e.g. TT/Td Booster (Countries 34); child annual health checks, hygiene education and eye screening (Country 13, G); deworming (Country E); male circumcision (Country 37)).

Countries with experience of integrated 'joint' delivery either delivered another intervention with HPV vaccine to the same target group and at the same time as HPV vaccination, or another intervention was delivered to a different target

Table 36: Different models of integration of HPV vaccine delivery implemented with other services/ interventions (number in brackets indicates country reference number)

Type of integrated delivery	HPV vaccination integrated within an existing school health programme	HPV vaccination integrated to an existing delivery	Add-on service provided alongside to the delivery of HPV vaccine	Add-on health education intervention provided alongside to the delivery of HPV vaccine	Cervical screening and HPV vaccination
School-based	TT and OPV (Country 3) Td (Countries 14, 30, 35) Generic School health programme (Country 4, 8, 30)	Child day outreach (Country 28, 33) Hepatitis B vaccination campaign (Country 26)	De-worming tablets & Vitamin A supplementation (Countries 15, 17, 28, 33)	Reproductive health (Countries 1, 4, 6, 18, 28, 30, 37) Hygiene / screening (Countries 14, 15, 28, 30)	
Health facility based					Mother and daughters' programme (Countries 1, 6, 19)

TT: Tetanus toxoid; OPV: Oral polio vaccine; Td: Tetanus diphtheria booster dose

group but in the same school or outreach site as that used for HPV vaccine delivery and at the same visit as HPV vaccine delivery. One country provides a good example of both of these scenarios: at the first school visit TT was administered to grade 7 alongside HPV vaccine dose 1; at the second school visit of the year oral polio vaccine (OPV) was administered to grade 1 and HPV vaccine dose 2 was administered to grade 7 (Country 3).

Combining HPV vaccine delivery with another major vaccination campaign (e.g. Hepatitis B or measles) seemed generally to have been unsuccessful because of organisational challenges, a lack of prioritization of HPV vaccine and reported confusion in messages directed to health care workers and the public (Box 10):

> "A national campaign to vaccinate all children 2–11 years of age against hepatitis B was conducted at the same time as the HPV vaccination campaign… This hepatitis B campaign involved vaccination at the health facility with community outreach; the hepatitis B vaccination was the main priority and the nurses' principal concern was reaching the goals for this campaign rather than for the HPV vaccination; Health facilities with fewer personnel had a greater challenge in implementing both vaccination campaigns without neglecting the regular vaccination schedule"
>
> *KI Country 26.*

Gavi-supported countries are encouraged and incentivised to provide another intervention that would be tailored to their context alongside HPV delivery [6]. Although all the Gavi demonstration projects included in this review are only in their first year of implementation, it seems that, based on the information that this study was able to collect, very few countries plan to take up this opportunity (Table 33). With the caveat mentioned above, overall the Gavi application process does not seem to have fostered innovation in the delivery of combined interventions, notably in reproductive health, which was one of the objectives of the demonstration programme approach.

Across all countries (Gavi-supported and non Gavi-supported), most countries that have delivered a combined intervention had such pre-existing programmes (school vaccination programme or existing school de-worming programme). In their reports, countries are not specific about whether they have considered adding interventions and whether they have gained lessons from delivery alongside other interventions. In one country it was obviously not a new idea:

> "In most polio campaigns the vaccine is delivered with deworming or vitamin A supplementation - it is not a new thing. HPV was no different. There were no problems with deworming tablets sometimes causing nausea or sickness."
>
> *KI Country E.*

Box 10. Case study – combining measles and HPV vaccine training

In 2015, the government received only 50% of the funds needed to deliver the measles campaign, which was conducted every three years for children aged 5 and below. The other 50% was to be funded by government, which on being unable to raise these funds decided to combine the measles vaccination campaign with the national HPV launch.

"At the central level this worked - everyone was trained on both the measles campaign and HPV. However, in the districts it failed."

Despite a training manual combining the two, which supported training on microplanning and catchment area mapping, trainers sent to the districts only focused on measles having concluded that having two disease foci to the training was likely to confuse people. Central government representatives reported surprise, as they "thought people would do what we asked them to do". Thus, when asked why they had not started HPV vaccination in January 2016, after having received HPV vaccine in December, health-workers stated they were waiting to be trained. Social mobilisation also faced difficulties. The government is now waiting for additional funds form UNICEF to strengthen training and mobilisation for HPV.

"We thought it would be a good thing because we didn't have funds and it would prevent people [trainers] coming and going twice to the districts. On the money side it worked, but on the implementation side.. it did not work". (KII, Country 33)

In January 2016, HPV vaccine training was added to training for a polio campaign. This time, it spurred delivery to start in some areas - it worked better the second time as the importance of HPV vaccine was emphasised and training was supervised.

However, some countries state that they have decided against combining delivery with other interventions pointing to a number of barriers preventing integration including: the absence of an overarching school health programme; no existing/ routinely delivered interventions to this age group; the fragmentation of other existing programmes; the lack of funds and unpredictability of financing for other programmes (e.g. deworming); the complexity of delivering multiple interventions and in some cases different types of staff needed; and general front line workload issues. In addition, a few countries noted that the restricted geographical remit of the demonstration projects meant that it was more challenging to involve national stakeholders and secure effective involvement of possible national partners outside of immunisation. Two countries wanted to minimise time spent in the schools and therefore disruption to the school day (Country 15, 16).

> "The decision to integrate all the services together, including HPV vaccine, has to come from the top, with a strong coordinating body to manage the different interventions and partners."
>
> *KI Country 22.*

Table 37. Gavi countries with approved HPV vaccine proposals

Country	Type of programme, Gavi approval date	Evidence of combined intervention implemented	Included in this review
Bangladesh	Demo 09/03/2015	No data	No
Benin	Demo 31/1/2014	No data	No
Burkina Faso	Demo 9/3/2015	No data	Yes
Burundi	Demo 31/01/2014	No data	No
Cameroon	Demo 31/01/2014	No	Yes
Cote d'Ivoire	Demo 31/1/2014	No, but possibly Y2	Yes
Ethiopia	Demo 6/5/2015	No, but possibly Y2	Yes
Gambia	Demo 31/1/201	No, but possibly Y2	Yes
Ghana	Demo 31/1/2013	Mentions generic school health programme but without details	Yes
Kenya	Demo 31/1/2013	Planned but dropped	Yes
Lao PDR	Demo 31/01/2013	Planned in the second year (Hygiene and oral care messages with eye screening)	Yes
Liberia	Demo 31/1/2014	Programme delayed-Ebola affected country	No
Madagascar	Demo 31/1/2013	**Yes** deworming and vitamin A (pre-existing programme)	Yes
Malawi	Demo 31/1/2013	No data	Yes
Mali	Demo 31/1/2014	Delayed start date to Oct 2015	No
Mozambique	Demo 24/05/2013	No	Yes
Nepal	Demo 4/11/2014	No data	No
Niger	Demo 31/1/2013	No, but exploring it (UNFPA)	Yes
Rwanda	National 15/2/2013	Yes deworming & vitamin A	No
Senegal	Demo, 31/1/2014	No data	No
Sierra Leone	Demo, 31/1/2013	Programme delayed-Ebola affected country	Yes
Tanzania	Demo 31/1/2013	Exploratory work done in Year 1 to identify potential interventions[53]. Not implemented	Yes
Togo	Demo, 19/3/2014	No, but possibly Y2	Yes
Uganda	National, 4/3/2014	Yes included in routine integrated outreach strategy	Yes
Uzbekistan	National, 4/3/2014	Yes, school programme with Td and OPV starts 2016	Yes (limited as future plans)
Zimbabwe	Demo, 24/05/2013	No, but possibly Y2	Yes

10.1.1 Combining service delivery with other interventions: Key lessons learnt and conclusions

- Inserting HPV into a wider school vaccination programme was not necessarily straightforward, as the target age group and/or schedule of other vaccines could differ from HPV. However when vaccination sessions were planned for other vaccines, this was seen as an opportunity to combine sessions. One country notes:

  > "Currently, school-based vaccination sessions are conducted twice a year (in April and in October). The administration of the first and the third doses of HPV vaccine will be combined with these existing sessions"
  >
  > *Uzbekistan Gavi application for a three-dose schedule*

- Few countries decided to test reproductive health interventions, presumably because the young age of girls to be vaccinated (age 9-11 years old) (Box 9). Countries that implemented reproductive health interventions tended to be UMIC countries that were targeting older age group girls.
- There was no evidence of any evaluation of the feasibility and cost effectiveness of combined interventions with HPV vaccine delivery. The decision to add on new interventions seemed to be opportunistic.
- Apart from countries with an existing well-established school health programme, generally in UMIC, there was no clear strategy to establish a more structured school-based health programme in which HPV vaccination would be one element. However, a few countries saw HPV vaccination as an avenue to strengthen the weak, existing, school health programme.
- In some cases, countries opportunistically combined already planned activities to the same target group (Hepatitis B vaccine introduction and cervical screening demonstration in one country) but outcomes seemed mixed and limited lessons learnt were reported on the outcomes of this ad hoc combined delivery.
- Several countries noted that a combined intervention was originally planned but this was not implemented highlighting possible organisational challenges.
- Organisational challenges around integration included national level coordination of the partners supporting delivery of the different interventions including agreement over the financial share of delivery costs between programmes. If delivery costs were borne by just one component of the integrated delivery package, the future of the other components would be at risk if funding is discontinued.

Box 11. Examples of reproductive health interventions implemented by countries

Reproductive health education provided with HPV vaccine

- ✔ Country 4: Sexual health education lessons delivered prior to vaccination days during sensitization (age 11-15).
- ✔ Country 1 & 6: 'Reproductive Health awareness sessions' provided in schools.
- ✔ Country 30: Health education on sexuality and puberty, bullying – as part of health education programme for all grade 4 children (Grade 4 and 5).
- ✔ Country 18: HIV prevention and hygiene messages provided to girls (Grade 4).

10.2 Integration with routine immunisation programme processes and structures

10.2.1 Assessment of integration with routine immunisation programme

We found that HPV vaccination was generally delivered through the routine immunisation programme, with the exception of a small number of earlier GAP demonstration projects set up independently (Countries 5, 6, 19). Exceptions included two countries whose HPV vaccine demonstration project was closely managed by EPI but chaired by a different MoH department (Cancer and reproductive health services) (Countries 6, I). Hence they shared the same programme structures and resources, including staff and logistical capacity as EPI although EPI did not lead the projects. HPV vaccine delivery was consistent with EPI processes in terms of planning, supply chain management, staff management and social mobilisation.

Similar processes to routine immunisation were used in terms of micro-planning, communication, social mobilisation, training strategies, and logistics. However, country reports often commented on the fact that several activities such as planning, social

mobilisation and supervision were felt to be more "intense" in terms of resource mobilisation and needed an extended period of preparation time. This tended to be especially true for the first round of vaccination.

The choice of the school-based delivery strategy led to more similarities with other vaccination campaigns than with how routine infant vaccines are traditionally delivered. Because of their recurrence, it can be argued that campaigns themselves have been "routinized".

