

# High uptake of HPV immunisation in Scotland – perspectives on maximising uptake

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## Citation style for this article:

Potts A, Sinka K, Love J, Gordon R, McLean S, Malcolm W, Ross D, Donaghy M. High uptake of HPV immunisation in Scotland – perspectives on maximising uptake. *Euro Surveill.* 2013;18(39):pii=20593. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20593>

Article submitted on 11 October 2012 / published on 26 September 2013

In September 2008, Scotland introduced a national human papillomavirus (HPV) immunisation programme with bivalent HPV vaccine, to prevent cervical cancer. This school-based programme routinely vaccinates girls aged between 12 and 13 years. A catch-up campaign, running over three years, also began at this time, offering vaccination to all girls aged 13 years to under 18 years old. The HPV immunisation campaign presented challenges due to this vaccine being targeted to girls in school and older girls who had left school. Following a long and comprehensive planning process, this campaign was successfully implemented across Scotland, delivering high vaccine uptake of 91.4% for three doses of vaccine in the first year (September 2008 to August 2009) for the routine cohort and 90.1% in the second year (September 2009 to August 2010) for the routine cohort. We describe the planning process, challenges and implementation strategies employed to achieve this high uptake.

## Introduction

Genital infections with the human papillomavirus (HPV) are common, with most sexually active individuals expected to become infected with one or more HPV types in their lives [1]. Persistent infection of the cervix with oncogenic HPV types can cause cancer. HPV infection is implicated in more than 99% of cervical cancers [2]. Since 2000, around 320 new cases of cervical cancer are identified in Scotland every year [3]. Younger women are more likely to be diagnosed with cervical cancer: the highest incidence rate is for 35-40 year olds [3]. The burden of disease from cervical cancer has been reduced by two thirds since 1986 after a well-organised, quality assured cervical screening programme was implemented [4].

Of the 27 European Union Member States plus Norway and Iceland, 19 have introduced HPV immunisation into their vaccination schedule [19]. In June 2007, the United Kingdom (UK) Joint Committee on Vaccination and Immunisation (JCVI) [5] recommended to the UK Government Health Departments that vaccination against HPV should be introduced routinely for females aged 12-13 years [6]. This recommendation

was supported by an independent cost-benefit analysis which indicated that an uptake for three doses of vaccine of 80% or more would be cost effective for this routine cohort providing that vaccine protection lasted for at least 10 years [7]. Modelling also informed a further recommendation that a catch-up campaign for all girls who were aged 13 to under 18 years at the start of the programme in September 2008 would also be cost effective [8].

In Scotland, responsibility for health and education are devolved to the national government. The country follows the UK immunisation schedule and benefits from UK-wide procurement of vaccine and national provision of standard guidance on immunisation practice (the Green Book) [9]. Scotland's 5.2 million population is divided into 14 regional health boards, which co-ordinate the local delivery of the national vaccination programme.

On the basis of the JCVI recommendation, in 2007, the Scottish Government announced plans for a routine programme for girls in second year of secondary school, aged 12-13 years [10] from September 2008 and a catch-up programme for girls aged 13-17 years to run over three years (September 2008 – August 2011) [11]. The average number of girls to be immunised annually as part of the routine programme is 25,500. For the catch-up campaign, the total target population of girls was around 77,000. While no specific target for uptake of HPV vaccination was set, the expectation was that uptake of 80% or more should be achieved for the routine programme. No figure was set for the catch-up campaign.

The proposed HPV programme had a high degree of political commitment, having featured in party manifestos in the Scottish Government elections in 2007. There was extensive media coverage of what was portrayed as the first 'anti-cancer' vaccine. This heightened from August 2008 when a British television celebrity announced her diagnosis with cervical cancer at the age of 27 and died in 2009 [12].

The Scottish Government asked Health Protection Scotland (part of National Service Scotland, with responsibility for public health) to ensure that there was a common approach to delivering the HPV immunisation programme across Scotland; that it was introduced to budget and on time; and to assess its uptake and consequent impact on health. This paper outlines the design and implementation of the HPV immunisation programme in Scotland, preliminary evaluation and the resulting uptake in the target population.

## Methods

### Project design and implementation

A number of decisions were made before planning could begin.