> "Mini immunization campaigns will be organized in primary schools of pilot districts with the aim to immunize all girls of primary grade 6"
>
> *KI Country 28.*

A small number of countries had existing school health programmes and HPV vaccination were inserted into this existing programme framework, and aligned with existing processes (e.g. consent, medication distribution and logistics). However, several countries noted that they were re-considering how these other interventions were delivered following HPV vaccine introduction.

Roles of staff and community workers generally aligned with other routine immunisation activities.

> "This [HPV vaccination] was planned around routine work"
>
> *KI Country 17.*

But new staff were drawn in at least 13 countries to supplement healthcare workers to deliver school vaccination activities. Remuneration levels were generally based on existing country rules and aligned to existing rates (e.g. allowances). Supervision activities and data collection/reporting appeared to be areas that were more often set up for HPV vaccine in parallel to routine processes (Table 37). Workload was considered high for vaccine delivery in schools and reporting activities. There were instance of reported disrupted activities of routine services, but generally these were reported to be low, probably because of the additional staff resources that were allocated to the vaccination activities. Several countries noted that the health care facilities tend to be understaffed so the campaign mode approach was disruptive to their routine services, with one saying that some facilities had to be closed for the duration of the vaccination. Those countries conducting house to house visits to enumerate girls reported that this activity tended to generate a very high workload for community health workers. A learning curve was mentioned as potentially reducing workload over time.Importantly the small size of most of the demonstration programmes, generally circumscribed to a few districts, often failed to permit assessment of the actual integration of HPV vaccination within routine processes. This was particularly the case for cold chain and transport logistics, as well as planning, staff allocation and financial sustainability. The choice of districts to host the HPV vaccination introduction were frequently found to be based on convenience rather than to test more challenging contexts that a national introduction would face (e.g. remote areas, areas with lower school attendance).

For the national programmes for which we had sufficient data, integration of HPV vaccination within the EPI tended to be significantly stronger than with demonstration projects, notably in relation to service delivery, vaccine management, reporting, supervision, and human resources. Delivery models took different forms of integration: (a) with the national school health programmes where HPV would be delivered with other vaccines or interventions; (b) with a national bi-yearly child health day routine programme; and (3) with the routine EPI programme, where districts and facilities would be left to decide how best to reach their target population (schools, fixed sites and integrated outreach). There were advantages and drawbacks to each of these, notably predictability of funding for models (a) and (b) while model (c) seemed to introduce more uncertainty and potential weaknesses notably in vaccine management and ascertaining coverage rates in a context where routine outreach services might not be consistently funded.

10.2.2 Coordination and collaboration beyond EPI

Coordination and collaboration with stakeholders outside the routine immunisation programme seemed to be more variable and depended on:

- Formal requirements by funders to set up an integrated cancer strategy; for instance, the Gavi application process requires countries to set up a Technical Advisory Group that will deliver a national inter-agency cervical cancer strategy.
- Ownership of the demonstration programme; for instance, the single (hospital) site programmes did not always involve the EPI, or tended to coordinate with EPI at a later stage of implementation.
- Some EPI led programmes did not refer to the involvement of the Reproductive Health programme and cancer-related departments.

- All school-based programmes involved the MOE to various degrees, but all acknowledge the critical importance of early involvement of education authorities.
- Unlike for other childhood vaccinations, school staff were considered critical to support the overall HPV vaccination process (notably for enumeration, mobilisation, support, awareness raising, consent, mop up and reporting activities).

Table 38. Summary of apparent embeddedness of HPV delivery into routine immunisation programmes (all countries)

EPI functions	Embeddedness with routine EPI processes	Specific challenges for HPV vaccine	Potential opportunities
School-based			
Preparation & planning	++	Need close collaboration with MOE at national and local level. Timeline to fit within one school calendar year. Enumeration of girls challenging and requires extended planning phase.	Opportunities to strengthen school health programme
Service delivery	+	Majority select school delivery outside of infant routine immunisation programme. However strategy similar to vaccination campaigns (eg. measles, MenA). Service delivery includes multiple concomitant delivery strategies (school, health facility, and outreach).	Opportunity to combine interventions/ services to be delivered
Human Resources	++	Same staff involved in delivery. High workload mitigated by additional staff recruited in demonstration projects.	Link with teachers/educated staff could be leveraged for other programmes
Training	++	*Training: similar to regular training strategy for new vaccine but need to train other staff (teachers)*	
Remuneration	++	*Remuneration: aligned on existing routine immunisation process to compensate for outreach work*	
Supervision	+	*Supervision: generally specific (not integrated) in line with campaign delivery*	
Social mobilisation	++	Similar processes but more "intensive". Specific challenges of potential rumours to manage.	
Supply Chain management	++	Scale up nationally poses similar challenges as for any new vaccines	
Cost, financial sustainability	+	Recurrent operational cost to fund school delivery (e.g. allowance, transport costs).	Invest in school programme, rather than in HPV vaccination *per se*
M&E, reporting	+	Similar to campaign reporting processes (daily reporting). Often parallel systems set up to the routine reporting systems. Challenges in reporting data (e.g. between different doses).	
Health facility[1]			
Functional integration with routine immunisation programme	+++	Understanding the number of girls to be vaccinated is a challenge as well as ensuring they come back in time for the subsequent doses. Reporting challenges and uncertainty of coverage data. Difficulties in planning appropriate number of doses. Challenge for girls to reach the vaccinating health facility (distance).	

[1]Excluding mothers-daughters programmes and those delivered in single site hospital

10.2.3 Key lessons learnt and conclusions

In relation to integration key lessons included:

- When EPI was leading the demonstration projects, integration with routine immunisation activities was usually strong and the regular routine human resources and infrastructure was used to deliver the HPV vaccine. HPV vaccination delivery led by EPI shared the processes and resources of the routine infant vaccination programme.
- Smaller scale projects run by entities other than the MOH showed minimal or no integration with routine services, and in some cases were run in parallel to the routine health service, hence limiting understanding of scalability. These projects also ended up using some EPI capacity (e.g. cold chain and logistics), often with minimal or late involvement of EPI, thereby reducing its capacity to integrate activities within the routine programme.
- Many countries used familiar delivery models and therefore the level of integration into standard processes tended to be high (e.g. (repeated) school-based campaign model, with additional mop-up activities in regular health centres). Hence delivery shared practices specific to campaign delivery (limited duration, additional staff, allowances, intensive supervision and reporting).
- Many specific characteristics of the HPV vaccination continue to be related to the introduction aspects of the new vaccine (significant initial investment in social mobilisation, specific vaccine focused training, intensive supervision, responding to possible emergence of rumours) and explain processes that tend to remain parallel (supervision, reporting) to the routine immunisation programme practices.
- There were only a limited number of unique traits to HPV vaccination that distinguished it from other routine vaccines. These involved the targeting of older girls, the often-complex enumeration process and the repetitive vaccination campaigns in schools for countries without existing school health programmes.
- Many aspects of integration with the routine immunisation programme process remained challenging to assess because of the small size of demonstration projects. Scale up may produce new challenges and learning curves and result in changes of strategy.
- Despite reporting high workload, negative effects on the routine delivery of other services were rarely commented upon. This may be owing to the small scale of the programmes (Section 7.3.3: Staff workload).
- A small number of countries had in the past or were envisaging to switch in the future from the campaign-style delivery to a health facility based strategy to foster a more cost-effective and integrated approach. One country that made this change reversed to school delivery because of poor coverage. Countries will have to trade-off the high coverage attainable in campaign style delivery with the more integrated approach to childhood routine vaccination and possible lower coverage outcomes.
- An increasing number of countries originally intended to test combining at least one other intervention with HPV vaccination but few have translated this into actual implementation. None have formally evaluated combined delivery.

10.2.4 Key recommendations

Based on findings related to integration, we recommend:

- Rigorous evaluation of combined interventions with HPV vaccine delivery is needed to assess the effect on implementation, coverage, workload and cost. Funding agencies should systematically encourage this.
- Gradual integration of processes into routine processes should be planned and formalised after the first round of vaccination is completed (notably for activities such as communication, reporting procedures and processes, supervision, social mobilisation, remuneration, and human resources management).
- Opportunities to initiate or strengthen existing school health programmes and/or pre-adolescent/adolescent health should be seized through on-going collaboration with partners (e.g. MOE, reproductive health departments).
- HPV vaccine is overwhelmingly being delivered through “routinized” campaigns, it is critical to ensure that other routine health services are not disrupted by recurrent school delivery or that possible disruptions are mitigated, and that this delivery mode is sustainably funded. This needs to be monitored and evaluated.
- Financing of operational costs of school-based delivery needs to be embedded into routine budget cycles.

11. Value Added

11.1 Background to demonstration projects

To examine the value that countries might have placed on the demonstration projects to date, it is necessary to note that access to vaccine for many LICs and LMICs was initially limited to demonstration projects and that the first projects were the result of donated vaccine from the two pharmaceutical companies producing HPV vaccine; Merck & Co. and GlaxoSmithKline Biologicals. These demonstration projects, either a result of a direct vaccine donation to the government or an external partner, or managed through Axios Healthcare Development for the GAP [7], allowed countries to gain experience in gender-specific vaccine delivery, and for many countries, in delivering vaccine to a novel target group. At that time, with one exception, vaccine donation for national roll-out was not an option. Thus, to gain experience with HPV vaccination, resource-poor countries had no alternative but to conduct demonstration projects. Rwanda was the only exception, since it received an industry donation through the Merck Qiagen Initiative [54] to start national implementation in its relatively small target population without a demonstration project [55].

In 2012 Gavi announced plans to support HPV vaccination demonstration projects or national programmes if the country had prior experience of HPV vaccination [21]. Gavi demonstration project support was, and is, granted for 2 years to allow countries time to test different delivery strategies, integration of HPV vaccine delivery with other adolescent services, and to prepare an application to Gavi for national programme funding. By early 2016, Gavi had approved demonstration project funding for 25 countries by April 2016, but only three countries had received approval for national programme support (Rwanda, Uganda, Uzbekistan) [21]. Of the 25 countries approved for Gavi demonstration projects, six had conducted at least one previous demonstration project. Only two of these initial projects had significant MOH/ EPI involvement (Countries 8, 23), three were run by partners that actively disseminated lessons to national stakeholders (Countries 6, 19, 31), and one was implemented completely separately from the MOH (Country 13).

Available data from the combined experience of all 66 demonstration projects and 12 national programmes in 46 countries contributed to this section; 29 of the 46 countries offered specific opinions on the value of demonstration projects. These 29 countries include: two countries that did not conduct a demonstration project and stated they had not needed one to introduce nationally; nine of the 10 countries that had experience of scaling up from a previous demonstration project (GAP or other) to a national programme provided information on the value of those initial projects; and 18 countries with only demonstration project experience offered perspectives on the potential benefits and drawbacks of demonstration projects to date. Data were interpreted in conjunction with those in Section 9: Sustainability.

11.2 Value found in demonstration projects

Reported experience suggests that demonstration projects do allow countries (i.e. national implementers, national implementers supported by external partners, or external partners who then disseminate lessons to national implementers) to gain valuable experience in a number of areas. These include the significant planning and budgeting requirements for school outreach, enumeration of the target population, acceptable consent procedures in older children and adolescents, effective mobilisation messages and working with the MOE. Realisation over the cold chain storage and transport requirements for the vaccine were also noted as important. Demonstration projects also allow for the development and piloting of new forms and IEC materials, and, more recently, practice in using standardised evaluation tools, e.g. the C4P costing tool [22].

> "The demo is really important so we can analyse the results of the delivery to a new target age group of a gender specific vaccine – routine immunisation usually targets children of less than a year."
>
> *KI Country H.*

> "Demos elucidated issues around enumerating out of school girls and consent issues around people thinking vaccine is experimental. We wouldn't have performed to this high coverage in the national if we didn't do demos."
>
> *KI Country 3.*

However, lessons have not been restricted to demonstration projects; six countries stated they had learnt substantial lessons during national implementation. A further six stated their preference for continuing after their HPV demonstration projects would be through phased introduction beginning with a few districts in year one with gradual expansion nationally.

> "There was no need for a demo as we have experience initiating new vaccines."
>
> *KI Country B.*
>
> "If the funding was adequate, we would have gone directly to phased national introduction, without necessarily going through a demo…. The [demo] will be useful to inform the national programme if it is used to test delivering through facilities only. It is likely the strategy may vary by county.. the country was going to apply for national funding but Gavi recommended [a demonstration project]. the EPI team learnt a lot of lessons. The demo allowed the team to check readiness and capacity and led to the decision over whether to roll-out all at once or conduct a phased introduction."
>
> *KI Country 13.*

11.3 Drawbacks of demonstration projects

Collated 'lessons learnt' from the 66 demonstration projects with at least six months of experience are largely a repetition of those reported after the very first demonstration projects in 2007-2010. Countries themselves have nuanced experiences and gained from the process of 'learning by doing'. However, they also experienced a number of drawbacks from conducting small-scale projects in areas that were not always nationally representative. The limited scale of demonstration projects means that it is difficult to assess the impact of HPV vaccine on national cold chain capacity and other primary healthcare services, and to demonstrate integration with the health system as national teams have to coordinate the project as a distinct entity. There were also several specific concerns in implementing demonstration projects in a small area of the country; three countries mentioned the need to restrict national mobilisation activities to avoid perceptions of inequity among communities not receiving the vaccine and rumours that the project was restricted in scope because it was 'experimental' (e.g. Countries 3, 8, C). If demonstration projects are carried out in districts or communities that are primarily selected for convenience, which have higher routine vaccination coverage, more extensive infrastructure and better education levels in comparison to national averages, the lessons learnt may not be applicable to national roll-out.

Eleven countries stated that the resource-intensive delivery strategies used during their demonstration projects are not sustainable without substantial financial support provided by international funders for delivery costs (Countries 8, 13, 17, 18, 21, 29, 31, 33, 37, A, I). Some countries indicated that high costing study results from demonstration projects deterred decision-makers from national roll-out (e.g. Countries A, 8, 21). Only one country is testing a more 'routine' delivery approach in their Gavi demonstration project, another is conducting a third demonstration project in order to test a routine delivery approach, six more plan to test the new 'routine' delivery strategy in phased national introduction. Among the 32 countries that shared opinions about the future funding availability for HPV vaccine delivery, sources from 18 stated considerable uncertainty.

Importantly, a number of countries seem to have stalled in terms of expanding HPV vaccination after delivering a demonstration project/s; projects were completed in 2010-11 in five countries that have now ceased HPV vaccine activities (Countries 5, 12, 20, 21, 36). These countries report valuable lessons learnt and could be ready for national roll-out, but no move has been made to source funding. Two other countries have done 3-4 GAP/other demonstration projects between 2010 and 2014 with no known plans for national roll-out (Countries 2, 23). There is some concern that, in several countries, demonstration projects could be used to delay decision making for national scale-up or discourage countries from a national HPV vaccination programme because of the cost of delivering vaccine in the project. For example, some countries reported finishing demonstration project funding allocated for 2 years, in just 1 year, for several reasons (see Table 32). Preparing applications and reports for Gavi demonstration projects and a subsequent application for national roll-out is time-consuming (although this was not specifically discussed in our interviews). Political commitment secured in order to begin an HPV vaccine demonstration project can wane over time and with high staff turnover institutional memory can be lost, potentially before national roll-out can commence.

11.4 Increasing the value of demonstration projects

The value of demonstration projects could be increased if countries used the opportunity

to test different delivery strategies in order to ensure that they gain experience in one that is both sustainable and effective. The implementers of only 7 projects purposefully selected areas that included more challenging or hard-to-reach target groups (Countries 2, 8, 12, 22, 36). Projects in only 2 countries simultaneously tested different vaccination venues (Uganda, Vietnam), one country tested different timings (India) [50] and only 2 others simultaneously tested different eligibility criteria (Tanzania, Uganda) [50, 51]. The opportunity to test the delivery of combined interventions with HPV vaccine has also been missed to date. Of 38 experiences that discussed combining HPV vaccination delivery, only a minority of countries have gained experience in simultaneous delivery with TT vaccine, deworming, vitamin A supplementation, and various health education messages (Section 10 Table 35). It is worth noting that three countries, which are conducting second demonstration projects through Gavi, having completed GAP projects with well-documented lessons learnt, are using the second demonstration project to try different delivery strategies (Countries 8, 13, 31). The rationale for other countries to complete second, third or fourth demonstration projects is unclear. One concern, which remains unanswered, is whether demonstration projects can actually discourage or significantly delay countries moving to national scale-up.

11.5 Scaling-up to national programmes and demonstration project contributions

The 20 Gavi demonstration projects for which we have at least six months of data continue to implement vaccination in 2016. As there is no available experience in transitioning from Gavi demonstration project to national implementation, it is difficult to draw conclusions on whether Gavi demonstration projects inform scale-up as intended and whether two-year demonstration projects are valuable. Most non Gavi-supported projects were only one year initiatives, although six countries elected to conduct multiple sequential non-Gavi projects (Bolivia, Georgia, Honduras, Lesotho, Nepal, and Uganda).

Nine of the ten countries with experience of scaling up from demonstration project to national implementation provided data on whether the demo informed their national programmes (Countries 1, 3, 4, 11, 16, 26, 30, 33, 35). Of these, two out of four UMIC's reported that the demonstration project informed the national programme (Country 3, 26). The high coverage achieved during the demonstration projects was important for political advocacy and lessons around consent and enumeration were learnt. One UMIC conducted demonstration projects with MOH involvement and reported more important lessons were learnt during the first year of their national programme (Countries 4). The final UMIC indicated that the demonstration project led by a provincial health department did not contribute to decision making for national introduction as information was not deemed useful in national planning (Country 30).

Among five LIC/LMICs that transitioned from GAP/other projects to national introduction, two reported that the demonstration was useful to prove high vaccine acceptance in the community and had illustrated some challenges (Countries 1, 16). Another two indicated the demonstration projects had been vital to learn how to coordinate with the MOE (Country 35) and in testing different delivery strategies (Country 33). The fifth indicated the demonstration projects had not influenced the design of the national programme and they would have gone straight to national introduction if possible (Country 11).

In 2015-16, two LMICs, Uganda and Uzbekistan, began scale-up to a Gavi-supported national programme after conducting demonstration projects with MOH involvement in 2008-9. Both planned national delivery strategies that were not tested in their previous demonstration projects. Lessons from the demonstration phase were specifically referenced by one of the country representatives involved in national planning, particularly for target enumeration, communications, and consent procedures. However, this does indicate that delivery strategies can be equally tested during national roll-out and may even yield more valuable lessons than during a demonstration project, given the more representative experience.

11.6 Conclusion

If designed well, demonstration projects can be used to test different delivery strategies, delivery in areas with particular challenges, and integration with national systems. A number of country representatives described them as useful practice. However, they can also distract countries from planning for the future and may cause a loss of momentum around HPV vaccine introduction. Given that many countries seem to learn many of the same lessons through demonstration projects but appear to need initial experience in vaccine delivery to fine-tune the social mobilisation and delivery strategies, there is potentially no reason why the lessons learnt in demonstration

projects could not be gained in a phased national roll-out. Phased national roll-out might maintain political commitment to scale-up implementation and avoid demonstration projects being set aside from national health systems as distinct entities. Demonstration projects were valuable when HPV vaccine had very recently become available to LMICs and support for national implementation was not accessible. However, as lessons learnt have been documented and few new lessons have been observed in recent demonstration projects, and as support for national programmes has become available, the value of conducting a demonstration project has decreased. Furthermore, as many countries come to the end of their Gavi demonstration projects in 2016 and have not submitted applications for national programmes, there are urgent questions over how to facilitate a transition phase in order to avoid loss of institutional memory.

Future new vaccine introductions including new target groups or delivery strategies may benefit from framing experiences around phased national introductions rather than demonstration projects. If phased national roll-out of a future new vaccine is not economically feasible when the new vaccine first becomes available, policy around demonstration projects should be regularly re-evaluated and made more flexible. Some countries may elect to conduct a demonstration project, but the opportunity to obtain support for a phased national roll-out should be made available as soon as possible.

12. Pitfalls experienced in projects/programmes

Review findings confirmed that HPV vaccine delivery is feasible in L&MIC. However, gathering lessons learnt included gaining valuable experience of strategies which did not work as well and could potentially cause an HPV vaccination project/programme to struggle or even fail.

12.1 Preparations

- **District/sub-national areas selected for demonstration projects are chosen areas with better than average DTP3 performance, infrastructure, and education levels**
  Consequences: While it is understandable that countries want to demonstrate HPV vaccine delivery in convenient districts to more easily coordinate monitoring and evaluation activities, this choice of 'easy' districts and 'easy' to access target populations reduces learning. It can lead to achievement of unrealistic coverage rates, which cannot necessarily be replicated elsewhere in the country or during national programmes.
- **Limited/lack of EPI involvement**
  Consequences: Delays in vaccine importation, insufficient cold chain capacity, inadequate vaccine transport, implementation of parallel systems of vaccination reporting (dose delivery, AE, stock management).
- **Limited/lack of education sector involvement**
  Consequences: Inaccurate enumeration of girls can result if MOE representatives are not involved in the planning of the project, or feel a lack of ownership and motivation to obtain the correct number of girls (e.g. through headcounts or through register book completion) and if they do not understand who is eligible for vaccination. The MOE may not make school heads aware of the project leading to refusal to cooperate with vaccinators in terms of allowing entry to school premises or organisation of eligible girls. Vaccination may be targeted at a school grade with a low proportion of eligible girls in comparison to a higher or lower grade. The vaccination schedule may be planned without taking into account school events, examinations and holidays; this can significantly affect rates of completion of the vaccine schedule.
- **Insufficient time allowed for planning**
  Consequences: Different collaborating ministries (e.g. MOH and MOE) may delay the start of the project as they require more time than expected to complete administrative/ bureaucratic tasks; transport may not be well coordinated e.g. one country did not allow enough time to plan transport and vaccinators had to walk long distances to schools; social mobilisation activities may be delayed due to delayed training leading to inadequate communication before vaccination days. Planning can take at least 9 months.
- **Limited/lack of supervision of training**
  Consequences: : Information is inadequately transferred down the 'cascade' from national to district to facility staff; misinformation or a lack of knowledge amongst health workers perpetuates vaccine refusal in parents; integration with training around other vaccines is not effective and only parts of the training are completed.