#### The optimum model of delivery

School-based delivery, delivery through primary care, or using a mixed model of both, were all considered. Following a subjective appraisal against key areas of implementation of the programme (including epidemiology and surveillance, service delivery, data management, communications and education criteria), an entirely school-based model, for those still at school was favoured. Health boards were left to decide how to best reach those who had left school (mainly aged over 16 years), choosing between delivery via general practice or specific health board run vaccination clinics.

#### Timing and phasing of the catch-up campaign

It was decided to start the catch-up at the same time or soon after the routine programme (1 October 2008) and spread the catch-up campaign over three years with oldest girls being immunised first. This entailed vaccination of 16-17 year olds in the first year (2008–09), 15-16 year olds in the second year (2009–10), with an option for anyone eligible for the catch-up to start and/or complete a vaccine course during the third year. The catch-up campaign ended in August 2011.

#### Identification of potentially 'hard-to-reach' girls and consideration of approaches through which they may be encouraged to participate in the campaign

'Hard-to reach' was defined as any combination of factors leading to a systematically increased likelihood of developing cervical cancer and/or reduced potential health gain from HPV immunisation, as a consequence of social or access issues in a defined group of people. These factors may result in: less likelihood of being immunised; less likelihood of attending for cervical screening; increased risk of persistent HPV infection. Approaches to enhance equitable access to the vaccine were developed.

#### Undertaking research to allow establishment of fit for purpose surveillance

Five key areas for specific study were identified.

- Identify knowledge and attitudes about HPV and cervical cancer and the proposed vaccine in parents, girls, education and healthcare professionals.

Subsequent testing of the acceptability of proposed messages to be included in public information materials.

- Develop an inexpensive robust HPV assay which could be used for surveillance purposes to identify, measure and monitor HPV infection in age groups eligible for vaccination [13,14].
- Establish background prevalence and circulating genotypes of HPV in unimmunised populations before the vaccine programme commenced [15].
- Establish a surveillance system to monitor vaccine uptake, safety and early impact of vaccine through the effects on HPV prevalence in the population attending for cervical screening (from the age of 20).
- Identify the characteristics of those who do not attend for cervical screening against those who do attend for cervical screening [16], to inform if using samples from the cervical screening programme is representative of women in Scotland.

The timeline for implementation is shown in Figure 1. A formal project management approach was adopted with a Programme Manager put in place using Prince2 methodology to monitor work-stream activities and manage risk. Five work-streams were created to address key aspects of implementation. Members of these work-streams were drawn from public health professionals in Scotland, from within Health Protection Scotland, health boards, National Health Service supporting services (including data services and communications) and Scottish Government. Members of work-streams were not paid for participation. Generally, meetings for each work-stream were held monthly, but frequency varied depending on the stage of the programme. All work-streams had Scottish Government and Programme Manager representatives.

#### Service Delivery

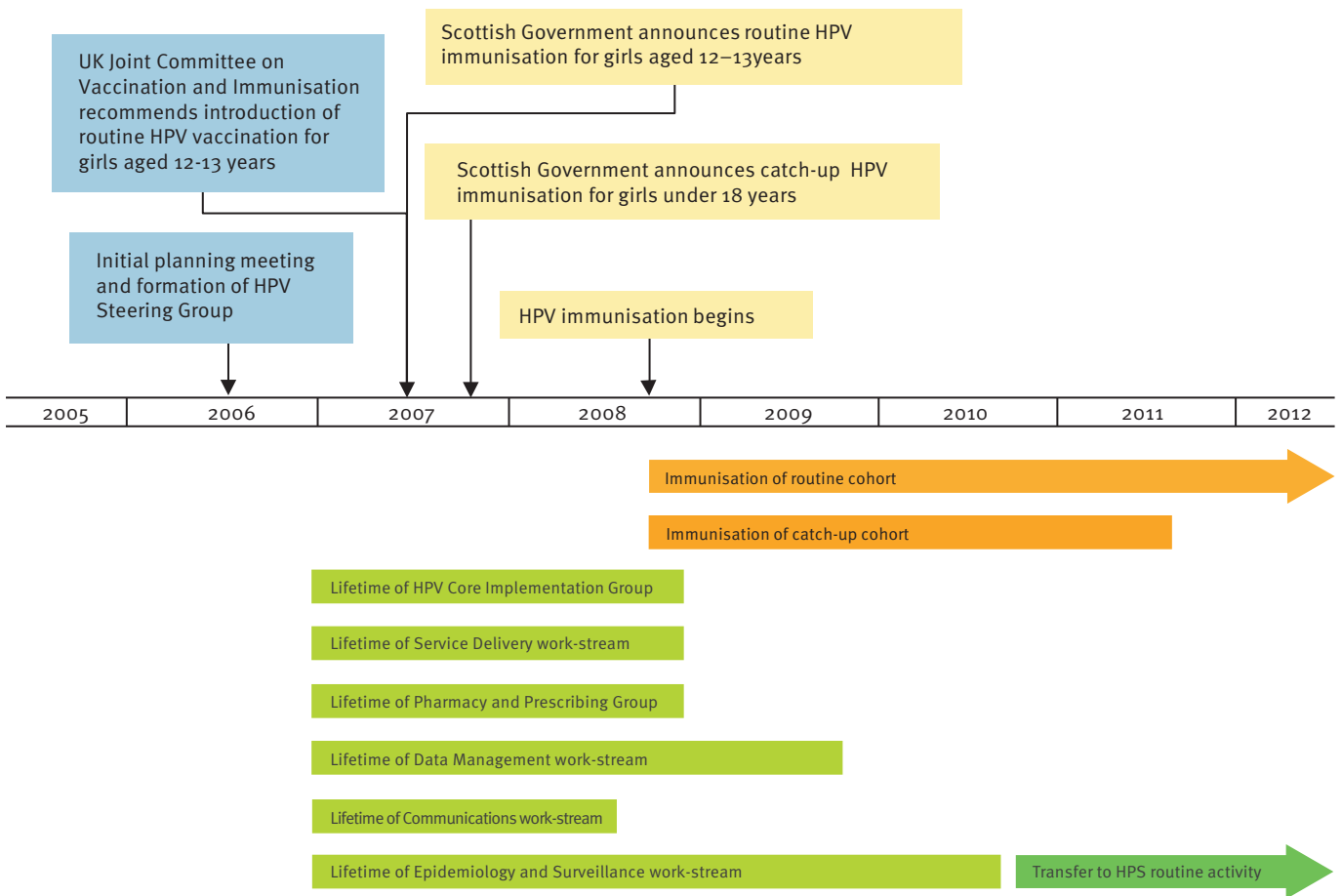
This work-stream ensured NHS preparedness by establishing good partnerships with health boards on local delivery, data flow and vaccine distribution. This work-stream undertook a performance management role by reviewing health board implementation plans and facilitating the sharing of good practice to ensure a consistency in access to the programme, especially for 'hard to reach' groups. This work-stream monitored service delivery in the initial stages. In addition, it also considered issues of consent. The Scottish Government led negotiations with primary care practitioners for enhanced services at a national level. Members included representatives from health boards, schools, education, school nurses, general practice, pharmacy and from all other work-streams. The chair was a senior public health clinician from one of the health boards.

#### Pharmacy and Prescribing

This working group, a sub-group of the Service Delivery work-stream, provided advice on pharmaceutical aspects and developed processes to: ensure the safe prescription (developed national patient group

**FIGURE 1**

Timeline for HPV immunisation programme planning and implementation in Scotland



HPS: Health Protection Scotland; HPV: human papillomavirus; UK: United Kingdom.

direction), supply and administration of vaccine; ensure vaccine procurement, storage and distribution complied with legislation and other requirements; ensure local systems for ordering, storing and distributing vaccine. This group also communicated progress through the Scottish Vaccine Update newsletter [17]. Members included pharmacy and logistics experts and representatives from health boards. The chair was a pharmacist from the National Health Service.

**Data Management**

This work-stream identified the eligible cohort and put in place call and recall of girls according to the vaccine schedule and ensured the flow of data from the point at which a girl is called for vaccination, to recording when vaccination is given. This required modification of national information systems and provided data to calculate uptake rates. This work-stream also managed the interface between education and public health departments for girls who had left school. Members included experts on data systems, systems