12.2 Communications

- **Insufficient collaboration between MOH and MOE**
  Consequences: In the most successful projects, rumours were addressed as soon as they arose. However, lack of collaboration between the MOH and MOE led to difficulties in disseminating messages and rumour detection and response.
- **Ineffective cascade training of educators/ communicators**
  Consequences: While cascade training was often used as it can be efficient, variable levels of monitoring and supervision meant that it was not successfully implemented in some countries leading to ineffective community mobilisation.
- **Insufficient time allowed for communications**
  Consequences: Countries reported difficulties when messages were disseminated less than a month before vaccination dates. Health workers reported feeling rushed in disseminating messages. Schools, especially private schools, reported needing more time to contact parents.

- **Lack of adequate mobilisation of private schools**
  Consequences: Parents of girls in private schools often need more information and more time to process information regarding a new vaccine. Not allowing for this during implementation could result in not being able to vaccinate girls attending private schools.
- **Unnecessary/ lengthy consent procedures**
  Consequences: Communities may become suspicious that the vaccine is 'experimental' or unsafe if consent is not usually required for other routine immunisations; rumours may start which reduce uptake or completion of the vaccine schedule. Lengthy or over-complicated consent procedures may reduce uptake due to the inconvenience for parents.

12.3 Delivery

- **Attempting to use age-based eligibility criteria when age is not commonly known or documented**
  Consequences: parents/ teachers and health workers will have considerable uncertainty over eligibility, potentially lowering uptake, confusing coverage estimates, and/or causing vaccination activities to take much longer.
- **Not providing a vaccination opportunity for out-of-school girls OR assuming out-of-school girls will come to health facilities with no strategy to identify or mobilise girls**
  Consequences: low uptake among out-of-school girls and low equity of coverage.
- **Lack of coordination with teachers**
  Consequences: Teachers may not understand the aims of the project/ eligibility criteria. Teachers may send girls home on vaccination day. Registers of eligible girls may not be accurate leading to too few or too much vaccine being transported to the school. Mobilisation of girls may not occur before vaccination day meaning absenteeism is high on vaccination day. If consent is needed it may take longer. Teachers may not assist following up girls absent from school or aid in reporting adverse events.

12.4 Achievements

- **Inaccurate enumeration of target population OR inaccurate implementation of eligibility criteria**
  Consequences: Relying on inaccurate enumeration data due to lack of time/ planning, or inadequate training or project/ programme design resulting in inaccurate use of eligibility criteria, may mean coverage achievements cannot be correctly calculated.
- **Lack of provision for out-of-school girls**
  Consequences: Reduced vaccination uptake.

12.5 Sustainability

- **Testing a resource intensive delivery strategy without planning for future sustainability**
  Consequences: High coverage may be achieved for the first year or two; however, another strategy will then have to be tested for feasibility when initial funding runs out.
- **Not involving the MOF from the beginning**
  Consequences: Lack of MOF involvement often meant insufficient or poorly-timed funding and insufficient budgeting for subsequent years of the programme.
- **Negative media exposure**
  Consequences: Politics (e.g. influence of anti-vaccination groups) and fears could be manipulated by local and national media leading to the spread of rumours and misinformation and potentially reduced vaccination uptake and/or the project/ programme ceasing prematurely.

13. Summary of recommendations

Section	Recommendations
Preparation	**Planning** • Strong inter-sectoral coordination is facilitated from the beginning, so that all decision-making and planning includes, at a minimum, national-level decision-makers from MOH, MOE, and MOF. • Sufficient time must be allowed in project/programme timelines for decision-making and planning at national and sub-national levels (e.g. this can take at least 9 months). • While EPI does not have to lead each demonstration project/programme, EPI must feel ownership of any HPV vaccination project/programme, as its active support and participation in planning and delivery phases is necessary for effective vaccine delivery. **Vaccine management** • The HPV vaccine should be transported together with the other EPI vaccines. This reduces the risk of temperature fluctuations by using established EPI systems and integration is cost efficient. HPV vaccine delivery timing needs to be coordinated with routine EPI vaccine delivery timings. • This is one of the key reasons why it is important to integrate HPV vaccine delivery with the EPI programme. • Appropriate cold storage can best be achieved when HPV vaccine delivery is closely integrated with the EPI programme. • Implementers of demonstration projects outside of the EPI should not assume that the EPI cold chain is adequate and working optimally, or available to be used for new vaccines. **Staff training** • General knowledge of HPV and cervical cancer is low among healthcare workers and the community. Careful training is necessary in order to explain the efficacy of the vaccine, the eligibility criteria and appropriate social mobilisation messages. • Adequate training is needed in order that staff can resist pressure to deviate from eligibility criteria and to ensure that coverage estimates are accurate. • Cascade training is likely to be more efficient and less expensive than a centralized training session (where all frontline staff are trained by a national 'trainer'). However, cascade training should be monitored and evaluated by national level staff to ensure consistency of messages. • Teachers and all healthcare workers, including those not delivering the vaccine, should be included in training. • Training should be conducted at least two months before vaccine delivery.
Communications	• A communication plan should be developed during preparation, to include specific strategies to ensure messages are delivered to out-of-school and hard-to-reach girls and their parents and communities. • Specific strategies to prevent and manage rumours should be outlined in the communication plan. • Teachers, health-workers, and community leaders should be trained to mobilise girls. Social mobilisation training should occur well before vaccination. • Face-to-face mobilisation meetings should be prioritised where possible. • Social mobilisation in communities should begin at least one month before vaccination, earlier if possible, especially for new projects. Time required (e.g. funds disbursement, printing) should not be underestimated. • High-level officials from MOH and MOE should address rumours as quickly as possible. • Schools, health-workers, community groups and media should be engaged with in the early stages of planning, as knowledge about HPV and vaccination may be low. If feasible, press kits and media sessions can be useful to engage the media. • Additional formative research may not be needed to identify key messages because there is consistency in the use of messages across projects/programmes that attained high coverage.

	• Message development should focus on: cervical cancer prevention; safety and efficacy, including lack of fertility impact or long-term adverse effects, government endorsement, delivery timing and venues and the need to return for a second dose. • Consent should be opt-out where feasible, ensuring consistency with existing EPI consent policy. If opt-in consent is chosen for HPV vaccination, processes should be streamlined and reasons clearly explained to parents and communities. • Intensity of social mobilisation should be assessed after the first year and potentially reduced, if high acceptance has been achieved in targeted communities.
Delivery	**Experience** • Countries should select a delivery strategy based on a combination of country specific factors: the proportion of the target group enrolled in school, absenteeism, operational costs, desired/adequate coverage, and programme sustainability. • Including a component of school-based delivery can yield high coverage. • Projects/programmes should be evaluated periodically in order to monitor the performance of the chosen delivery strategy and test different approaches in terms of coverage and cost. • A combination of delivery strategies rather than a single strategy alone is essential to achieve high coverage if school enrolment is low. Countries with limited resources may decide to minimise outreach if it does not give significant additional impact. • If school-based delivery is planned, microplanning should include an exercise to enumerate all schools including non-registered schools. • A specific mobilisation strategy for out-of-school girls to encourage them to attend vaccination days at schools, outreach sites or the nearest health centre should be implemented. • If resources allow, active follow up of girls who missed doses can yield high coverage and successfully use mobile phones or utilise teachers and CHWs. However, during planning, the expense and time required must be realised. • Poorly executed mop-up activities can cost more than their incremental benefit justifies. When planning with limited resources, the cost-effectiveness of mop-up activities should be assessed; a threshold of coverage is a transparent strategy in which to limit mop-up activities to those areas where they will be the most efficient e.g. only conducting a return visit to a school if <80% of girls received the dose on the first day. However, an opportunity for all girls who have missed doses to obtain vaccine should be provided – social mobilisation should include messages on the nearest health centre where the vaccine can be accessed. • Staff should be trained on how to deal with the presentation of newly eligible girls at the vaccination site when returning to deliver the second/ third dose. • If resources allow, planning a two-stage delivery of each dose can be successful in reaching those girls who initially refused vaccination, especially when implementing HPV vaccination for the first time. **Target population enumeration** • Given the data difficulties, it should be accepted that there are considerable uncertainties with the number of doses needed. If good records are kept for the first dose, vaccine needs can be adjusted for the second dose and for future cohorts. • Countries should allow for a buffer stock when ordering vaccines so that undercounting of eligible girls does not result in restricted access to vaccine. • As many schools are not registered by the MOE, local validation of the number of schools is needed. • A system of pre-registration of girls at school needs to be implemented a few weeks before vaccine delivery to ensure that the vaccination team brings the appropriate number of doses. • If teachers are asked to count girls, clear instructions need to be given to them on the eligibility criteria. • School absentee rates should be accounted for in the vaccine needs estimates. • During implementation of the first dose, a robust records system should be established, which should be used for future target group calculations.

	Availability of staff • Vaccination team size should be decided during microplanning, after a human resources capacity assessment in each area. Team size should vary depending on the size of schools in the catchment population, or the number of schools necessary for each team to visit, in order to maintain efficiency. • Teams can include teachers and CHWs in order to decrease the number of qualified nurses needed for vaccine delivery sessions. • Integration with other outreach activities, spreading HPV vaccine activities over a longer time period, task shifting to lower cadre staff, and/or allowing for longer working days could minimize the impact of HPV vaccine activities on other routine services if human resources are thought to be limited in country. These strategies and/or other strategies should be tested and evaluated. **Staff supervision** • Supervision is recommended for HPV vaccine projects/programmes although the intensity could decrease over time and supervision could be integrated with routine EPI supervision to decrease costs. • New vaccine introduction should be used as an opportunity to strengthen the capacity of supervisors at the national, regional and district levels. **Staff remuneration** • The cost impact of staff per diems should not be overlooked when planning HPV vaccine introduction. Making HPV vaccination part of routine activities for health workers may avoid or reduce per diem payments for delivery of 'special' interventions. • Minimising the number of health centre staff needed at the vaccination sites could minimise cost, if other community workers regularly conduct outreach activities as part of their day-to-day job and HPV can be integrated into those activities. • Integration with other outreach activities could allow the cost of per diems to be shared across multiple different programmes/ health interventions. **Adverse event (AE) monitoring and reporting** • Non-EPI stakeholders, such as teachers and parents, should be involved in monitoring and reporting AE. • All countries should have standardized national guidelines and training procedures for reporting and responding to AE/SAEs. • AE reporting should be standardised globally (e.g. always reported with denominators) for the sake of comparability.
Achievements	**Coverage** • Including a component of school-based delivery can yield high coverage and is recommended if resources allow. If school enrolment is low, a mixture of strategies could be important in order to attain good coverage. There is limited data on how to deliver a health facility based strategy successfully. • The grade based eligibility criteria in a school programme is the easiest and quickest strategy to implement; however, we recommend taking into account country specific factors of acceptability to the target group and school enrolment statistics. Grade based eligibility criteria can make target population enumeration and coverage calculations challenging; these processes are easier when eligibility criteria are the same for in-school and out-of-school girls. • If countries decide to change delivery strategy, the effects on coverage should be carefully monitored and evaluated. • Good relationships between the MOH and MOE should be developed. Coordination should begin at an early stage of the planning process, and collaboration should continue during implementation in the districts to ensure the vaccine delivery is planned and carried out within school timetables, efficiently, and achieves high coverage. • Planning should allow sufficient time for fund disbursement, customs clearance and preparation activities including planning transport requirements to ensure that scheduled vaccination dates are adhered to and that all vaccine doses are delivered in the same school year. • Encourage high-level political commitment to the project/programme in order to reduce bureaucratic hurdles, to secure ring-fenced funding and ensure timely delivery of the vaccine.