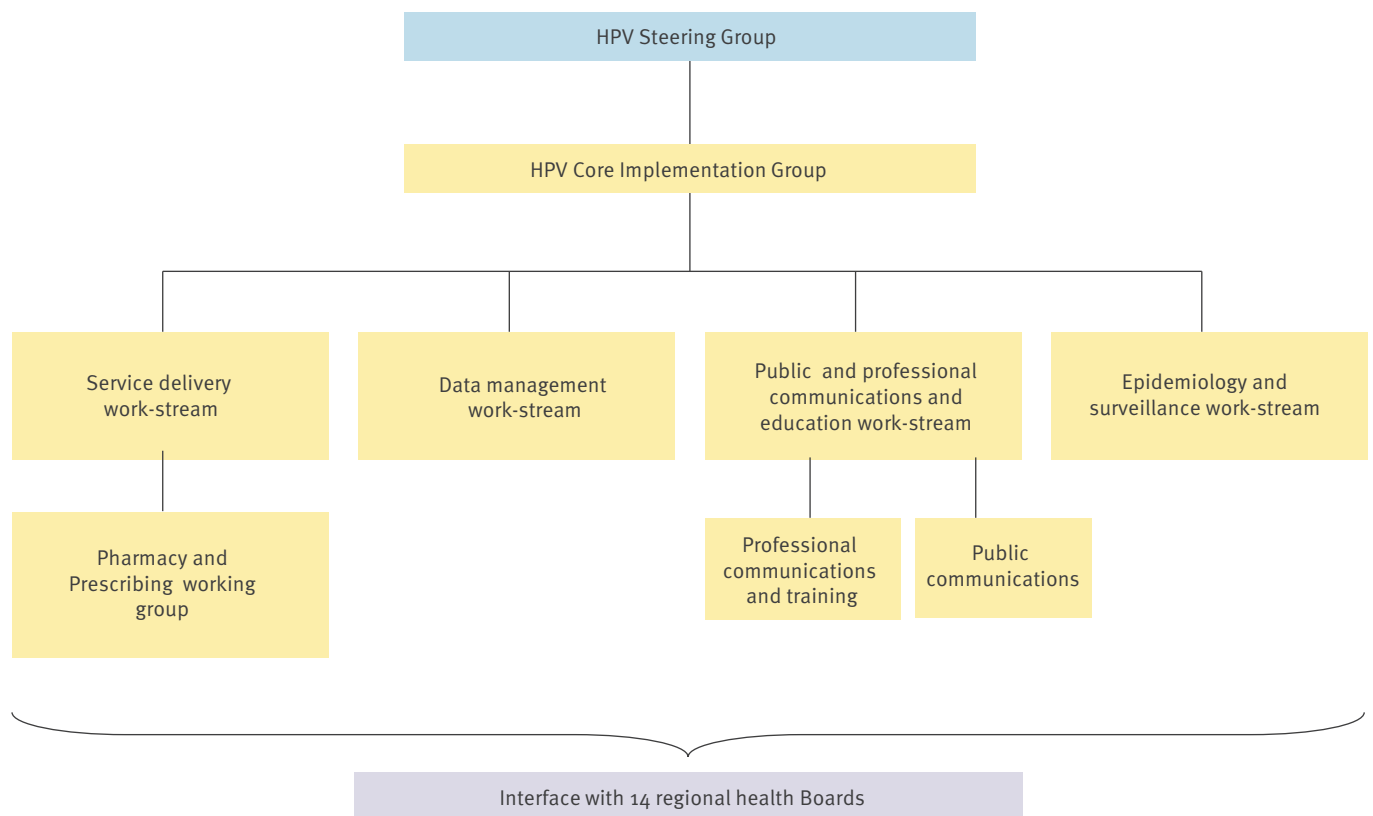
design, data analysis, epidemiologists and representatives from health boards, education, screening, general practice and other work-streams. The chair was a senior public health clinician from one of the health boards, who had a special interest in national data systems.

**Communication and Education**

This work-stream developed and implemented a multi-media campaign (including Internet, TV and cinema) to raise awareness, understanding and acceptance of the HPV immunisation among girls and their parents, healthcare and education professionals. Professional communications included briefing key stakeholders, informing service providers through regular professional letters, and training immunisers (i.e. nurses providing vaccination in schools). A common strapline for all materials ‘Together we can beat cervical cancer’ and a brand image based on a school girl talking to her friends were designed. Additional work was done to reach girls who had left school, including using

**FIGURE 2**

Programme structure for the HPV Immunisation Programme in Scotland



HPS: Health Protection Scotland; HPV: human papillomavirus

pink camper-vans to promote awareness. Members included public communications experts, training experts, epidemiologists and representatives from schools, education, general practice, national health telephone help-line (NHS24), health boards and other work-streams. The chair was a senior communications expert from the National Health Service.

### Epidemiology and Surveillance

This work-stream put in place tools to evaluate the immunisation programme, in terms of uptake and safety, and to monitor the impact of the programme on rates of high-risk HPV infection, cervical cancer and on cancer precursors. The aim being that this would provide evidence to inform decisions about the future mix of screening, HPV testing and immunisation needed to continue to effectively prevent, detect and treat cervical cancer. A national Scottish HPV Reference Laboratory was established. Members of this work-stream included epidemiologists, data analysts, statisticians, laboratory representatives and representatives from the data management group, health boards and the Health Protection Agency in England (currently Public Health England) to ensure harmonisation of surveillance across the UK. This work-stream was chaired

by the senior clinician and programme lead within Health Protection Scotland.

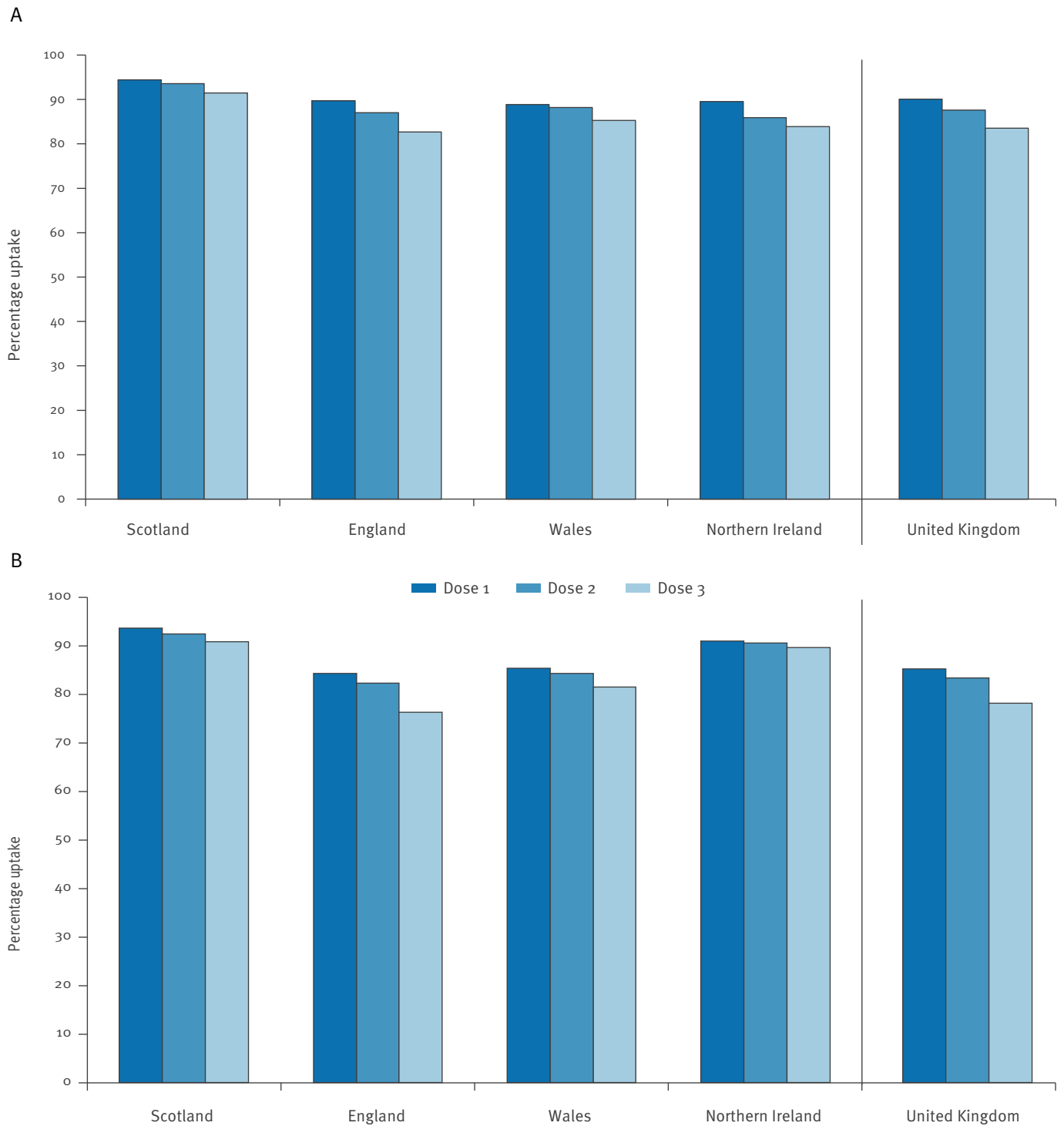
The progress of these work-streams was closely coordinated by a Core Implementation Group which met monthly (Figure 2). This group comprised the chairs of the work-streams, programme management and leads from the Scottish Government. A government appointed steering group oversaw the programme, signed off strategic decisions and commissioned reviews by external auditors, ‘gateway reviews’, to look in detail at risks, issues, governance and processes at key stages in the planning process. This group met quarterly, with membership drawn from senior staff involved with the programme including organisation directors, leads from schools, education, general practice, screening, sexual health and health boards and public/patient representation. The chair was a senior executive from one of the health boards, who was not directly involved in the programme.