	• Engage the community and community health workers in order to increase acceptance and uptake of the vaccine and aid identification of out-of-school girls or girls missing doses. • More intense social mobilisation (e.g. more information and over a longer period) should be planned for urban areas and private schools as these groups are potentially more exposed to negative media exposure and rumours and more likely to refuse vaccination. • Out-of-school girls should be specifically targeted with social mobilisation messages and provided with an opportunity to access the vaccine either at schools, during vaccination days, health facilities or outreach sessions. • An opportunity for girls who missed doses to receive the vaccine should be supplied, either at return visits to schools or referral to health facility or outreach sites, depending on the resources available. • Staff may need retraining or refresher training in the use of data collection forms in order to ensure adequate quality administrative data. • Different strategies and target populations and integration with other services should be tested in order to gain experience for later implementation. **Monitoring and Evaluation** • HPV demonstration projects must include discussion and agreement with EPI personnel at the planning phase about how HPV vaccination will be integrated within EPI structures. • Monitoring and reporting systems should be standardised, so that issues such as who is responsible for holding vaccination cards can be agreed. • Reporting should be consistent with target group selection, i.e. if vaccinating girls by school grade, reporting should also be by school grade and by age if necessary. • Where feasible, electronic systems should be used to improve data collection and tracking.
Sustainability	**Scale-up** • More case study research should be conducted on scale-up experiences. • Further research should be conducted on the costs versus benefits of school-based delivery approaches within national scale-up. • Further exploration of sustainable funding alternatives should be conducted and disseminated, to encourage more countries to scale-up demonstration projects.
Integration of HPV vaccine with EPI and the health system	• Rigorous evaluation of combined interventions with HPV vaccine delivery is needed to assess the effect on implementation, coverage, workload and cost. Funding agencies should systematically encourage this. • Gradual integration of processes into routine processes should be planned and formalised after the first round of vaccination is completed (notably for activities such as communication, reporting procedures and processes, supervision, social mobilisation, remuneration, and human resources management). • Opportunities to initiate or strengthen existing school health programmes and/or pre-adolescent/adolescent health should be seized through on-going collaboration with partners (e.g. MOE, reproductive health departments). • HPV vaccine is overwhelmingly being delivered through “routinized” campaigns, it is critical to ensure that other routine health services are not disrupted by recurrent school delivery or that possible disruptions are mitigated, and that this delivery strategy is sustainably funded. This needs to be monitored and evaluated. • Financing of operational costs of school-based delivery needs to be embedded into routine budget cycles.

14. Study limitations

Due to the timing of the study, we were able to collect data from the first year of 19 of 20 of the Gavi demonstration projects included in the review (we could not interview an EPI representative from Mali about their new Gavi project). Seven of the 20 Gavi projects had delivered a second year and we were able to conduct 5 interviews about the second year of implementation. There may be many more documented lessons when all of these projects have been completed (after their second year). Only 12 Gavi projects had an estimate of coverage available; nine coverage surveys and three administrative estimates from Gavi projects; this was largely due to delays in evaluation teams conducting coverage surveys or finalising results (only one further coverage survey was known to be completed but the results were not available for our review).

Reporting of data and experiences in the literature and in interviews was highly variable across countries and projects/programmes. The information presented here is biased by the availability of data, which may have been lower for less successful projects/programmes.

Representatives from four countries did not respond or refused to be interviewed and this limits our learning from these project/programme experiences. Interviewees committed varying amounts of time for the interview and follow-up questions, although most consented to at least one hour of interview. During the interview, they provided variable levels of detail. The level of recall varied when projects/programmes were undertaken a number of years ago, and, in two instances, the key focal person who was the project manager, had left the organisation and was not contactable (Countries 10, 16). Information was then obtained from the staff who remained but who had not been in charge of the project and who may not have remembered or known various specific details about the project set-up and implementation.

15. Conclusions

Considerable experience in HPV vaccine delivery is now available from LAMIC. The documented lessons learnt and key findings are applicable across world regions and are very similar to the key findings documented during the first demonstration projects in 2007. Many lessons have been learnt that should make it easier for countries still considering HPV vaccination to plan their projects/programmes and perhaps deliver HPV vaccine through phased national delivery rather than demonstration projects. Recommendations need broad dissemination to improve HPV vaccine introduction, delivery, and scale-up and encourage best practice.

Among Gavi eligible or graduating countries, the availability of funding is the most cited factor governing the perceived sustainability of the programme. Countries need more information on future funding opportunities for HPV vaccine delivery, after their first demonstration projects. Countries eligible for HPV vaccine support, but that have not yet applied to Gavi for support, are aware of the support being available but often have competing priorities with other new vaccine introductions and limited capacity at the national level to introduce multiple new vaccines in the same time period.

Limited data are available and further evaluation is needed on a number of topics including: catch-up strategies, scale-up to national programmes, delivery of HPV vaccine alongside other interventions, integration with existing health system structures and the key drivers of project/programme costs.

16. Appendices

Appendix A: Country, project/programme and delivery experience characteristics as of May 2016

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp #)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Bhutan	LMIC	88.1 (2013)	Demo (GAP)	1	2009	(1)	21 schools (3200 girls)	Age 9-13	School-based	~	None	Gardasil®
			National	2	2010	(2)	(47888 girls)	Age 12-18 (catch up campaign)	School-based	~	None	Gardasil®
					2011-13	(3)		~	None	Age 12	Health facility + outreach	Gardasil®
					2014-	(4)		Grade 6	School + health facility	Age 12	Health facility + outreach	Gardasil®
Bolivia	LMIC	88.1 (2013)	Demo (GAP)	1	2009	(5)	69 sites (3900 girls)	Age 9-13	School-based	Age 9-13	Health facility	Gardasil®
			Demo (GAP)	2	2009	(6)	19 sites (3300 girls)	Age 9-13	School + health facility	Age 9-13	Health facility + outreach (mobile clinics)	Gardasil®
			Demo (GAP)	3	2010	(7)	594 sites (30400 girls)	Grades 5-6	School-based	Age 9-13	Health facility	Gardasil®
			Demo (GAP)	4	2010-11	(8)	2,142 sites	Grades 5-6	School-based	Age 9-13	Health facility	Gardasil®
Botswana	UMIC	83.8 (2009)	Demo (WB)	1	2013	(9)	23 schools (2754 girls)	Age 9-13 in Grades 4-6	School-based	~	None	Gardasil®
			Demo (MOH)	2	2014	(10)	3 districts (6646 girls)	Age 9-13 in Grades 5-7	School + health facility	Age 9-13	Health facility	Gardasil®
			National	3	2015	(11)		Age 9-13 in Grades 5-7	School + health facility	Age 9-13	Health facility	Gardasil®
					2016-			*Grade 5*	*School + health facility*	*Age 9*	*Health facility*	*Gardasil®*
Brazil	UMIC	94.4 (2005)	Demo (GAP)	1	2010-11	(12)	19 schools (1574 girls)	Grade 6 & 7 (est. age 11-15)	School-based and available at hospital for those that missed vaccination day	~	None	Gardasil®
			Demo (MOH)	2	2010-12	(13)	262 schools (20661 girls)	Age 11-15	School-based	Age 11-15	Outreach using mobile teams + 2 permanent delivery community sites	Gardasil®
			National	*3*	2014	(14)		Age 11-13	School + health facility	Age 11-13	Health facility	Gardasil®
					2015	(15)		Age 9-11	School + health facility	Age 9-11	Health facility	Gardasil®
					2016			*Age 9*	*School + health facility*	*Age 9-13*	*Health facility*	*Gardasil®*
Burkina Faso	LIC	67.5 (2013)	Demo (Gavi)	1	2015-	(84)	2 districts (8397 girls)	Age 9	School-based	Age 9	Health facility + outreach sites	Cervarix®

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp#)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Cambodia	LIC	98.4 (2012)	Demo (GAP)	1	2009-10	(16)	1 hospital (2100 girls)	~	None	Age 11-18	Health facility	Gardasil®
			Demo (GAP)	2	2010-11	(17)	9 schools + 1 hospital (8000 girls)	NA	School + health facility	Age 11-18	Health facility	Gardasil®
Cameroon	LMIC	91.5 (2012)	Demo (GAP)	1	2010	(18)	(6400 girls)	Age 9-13 in grade 6	School + health facility	Age 9-26	Health facility + outreach in mobile clinics and community sites	Gardasil®
			Demo (Gavi)	2	2014-	(19)	(22195 girls)	Age 9-13 in grades CE1, CE2, CM1, CM2	School-based	Age 10	Health facility + out-reach in mobile clinics and community sites	Gardasil®
Chile	HIC	92.7 (2012)	National (MOH)	1	2014	(85)	Annual schedule	Age 9-11 with catch-up to age 13	School-based	Age 9-13	Health facilities	Gardasil®
Cote d'Ivoire	LMIC	61.9 (2009)	Demo (Gavi)	1	2015-	(86)	2 districts (13,340 girls)	Age 10	School-based	Age 10	Health facilities + outreach with active search using CHWs	Gardasil®
Ethiopia	LIC	67.9 (2006)	Demo (Gavi)	1	2015-	(87)	2 districts	Grade 4	School-based	Age 10	Outreach with active search using CHWs	Gardasil®
The Gambia	LIC	68.7 (2013)	Demo (Gavi)	1	2015-	(88)	(9438 girls)	Grade 3 ≥9 years	School-based	Age 9-13	Health facility and outreach	Gardasil®
Georgia	LMIC	96.5 (2013)	Demo (GAP)	1	2010		23 schools (2754 girls)		None	NA	Health facility	Gardasil®
			Demo (GAP)	2	2010-14		3 districts (6646 girls)		None	NA	Health facility + outreach in mobile clinics	NA

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp#)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Ghana	LMIC	88.9 (2014)	Demo (GAP)	1	2013	(21)	Northern (6) and Central (7 districts) regions (33725 girls)	Grades 4-5	School-based with mop-up activities	~	None	Gardasil®
			Demo (Gavi)	2	2013-14	(23)	4 districts	Grade 4	School-based	~	None	Gardasil®
					2014-15	(24)	4 districts	Age 10	School-based	Age 10	Health facility + outreach	Gardasil®
Guyana	LMIC	71.5 (2012)	Demo (GAP)	1	2012-13	(25)	4 regions (6900 girls)	NA	School-based	NA	Health facility + outreach in mobile clinics and community sites	Gardasil®
			National	2	2014	(26)		NA	NA	NA	NA	Gardasil®
Haiti	LIC	NA	Demo (GAP/PIH)	1	2009	(27)	162 schools (3300 girls)	Age 10-12	School-based	~	None	Gardasil®
Honduras	LMIC	89.3 (2013)	Demo (GAP)	1	2011	(28)	25 sites (4775 girls)	Age 9-13	School + health facility	Age 9-13	Health facility + out-reach in	Gardasil®
			Demo (GAP)	2	2012-13	(29)	298 schools (3200 girls)	Age 9-13	School-based with mop-up +/or vaccine available at health facility	~	None	Gardasil®
			Demo (GAP)	3	2014	(30)	1083 schools, La Paz (8483 girls)	Age 10-11	School + health facility	NA	Health facility	Gardasil®
			National	4	2016-	(31)		Age 10-11	School + health facility	NA	Health facility	Gardasil®
India	LMIC	93.3 (2011)	Demo (PATH/ MOH)	1	2009-10	(32)	279 schools + 399 clinics (14533 girls)	Age 10-14	School + health facility. Campaign style delivery at 3 fixed time points	Age 10-14	Health facility	Cervarix®
					2009-10	(33)	258 schools + 273 clinics (12636 girls)	Age 10-14	School + health facility. Routine delivery vaccine every month	Age 10-14	Health facility	Gardasil®