### Vaccine uptake

Scotland has well established universal healthcare data systems. Every citizen has a unique Community Health Index (CHI) number and medical data systems use this

**FIGURE 3**

HPV vaccine uptake in routine year (girls aged 12–13 years) for (A) 2008–09<sup>a</sup> and (B) 2009–10<sup>b</sup>, United Kingdom



HPV: human papillomavirus.

Adjustments to the denominator populations used to calculate these uptake statistics are ongoing and rates shown here should be regarded as indicative; final uptake data will be published by each UK administration separately.

<sup>a</sup> First year of the programme.

<sup>b</sup> Second year of the programme.

Source: Information Services Division, NHS National Services Scotland; Public Health Wales; for England and Northern Ireland data were provided via personal communication Joanne White, September 2010, Department of Health (Health Protection Agency) and Ruth Campbell, September 2010, Public Health Agency in Northern Ireland.

**TABLE 1**

Uptake of HPV vaccine for the first routine school year (12–13 year old girls), Scotland, 2008–09

NHS Board	Number of girls in cohort	Number 1st dose	% uptake of 1st dose	Number 2nd dose	% uptake of 2nd dose	Number 3rd dose	% uptake of 3rd dose
Ayrshire and Arran	2,091	1,968	94.1	1,957	93.6	1,943	92.9
Borders	653	616	94.3	610	93.4	604	92.5
Dumfries and Galloway	867	835	96.3	833	96.1	826	95.3
Fife	2,026	1,891	93.3	1,876	92.6	1,835	90.6
Forth Valley	1,703	1,630	95.7	1,618	95.0	1,582	92.9
Grampian	2,964	2,802	94.5	2,778	93.7	2,718	91.7
Greater Glasgow & Clyde	6,564	6,177	94.1	6,120	93.2	5,982	91.1
Highland	1,786	1,661	93.0	1,648	92.3	1,622	90.8
Lanarkshire	3,465	3,306	95.4	3,266	94.3	3,118	90.0
Lothian	4,373	4,114	94.1	4,074	93.2	4,003	91.5
Orkney	117	108	92.3	107	91.5	106	90.6
Shetland	132	124	93.9	124	93.9	123	93.2
Tayside	2,297	2,190	95.3	2,164	94.2	2,098	91.3
Western Isles	171	158	92.4	157	91.8	150	87.7
<b>All Scotland</b>	<b>29,286</b>	<b>27,652</b>	<b>94.4</b>	<b>27,403</b>	<b>93.6</b>	<b>26,781</b>	<b>91.4</b>

to ensure accurate record keeping and population registers for preventive medical services. The Scottish Child Health Surveillance Programme – Schools system [30] was used as the call and recall register for school-based immunisation. Health boards, education authorities and private schools worked together to revise the accuracy and completeness of their data prior to the initial call.

Eligible girls who were not at school were identified by extracting data from school registers of those who had left school. Individual records of those immunised were sent to central data collection points in the individual health boards and entered into the child health system. Details of vaccination status were extracted from the system, collated, analysed and presented using validated national procedures. Uptake rates were calculated using population denominators derived from the system.

### Preliminary evaluation

A qualitative evaluation was undertaken following the end of the first year of vaccination. The aim of this survey was to establish how the programme structure and management had functioned and how the performance management aspects had worked. The questions were based on previous surveys of projects related to immunisation, modified through consultation and adapted into an online format for ease of completion and analysis.

The survey was made available for completion to representatives of all health board immunisation teams

and all members of the Core Implementation Group, the National Steering Group and the work-streams. Work-streams contributed composite answers, but individuals may also have returned a completed survey. Not all questions were relevant to all respondents. Common elements and themes were manually identified across the range of responses by a member of Health Protection Scotland staff who was not involved in the programme.