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp#)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Kenya	LIC	83.6 (2012)	Demo (GAP)	1	2011	(34)	1 health facility	Age 9-13 in grades 4-8	School-based (Girls recruited at school visited health facility)	~	None	Gardasil®
			Demo (Gavi)	2	2013-15	(35)	1 County	Age 10	School-based	~	None	Gardasil®
			Demo (Gavi)	*3*	*2016-17*		*1 County*	~	*None*	*Grade 4*	*Health facility only*	*Gardasil®*
Kiribati	LMIC	NA	Demo (GAP/ ACCF)	1	2011-13	(36)	4 islands (out of 33) (1683 girls)	Grades 3-4: girls ≥9 years	School-based with mop-up activities	~	None	Gardasil®
Laos PDR	LMIC	97.3 (2013)	Demo (Gavi)	1	2013-15	(37)	Capital city province	Grade 5	School + health facility + outreach session	Age 10	Girls invited to school or health facility or outreach	Gardasil®
Lesotho	LMIC	79.6 (2013)	Demo (GAP)	1	2009	(38)	2 districts (40100 girls)	Age 9-18	School-based	~	None	Gardasil®
			Demo (GAP)	2	2010-11	(39)	2 districts (40000 girls)	Age 9-13	School-based	~	None	Gardasil®
			National	3	2012-	(40)		Age 9-13	School-based	~	None	Gardasil®
Madagascar	LIC	77.1 (2003)	Demo (Gavi)	1	2013-15	(41)	(6652 girls)	Grade 2	School + health facility	Age 10	Health facility + outreach	Cervarix®
Malawi	LIC	96.9 (2009)	Demo (Gavi)	1	2013-14	(42)	2 districts (5016 girls)	Grade 4	School-based with mop-up activities	Age 10	Health facility	Gardasil®
					2014-15	(43)	2 districts (5016 girls)	Grade 4	School-based	Age 9-13	Health facility with some outreach	Gardasil®
Mali	LIC	64.4 (2013)	Demo (GAP)	1	2012	(44)	Bamako city (11000 girls)	~	None	Age 9-13	Health facility	NA
			Demo (Gavi)	2	2015-17	(45)	2 districts (12400 girls)	Age 10	School-based	Age 10	Health facility + outreach	Gardasil®

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp#)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Moldova	LMIC	87.9 (2013)	Demo (GAP)	1	2010-11	(46)	87 schools	NA	School-based	~	None	Gardasil®
Mongolia	LMIC	94.7 (2013)	Demo (GAP)	1	2012	(47)	2 districts + 2 Aimags (14063 girls)	Age 11-15	School + health facility + outreach	Age 11-15	Health facility + outreach	Gardasil®
					2014	(48)	Ulaanbaatar city (2056 girls)	Age 9-14	School-based	~	None	Gardasil®
Mozambique	LIC	87.4 (2013)	Demo (Gavi)	1	2014-15	(49)	3 regions	Age 10	School + outreach using CHWs	Age 10	Health facility + Outreach using CHWs (active search in the community)	Cervarix®
Nepal	LIC	98.5 (2013)	Demo (ACCF)	1	2008	(50)	17 schools	Grades 5-7	School-based	~	None	Gardasil®
			Demo (GAP/ ACCF)	2	2010	(51)	24 sites	Age 9-13	School with mop-up + health facility	Age 9-13	Health facility	Gardasil®
			Demo (ACCF)	3	2011-14	(52)	216 sites	Age 9-13	School + health facility	Age 9-13	Health facility	Gardasil®
			Demo (Gavi)	4	2015-17	(53)	2 districts (667 schools + 97 health facilities)	Grade 6	School + health facility	Age 10	Health facility	Cervarix®
Niger	LIC	62.8 (2012)	Demo (Gavi)	1	2014-16	(54)	2 districts (22635 girls)	Grade 5 in Niamey. Grade 6 in Manarounfa	School-based	Age 11	Outreach	Gardasil®
Papua New Guinea	LMIC	85.6 (2012)	Demo (GAP)	1	2012	(55)	New Britain province (15000 girls)	Age 9-13	School + mop-up activities	Age 9-13	Health facility	Gardasil®
Peru	UMIC	91.8 (2013)	Demo (PATH/ MOH)	1	2007-08	(56)	264 sites (10200 girls)	Grade 5 ≥ 9 years	School + health facility + outreach (home visits for defaulters)	Age 9-13	CHWs outreach mobilised girls to health facility	Gardasil®
					2009-10	(57)	163 sites	Grade 5 ≥ 9 years	School + health facility	Age 9-13	Health facility	Gardasil®
			National	2	2011-12	(58)		Age 10	School-based	~	None	NA
					2014-			Age 10	School-based	~	None	NA

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp#)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Philippines	LMIC	88.2 (2009)	Demo (Jhpiego)	1	2010	(59)		NA	NA	NA	NA	NA
Rwanda	LIC	93.4 (2013)	National (Merck)	1	2011-13	(60)	(337,552 girls)	Grades 6 & catch-up in secondary 2&3	School with mop-up + Health facility	Age 12	CHWs mobilised girls to come to the health facility	Gardasil®
			National (Gavi)		2014-	(61)		Age 12	School with mop-up + health facility	Age 12	CHWs mobilised girls to come to the health facility	Gardasil®
Senegal	LMIC	73.4 (2014)	Demo (Gavi)	1	2015-	(89)	2 districts	Age 9	School-based	Age 9	Health facility + outreach	Gardasil®
Sierra Leone	LIC	NA	Demo (Gavi)	1	2013-14	(62)	Bo district	Age 9	School-based	Age 9	Community outreach	NA
Solomon Islands	LMIC	80.7 (2007)	Demo (Gavi)	1	2015-	(90)	(10,062 girls)	Age 9-12	School-based	Age 9-12	Health facility + fixed outreach sites	Gardasil®
South Africa	UMIC	89.6 (2005)	Demo (UCT)	1	2010	(63)	1 clinic Soweto	~	None	Age 12-19 (girls & boys)	Health facility	Gardasil®
			Demo (KZN DoH)	2	2011	(64)	31 schools, (1000 girls)	Grades 4-5	School-based with mop-up	~	None	Gardasil®
			Demo (UoS)	3	2013	(65)	Western Cape and Gauteng	Grades 4-7	School-based	~	None	Gardasil® & Cervarix®
			National	4	2014-	(66)	Government schools (480,465 girls)	Grade 4: ≥9 years	School-based with mop-up	~	None	Cervarix®
Tanzania	LIC	83.5 (2013)	Demo (GAP)	1	2010-11	(67)	67 schools (split by strategy) (3352 girls)	Grade 6 girls	School-based with mop-up	~	None	Gardasil®
					2010-11	(68)	67 schools (split by strategy) (2180 girls)	Age 12	School-based with mop-up	~	None	Gardasil®

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	[exp#]	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
			Demo (Gavi)	2	2014-15	(69)	Kilimanjaro region (18915 girls)	Grade 4 ≥9 years	School-based with mop-up	Age 9	Health facility	Gardasil®
					2015-16	(70)	Kilimanjaro region	Age 9 (any grade)	School-based if school is distant from health facility or health facility based if school is near to facility.	Age 9	Health facility + fixed outreach sites	Gardasil®
Thailand	UMIC	95.6 (2009)	Demo (Jhpiego)	1	2010	(71)		NA	NA	NA	NA	NA
Togo	LIC	97.5 (2013)	Demo (Gavi)	1	2015-	(91)	2 districts	Age 10	School-based	Age 10	Health facilities + mobile outreach	Cervarix®
Uganda	LIC	91.5 (2013)	Demo (PATH/ MOH)	1	2008-09 2010-11	(72)	195 schools + 41 clinics in 1 district (3459 girls) (2010: 2835 girls)	Grade 5	School + health facility	Age 10	Health facility	Gardasil
					2008-09 2010-11	(73)	222 schools + 28 clinics in 1 district (2263 girls) (2010: 1923 girls)	Age 10	School + health facility + outreach integrated with Child Days Plus programme	Age 10	Schools + health facility + outreach sites during Child Days Plus programme	Cervarix®
			Demo (GAP)	2	2010	(74)	Mildmay clinics	~	None	Age 9-15 HIV+	Health facility + outreach	Gardasil®
			Demo (Merck)	3	2012-14	(75)	14 districts (48055 girls)	Grade 4	School + outreach integrated with Child days Plus programme	Age 10	Schools and outreach integrated with Child days Plus programme	Gardasil®
			National (Gavi)	4	2015-	(76)	National	Age 10	School-based if schools distant from health facility, otherwise, health facility based	Age 10	Health facility + fixed community/ school outreach sites	Gardasil®
Uzbekistan	LMIC	88.5 (2011)	Demo (GAP)	1	2009	(77)	(8450 girls)	~	None	NA	Health facility	Gardasil®
			National (Gavi)	*2*	*2016-*		*National*	*Age 12 (any grade)*	*School + health facility*	*Age 12*	*Health facility*	*NA*

Country	Income Group[1]	Primary School net enrolment ratio[2]	Demo/ National (funding source)[3]	Distinct progr'ms	Year(s) of HPV vaccination	(exp#)	Vaccination sites (Target popn size)[4]	School-based strategy		Community strategy		Vaccine
								Target population	Strategy +/- mop-up	Target population	Strategy +/- mop-up	
Vanuatu	LMIC	98.9 (2005)	Demo (ACCF)	1	2009	(78)	Efate Island (1000 girls)	Age 10-12	School-based	~	None	Cervarix®
			National (ACCF)	2	2013	(79)	(2503 girls)	Age 12	School + outreach	Age 12	Outreach	Cervarix®
					2015-	(80)		Grades 4-5 + catch-up until age 15	School + outreach	Age 9-13	Outreach	Cervarix®
Vietnam	LMIC	98.1 (2012)	Demo (PATH/ MOH)	1	2008-10	(81)	4 districts (4302 girls)	Grade 6 ≥ 9years old	School + health facility	Age 11	Health facility	Gardasil®
					2008-10	(82)	4 districts (2712 girls)	~	None	Age 11	Health facility	Gardasil®
Zambia	LMIC	91.4 (2013)	Demo (GAP)	1	2013-14	(83)	(28294 girls)	Grade 4	School + health facility	Age 10	Health facility	Gardasil®
Zimbabwe	LIC	93.9 (2012)	Demo (Gavi)	1	2015-	(92)	2 districts	Age 10	School-based	Age 10	Health facility + out-reach using CHWs and active search	Cervarix®

'NA' indicates data not available.
'~' indicates not applicable
[1]World Bank country classifications (February 2014).
[2]UNESCO Institute of Statistics most recent available data: year is indicated in brackets.
[3]'Demo': Demonstration/ pilot project; 'National': National programme.
[4]The size of the target population is listed if available from the literature.