## Results

### Programme

The planning process was effective and immunisation began on time as planned. This was the first time there had been performance management of health boards for a national campaign. There was equal and consistent participation from all health boards.

The programme was audited twice during the planning process at ‘gateway reviews’. At these reviews, external auditors scrutinised processes, governance, risks and issues. In addition to reviewing documentation, interviews were held with key personnel in the programme. Financial impact was assessed at each review. The programme received positive evaluation at each review and was allowed to proceed onto the next stage.

The HPV Steering Group met for the last time in September 2010, when the success of the planning process and implementation was acknowledged and the programme officially closed. Immunisation continues

for the routine cohort as part of the routine childhood programme. Long term monitoring of HPV immunisation and the impact on disease continues. These responsibilities lie with Health Protection Scotland.

## Vaccine uptake

### Vaccine uptake in the routine cohort (girls aged 12–13 years)

Figure 3 shows uptake data for the first year of the vaccination campaign (2008–09), comparing uptake of first, second and third doses for all UK countries. The Scottish programme achieved 91.4% uptake for all three doses of vaccine, compared with 83.5% for the average across the whole of the UK. Scotland continued this success in year 2 of the vaccination campaign (2009–10), with 90.1% uptake in the routine cohort.

Table 1 shows vaccine uptake for the routine cohort by health boards in 2008–09. All health board regions achieved uptake of more than 87% for three doses of vaccine in this year. Health board regions encompass inner city, rural and island regions.

### Vaccine uptake in the catch-up campaign

Vaccine uptake for those girls in the catch-up cohort and still attending school was comparable to uptake of the routine year, at overall 87% uptake of three doses for all school years [18]. Vaccine uptake for those girls who had left school was significantly lower at 32% uptake of three doses of vaccine. Overall, the uptake of three doses of vaccine for all girls eligible (both in and out of school) was 65% uptake of three doses of vaccine.

A more detailed analysis of routine and catch-up uptake has been published elsewhere, including the effect of deprivation on uptake [31].

## Qualitative evaluation

Thirty responses were received to the online survey. These were individual responses and group responses, which limited any detailed analysis. Responders provided satisfaction scores to key questions about each work-stream, these are summarised in Table 2. Highest levels of satisfaction (scoring over 90% for what worked well) were for:

- the logistics of vaccine supply, distribution and dispensing;
- in-school vaccination arrangements and identification of girls in school;
- consent procedures (development of consent form and process of obtaining consent);
- communication resources for girls, partnership working and media campaign (this media campaign was award winning);
- input from Health Protection Scotland;
- expert advice and guidance managing adverse events and associated communications;
- data security and information governance;
- direction given by the National Steering Group.

Lowest levels of satisfaction (scoring less than 70%) were for:

- out of school vaccination arrangements and the identification of girls out of school;
- data flow between health boards and education authorities;
- capturing data across health board boundaries.

## Discussion

Immunisation programmes constitute an essential method of protecting health. A programme is composed of a number of inter-linked resources, processes and structures which require co-ordination to enhance overall effectiveness and efficiency. To introduce HPV immunisation in Scotland, a project management approach was adopted to achieve these ends. This report discusses the relationship between the high uptake attained and key themes identified from this structured approach.

The key measure of initial effectiveness, achieving at least 80% uptake of completed courses in the cohort eligible for routine immunisation was attained. Coverage was lower in the cohorts eligible for the catch-up campaign but still reached 65% overall for three doses of vaccine. There was however a considerable disparity between uptake in those in and out of school who were eligible for the catch-up campaign. The reasons for this have been explored elsewhere [31].

The uptake rate for completed courses of HPV immunisation in the routine cohort in Scotland (91% in the first year of implementation) is amongst the highest reported in the world. Uptake in comparably resource-rich countries within Europe [19] ranged between 24–84%, was 14% in the United States [20] and 73% in Australia [21]. Uptake in those countries delivering vaccine only in schools ranged between 63 and 83%. In many countries, uptake is lower than expected. Scotland also achieves high uptake rates for other immunisations: completion of childhood primary course at the age of one year is currently 97.4%; the first dose of measles-mumps-rubella (MMR) vaccine at the age of two years is currently 94.3%; completion of booster courses is currently 91.9% at the age of five years [22]. This indicates a general population acceptance for immunisation as a measure to protect personal and family health. It is also a sign that the country's well-established public health and primary care systems are effective.