Italicised text indicates information received on projects/ programmes starting in 2016 or later.

Abbreviations: ACCF, Australian Cervical Cancer Foundation; CHW, community health worker; Demo, demonstration/pilot project; GAP, Gardasil® Access Program; est., estimated; HPV, human papillomavirus; KZN DoH, KwaZulu-Natal Department of Health; LIC, low income; LMIC, lower-middle income; MOH, ministry of health; national, national programme; NA, not available; UCT, University of Cape Town; UMIC, upper-middle income; UNESCO, the United Nations Educational Scientific and Cultural Organisation; UoS, University of Stellenbosch; WB, World Bank.

Appendix B: Example Medline search results

1	Papillomavirus Vaccines/	5085
2	hpv.ab,ti.	26945
3	human papillomavirus.ab,ti.	23071
4	human papilloma virus.ab,ti.	3661
5	exp Immunization Programs/	10517
6	exp Vaccination/	70018
7	immuni$.ab,ti.	229073
8	vaccin$.ab,ti.	225394
9	2 or 3 or 4	33568
10	Immunization/	46296
11	5 or 6 or 7 or 8 or 10	415268
12	9 and 11	7745
13	1 or 12	8441
14	gambia/	2133
15	gambia.ab,ti.	1774
16	14 or 15	2621
17	limit 16 to yr="2014-Current"	150
18	13 and 17	0
19	senegal/	4852
20	senegal.ab,ti.	4103
21	19 or 20	6035
22	limit 21 to yr="2014-Current"	376
23	13 and 22	2
24	zimbabwe/	4890
25	zimbabwe.ab,ti.	3737
26	24 or 25	5778
27	limit 26 to yr="2014-Current"	299
28	13 and 27	0
29	chile/	10403
30	chile.ab,ti.	8360
31	29 or 30	12887
32	limit 31 to yr="2014-Current"	990
33	13 and 32	6
34	burkina faso/	2398
35	"burkina faso".ab,ti.	2409
36	34 or 35	2980
37	limit 36 to yr="2014-Current"	316
38	13 and 37	0
39	"cote d'ivoire".ab,ti.	1431
40	cote d'ivoire/	2595
41	39 or 40	2969
42	limit 41 to yr="2014-Current"	195
43	13 and 42	1
44	ethiopia/	7873
45	ethiopia.ab,ti.	6694
46	44 or 45	8911
47	limit 46 to yr="2014-Current"	1268
48	13 and 47	1
49	"solomon islands".ab,ti.	508

50	solomon islands/	892
51	49 or 50	1072
52	limit 51 to yr="2014-Current"	62
53	13 and 52	0
54	togo/	870
55	togo.ab,ti.	942
56	54 or 55	1134
57	limit 56 to yr="2014-Current"	89
58	13 and 57	0
59	bhutan/	240
60	bhutan.ab,ti.	288
61	59 or 60	361
62	limit 61 to yr="2009 -Current"	188
63	13 and 62	5
64	bolivia/	2013
65	bolivia.ab,ti.	2108
66	64 or 65	2792
67	limit 66 to yr="2009 -Current"	939
68	13 and 67	2
69	botswana/	1275
70	botswana.ab,ti.	1364
71	69 or 70	1648
72	limit 71 to yr="2013 -Current"	283
73	13 and 72	3
74	brazil/	62883
75	(brazil or brasil).ab,ti.	48616
76	74 or 75	75353
77	limit 76 to yr="2010 -Current"	29830
78	13 and 77	55
79	cambodia/	2388
80	(cambodia or cambodge).ab,ti.	2169
81	79 or 80	3029
82	limit 81 to yr="2009 -Current"	1277
83	13 and 82	5
84	(cameroon or cameroun).ab,ti.	4286
85	cameroon/	4051
86	84 or 85	5216
87	limit 86 to yr="2010 -Current"	1691
88	13 and 87	7
89	georgia/	9405
90	(georgia or Sakartvelo).ab,ti.	6753
91	89 or 90	12915
92	limit 91 to yr="2010 -Current"	2609
93	13 and 92	18
94	ghana/	5275
95	ghana.ab,ti.	5071
96	94 or 95	6357
97	limit 96 to yr="2013 -Current"	1228
98	13 and 97	1
99	guyana/	562

100	guyana.ab,ti.	623
101	99 or 100	897
102	limit 101 to yr="2012 -Current"	126
103	13 and 102	0
104	haiti/	2504
105	haiti.ab,ti.	1958
106	104 or 105	2948
107	limit 106 to yr="2009 -Current"	1325
108	13 and 107	9
109	honduras/	907
110	honduras.ab,ti.	1125
111	109 or 110	1361
112	limit 111 to yr="2011 -Current"	265
113	13 and 112	7
114	india/	82017
115	india.ab,ti.	53099
116	114 or 115	96520
117	limit 116 to yr="2009 -Current"	32162
118	13 and 117	100
119	kenya/	12121
120	kenya.ab,ti.	11071
121	119 or 120	14645
122	limit 121 to yr="2011 -Current"	3798
123	13 and 122	13
124	kiribati/	1003
125	kiribati.ab,ti.	110
126	124 or 125	1059
127	limit 126 to yr="2011 -Current"	163
128	13 and 127	0
129	(laos or lao).ab,ti.	2008
130	laos/	1391
131	129 or 130	2431
132	limit 131 to yr="2013 -Current"	404
133	13 and 132	0
134	lesotho/	311
135	lesotho.ab,ti.	422
136	134 or 135	481
137	limit 136 to yr="2009 -Current"	157
138	13 and 137	1
139	madagascar/	2581
140	madagascar.ab,ti.	3029
141	139 or 140	3543
142	limit 141 to yr="2013 -Current"	549
143	13 and 142	0
144	malawi/	3555
145	malawi.ab,ti.	3743
146	144 or 145	4441
147	limit 146 to yr="2013 -Current"	934
148	147 and 13	3
149	mali/	1862

150	mali.ab,ti.	2281
151	149 or 150	2754
152	limit 151 to yr="2012 -Current"	569
153	152 and 13	5
154	(moldova or moldavia).ab,ti.	516
155	moldova/	604
156	154 or 155	882
157	limit 156 to yr="2013 -Current"	98
158	157 and 13	2
159	mongolia/	1306
160	mongolia.ab,ti.	2126
161	159 or 160	2647
162	limit 161 to yr="2012 -Current"	747
163	162 and 13	1
164	morocco/	4302
165	morocco.ab,ti.	3413
166	164 or 165	5304
167	13 and 166	6
168	mozambique/	1622
169	mozambique.ab,ti.	1974
170	168 or 169	2323
171	limit 170 to yr="2014 -Current"	302
172	171 and 13	0
173	nepal/	5554
174	nepal.ab,ti.	5146
175	173 or 174	6611
176	limit 175 to yr="2008 -Current"	3107
177	176 and 13	6
178	niger/	947
179	niger.ab,ti.	8535
180	178 or 179	8706
181	limit 180 to yr="2014 -Current"	692
182	181 and 13	0
183	papua new guinea.ab,ti.	3512
184	papua new guinea/	2964
185	183 or 184	4294
186	limit 185 to yr="2012 -Current"	570
187	186 and 13	1
188	peru/	6144
189	peru.ab,ti.	6012
190	188 or 189	8298
191	limit 190 to yr="2007 -Current"	3606
192	191 and 13	26
193	(philippines or pilipinas or filipinas).ab,ti.	5438
194	philippines/	6935
195	193 or 194	8853
196	limit 195 to yr="2010 -Current"	1830
197	196 and 13	4
198	rwanda/	1649

199	rwanda.ab,ti.	1532
200	198 or 199	2072
201	limit 200 to yr="2011 -Current"	617
202	201 and 13	8
203	sierra leone.ab,ti.	1053
204	sierra leone/	948
205	203 or 204	1290
206	limit 205 to yr="2013 -Current"	377
207	206 and 13	0
208	south africa.ab,ti.	19388
209	south africa/	33165
210	208 or 209	37735
211	limit 210 to yr="2011 -Current"	8784
212	211 and 13	36
213	tanzania/	8464
214	tanzania.ab,ti.	7676
215	213 or 214	9927
216	limit 215 to yr="2010 -Current"	3322
217	216 and 13	17
218	thailand/	21183
219	thailand.ab,ti.	17744
220	218 or 219	26226
221	limit 220 to yr="2010 -Current"	7834
222	221 and 13	37
223	uganda/	8601
224	uganda.ab,ti.	8087
225	223 or 224	10265
226	limit 225 to yr="2008 -Current"	4692
227	226 and 13	32
228	uzbekistan/	1804
229	uzbekistan.ab,ti.	856
230	228 or 229	1999
231	limit 230 to yr="2009 -Current"	242
232	231 and 13	2
233	vietnam/	9403
234	vietnam.ab,ti.	8707
235	233 or 234	12413
236	limit 235 to yr="2008 -Current"	4654
237	236 and 13	27
238	zambia/	3347
239	zambia.ab,ti.	3148
240	238 or 239	4135
241	limit 240 to yr="2013 -Current"	640
242	241 and 13	3
243	18 or 23 or 28 or 33 or 38 or 43 or 48 or 53 or 58 or 63 or 68 or 73 or 78 or 83 or 88 or 93 or 98 or 103 or 108 or 113 or 118 or 123 or 128 or 133 or 138 or 143 or 148 or 153 or 158 or 163 or 167 or 172 or 177 or 182 or 187 or 192 or 197 or 202 or 207 or 212 or 217 or 222 or 227 or 232 or 237 or 242	398
244	developing countries/	65420
245	limit 244 to yr="2007 -Current"	17905
246	245 and 13	142

247	GAVI.ab,ti.	238
248	limit 247 to yr="2007 -Current"	213
249	248 and 13	31
250	(Low-income countries or LIC).ab,ti.	3274
251	limit 250 to yr="2007 -Current"	2510
252	251 and 13	19
253	(Low-middle income countries or LMIC).ab,ti.	456
254	limit 253 to yr="2007 -Current"	445
255	254 and 13	2
256	243 or 246 or 249 or 252 or 255	545

Appendix C: Interview topic guide for countries with HPV experience

Key Informant Interview Topic Guide: Countries with experience of HPV vaccination in a demonstration/ pilot project or national roll-out.

The interview will involve structured and open questions on a selection of the following topics dependent on what information is obtained from the published and grey literature review:

Decision making at the national/ regional level:

- How was the decision made to conduct the HPV vaccine demonstration project/ national* programme? (*delete as appropriate and use this phrase for the remainder of the interview)
- What information influenced the decision and planning? (e.g. information from other countries/ info from a previous pilot?

Planning:

- Was there a planning committee?
- Who was involved in the planning committee? (e.g. representatives from Reproductive Health, Adolescent Health and Cancer services on the National Immunization Technical Advisory Group (NITAG) or Technical Advisory Group (TAG) for the HPV vaccine projects?)
- How was planning integrated with other sectors e.g. EPI / education sectors?
- Is there a national cervical cancer control programme? How was the introduction of HPV vaccine integrated with the national cervical cancer control programme and screening services?
- Were there specific challenges/benefits in involving the stakeholders you have mentioned/ developing these collaborations?

HPV vaccine delivery strategy:

- What was the target population for HPV vaccine delivery?
- Vaccination venues?
- Timing of vaccination – was HPV vaccination performed on specific days or was it introduced as a routine vaccine available at any time? If it was provided on specific days - How many days? How were girls who were absent on the day of vaccination accessed (were there 'mop-up' activities?)?
- Was there a specific delivery strategy for out-of-school girls/ identified hard-to-reach girls (married/ nomadic/ lower SES girls?)? What was this strategy?
- How was delivery of HPV vaccine integrated with the EPI programme? Was this beneficial/ problematic?
- How did health workers/ the government health officials coordinate with schools/ education sector (IF vaccine was delivered in schools/ on school days) / other vaccination venues? Was this advantageous/ problematic? What were the lessons learnt from this? If schools delivery was used what was the role of teachers and educational staff in the delivery (organising, consent taking, follow-up of absentees, completing reporting forms?)?
- Was HPV vaccine delivered with any other services (e.g. other vaccines/health education/ child health interventions…)? Lessons learnt from this?
- Has the pilot continued for >1 year?
- Has the delivery strategy changed over the years of pilot/introduction? Why was the strategy changed? (What happened and what effect did it have on the delivery strategy?)
- What were the main challenges experienced?

Vaccine management:

- Prior to vaccine delivery, how was the amount of vaccine required, calculated? How was a denominator estimate made for both in-school and out-of school girls? Did this estimate prove accurate?
- How was vaccine supplied to the delivery sites? How did the supply chain differ from that used for other EPI vaccines?
- Did more girls than expected present at any of the venues? How was this managed in terms of vaccine/syringe supply? Were there sufficient supplies of vaccine and consumables at each venue?
- How was the waste generated by vaccination managed and disposed? Was it monitored? Was it done safely? How did this differ from the management of EPI vaccines?

Cold Chain:

- Was an assessment of cold chain capacity completed before implementation (of the demo/ national programme)?
- Were changes needed and made to the cold chain facilities for HPV (before, during or after HPV vaccine delivery)?
- How did the HPV cold chain differ/ was it different from systems used for other EPI vaccines?

Quality/ Safety of care:

- Immunization safety: How were AE/SAE reported? Were there any AE/SAEs? How were these dealt with?
- If the vaccine was delivered outside of the health facility, were emergency kits present at delivery of all vaccination rounds?
- Safe injection procedures – were they outlined to health workers, were they assessed?
- How were safety processes for HPV vaccine (AE/SAE reporting and safe injection procedures and training) different from what is done in the EPI program (policies, procedures, reporting, etc)?

Social mobilisation:

- Was there a plan to carry out social mobilisation/ an educational campaign prior to HPV vaccine delivery? Was it done?
- What were the key messages and communication materials used?
- How the messages were delivered (radio/ drama/ newspaper?)?
- Who delivered the key messages about HPV vaccine (was it a MOH spokesperson/ community leaders/ religious leaders?)
- Who was the target audience?
- When/ how often was social mobilisation done and how far in advance of vaccination with each dose?
- Were vaccine recipients given incentives to attend the vaccination venue?
- Were messages delivered during social mobilisation integrated with educational messages about other health interventions/ other vaccines e.g. EPI vaccines? Have there been any indications that HPV vaccine delivery increased demand for other routine vaccines?

The consent process:

- How did parents give permission to vaccinate? Opt-in or opt-out?
- How were parents informed about vaccination activities for opt-out consent/ how were parents accessed for opt-in consent?
- Was the process the same as for other routine vaccinations e.g. infant vaccinations or TT boosters in older children?

Coverage/ acceptability of HPV vaccine:

- Do you have information on acceptability of vaccination/ refusals? How were issues overcome? What did parents say were factors that made them get their daughters vaccinated/ prevented them getting their daughters vaccinated? What were the reasons for non-vaccination? What were the reasons for not completing the 3-dose series?
- Coverage of dose 1, 2, 3 for each year of implementation? In school girls and out-of-school girls? How were these calculated – what was the denominator used?
- Completion rate

Availability of healthcare staff:

- How many staff were used to deliver the vaccine/ how many used at each vaccination session? Did this differ between sessions at the health centre/ school/ other outreach site?
- Were staff the same staff as those used to deliver EPI vaccines?
- What was the distribution of staff – how many were allocated to HPV vaccine delivery per facility/ per school/ per community? How many individuals/ schools/ communities would one HW cover?
- What was staff workload like during the vaccination? Did it affect normal day-to-day health worker activities? How long did vaccination activities take?
- Is there any evidence of the extent to which routine healthcare activities including routine EPI were disrupted during HPV vaccine activities?
- Did HPV vaccination and social mobilisation activities influence the relationships between local health workers and the community/ schools?

Training of staff:

- Who participated in training (District representatives/ Number of HWs/ teachers/ community members?)? Did they train others?
- Did training reach the numbers expected/ was more training necessary?
- When was it (how long before vaccination)?
- How long was it? Is it now routine training or was it a one-off?
- Who conducted training?
- Was it integrated with training for routine EPI program?

Remuneration of staff:

- Were per diems used to pay staff for vaccine delivery/ to attend training/ to conduct social mobilisation activities?
- Were incentives to staff used/ helpful/ necessary for quality of care?
- Are processes for remuneration similar to EPI vaccines? Were per diems the same amount as given for routine EPI vaccine delivery?

Performance and supervision of staff:

- What support and supervision of staff was conducted during HPV vaccine implementation?
- Was supervision integrated with other EPI/ health facility supervision?
- Did the level of supervision differ from routine EPI vaccine delivery? Why?

Monitoring & Evaluation – Reporting systems

- How was data collected at the site of delivery on the number of girls vaccinated/ the number who received dose 2 after dose 1?
- Was the quality of data collection assessed or supervised?
- Were data collection forms and subsequent data management processes integrated with the national HMIS / the routine EPI reporting systems?

Financial support for HPV vaccine and sustainability:

- Who financed the vaccine?
- Who financed the delivery costs?
- What are plans for financing the HPV programme in the future?
- Has a costing study been undertaken of the demonstration project/ national programme? Details?

If the country performed a demo/ pilot programme; has there been scale-up after the demo to more regions or national roll-out?

If yes:

- How was the decision made to scale-up from pilot/ demo to a national programme?
- Did the experience/results from the pilot/ demo influence the decision to scale up? Which experiences/ what results influenced the decision?
- Which factors perceived to influence successful demonstration projects can help ensure "success" when going national?
- What problems that occurred during the demonstration phase have/ will inform strategy for national scale up?
- Key differences between demonstration projects and national program and key challenges in scaling up. E.g. Were the activities the same or different? How involved was the EPI program for each? Did that make a difference?
- Were there changes in strategy for year 2 of demonstration project or national scale-up and rationale for this (e.g. influence of demonstration project results on the national delivery strategy)?
- What aspects of EPI functions are expected to change with the scale-up of HPV demonstration projects?

Appendix D: Interview topic guide for countries with no HPV vaccine experience

Key Informant Interview Topic Guide: Countries who have not yet implemented HPV vaccine demonstration projects.

The interview will involve structured and open questions around factors influencing the decision to implement/ not-implement HPV vaccination:

- The interviewee's role and experience in the immunization services in general and in decisions related to the HPV vaccination programme specifically.
- Factors influencing the decision on HPV vaccine introduction
- Do you feel cervical cancer rates are a health priority for the country?
- How can cervical cancer be prevented? Are you aware that there is a vaccine against HPV?
- Are you aware that HPV vaccine is available through GAVI funding (free for a demonstration project, subsidised for a national programme)?
- In your view, what are the key reasons why HPV vaccine has not yet been introduced/ an application to GAVI for funding for introduction of HPV vaccine has not been made?
- Are there other interventions which are/will be prioritised before HPV vaccine? For what reasons?
- Have there been discussions in the MOH on the opportunity to introduce HPV vaccine? Who has been involved in these discussions (roles/ titles (not names))? What have been the outcomes of these discussions/ what are the key points raised by different stakeholders?
- If so, what information was needed in those discussions or what would be needed now if discussions were to take place about introducing HPV vaccine in a pilot/ national programme?
- Does the country have experience of GAVI Alliance funding? What was the experience (were there particular benefits/ drawbacks that you know of?)

Decision processes

How are decisions made on whether to introduce new vaccines? (Probes: are there committees e.g. an immunization advisory committee? Who is involved? Are stakeholders from outside the MOH involved?)

Which vaccines have been introduced into the national vaccination programme/ introduced in demonstration projects in the last five years? What information was required in order to introduce these new vaccines? How was the final decision arrived at? What factors influenced these decisions?

Appendix E: Data collected in each of the two data collection periods

	Original grant; data collection period Nov 2014-April 2015	Supplement grant; data collection period Nov 2015-1st May 2016	Total
Total countries targeted for data collection	37 LAMICs with at least 1 year of HPV vaccination experience in demonstration projects or national pro-grammes	30 countries: 9 new countries with new projects since May 2015; 8 that we were unable to reach in the first phase of data collection; 5 with year 2 Gavi project data; 5 with data on new projects/ programmes.	46
Demonstration projects	55	11 additional	66
National programmes	8	4 additional	12
Scale-up experiences	7	3 additional	10
Published literature full texts	41 full texts and 9 conference abstracts	20 extra full texts and 2 conference abstracts	61 full texts and 11 conference abstracts
Grey literature	124 reports from 35 countries Including: 4 Gavi PIE, 1 Gavi costing report, 2 Gavi coverage surveys, 16 GAP final reports	64 further reports from 26 countries Including: 5 Gavi PIE, 6 Gavi costing reports, 4 Gavi coverage surveys,	188 reports, presentations, datasets, etc. from 44 countries Including: 9 Gavi PIE, 7 Gavi costing reports, 6 Gavi coverage surveys, 16 GAP final reports.
Key informant in-terviews	27 interviews regarding 23 countries (of 33 targeted for interview)	29 further interviews in 27 countries (of 30 targeted for interview)	56 interviews regarding 40 countries

Appendix F: Gaps in analysis and unanswered questions

There are a number of areas where the data are limited but where more data will come available in the next year(s):

- **Delivery**
  a. Evaluation of catch-up campaigns
  b. Evaluation of a 2 dose strategy with a 12 month interval e.g. Chile
  c. Evaluation of the decentralised approach where localities choose the most convenient outreach or health facility based strategies for them (does this result in predominantly school based delivery anyway? Implications for target population enumeration and coverage?) e.g. Brazil, Uganda, Tanzania.
  d. Data on national programmes, phased national roll-out, or transitional periods after the demonstration period but before a national programme.
  e. Long-term coverage achievements once the initial concentration of resources during the demonstration project has waned.
  f. Specific delivery challenges in urban areas and best practices for enumeration to cope with migration, communication, anti-vaccine lobbyists.
- **Social mobilisation**
  a. Media engagement – best practices?
  b. What was done versus what was reported to have been done and which messages or methods were most accessed by the community
- **Integration of HPV vaccine delivery with other interventions**
- **Scale-up processes from demonstration project to national programme**
- **The value of demonstration projects**
- **Key drivers of programme costs and sustainability**

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