Based on structured feedback from participants, the introduction of the HPV immunisation programme was perceived to have been effectively managed. This was despite challenges in the initial planning phase, a lack of national agreement with primary care practitioners for the first time for a new vaccine programme, introduction of new data systems in some health board areas and the need to schedule a multi-dose course for the first time in an adolescent age group.

**TABLE 2**

Qualitative evaluation of the HPV immunisation programme, results of the online survey, components rated as having worked well, Scotland, 2010

Work stream	Assessed components	Positive responses / Total responses
Service delivery	Operational service delivery (e.g. infrastructure, resources, contracts)	21 / 25
	In-school vaccination arrangements	27 / 27
	Out of school vaccination arrangements	15 / 24
	Partnership working (e.g. education authorities, religious groups)	25 / 26
	Consent procedures	23 / 24
	Expert advice and guidance	23 / 24
Data management	Identification of population of girls in school	25 / 26
	Identification of population of girls out of school	16 / 25
	Data flow between health and education authorities	17 / 26
	Data security and information governance	19 / 20
	Capturing data across Health Board boundaries	8 / 13
	Data extraction, transfer and analysis	9 / 12
Procurement and logistics	National vaccine selection and procurement process	13 / 18
	Vaccine supply and delivery to Health Boards	17 / 18
	Liaison with Holding Centres	18 / 18
	Resources/capacity for vaccine storage	19 / 19
	Cold chain maintenance	20 / 20
	Patient Group Directives (communal prescriptions)	20 / 20
Public and service communication	Training resources for healthcare professionals and providers	18 / 22
	Communication with healthcare professionals	22 / 25
	National HPV vaccination media campaign	24 / 26
	Expert advice and support for communication	23 / 25
	Communication resources for girls receiving the vaccine (e.g. leaflets, websites)	23 / 25
Epidemiology and surveillance	Monitoring of vaccine uptake	20 / 24
	Vaccine safety monitoring	22 / 24
	Advice and guidance for managing adverse events	22 / 24
	Long-term monitoring of vaccine impact on cervical cancer and cancer precursors	9 / 12
National project management	Relationship between national programme and local immunisation coordinators	16 / 20
	Direction given by HPV National Steering Group	20 / 21
	Input into the campaign from HPS	22 / 24
	Involvement of faith groups in planning stages	7 / 9
	Programme governance (e.g. reporting, accountability)	15 / 18

The project management approach adopted is unlikely to be of itself a key factor in the achievement of the relatively high uptake rate. However, it allowed the identification of some of the key factors that may have influenced uptake rates and has highlighted areas for improvement. Three broad groups of inter-related factors were identified by those involved in managing the project as key to the achievement of the high levels of uptake: school-based delivery, tailored communications directed at adolescent girls and good logistical services.

High rates of uptake of completed courses of HPV vaccination achieved through school-based models of

delivery have been reported in other countries. The differential in rates between girls in and out of school has been noted in the UK previously with the meningococcal sero-group C conjugate vaccination catch-up campaign [23]. The positive experience of UK school nurses involved in the programme and the motivation this gave them has been reported [24].

The importance of targeted communications is clearly reflected in the uptake rates. According to information received from the Communications work-stream based on their work to evaluate the communications produced, girls, parents and healthcare professions were satisfied with the information they received. The high



profile illness and death of a young television celebrity from cervical cancer could have played a role in the uptake of the vaccine. The year in which she was ill and died (2008–09) saw a large increase in the number of young women in Scotland attending cervical screening [25].

The National Institute for Clinical Excellence (NICE) guidance [26] and Cochrane reviews [27,28] advocate the use of data systems for call-recall, and in this case existing registers could be adapted relatively easily for this purpose, although significant work was needed to establish accuracy within the system. A draw back to the catch-up campaign was the lack of an accurate register of those older girls who were not at school.

There were a number of limitations with the approach taken. Health board registers of 16 and 17 year old girls who had left school were inaccurate and uptake rates based on them are therefore estimates. Survey responses were subjective and not collected uniformly (some from individuals, some via group discussion) - this is therefore a qualitative unstructured assessment. Scottish Government invested, in relative terms, a considerable resource in ensuring the successful planning and implementation of the programme. Scotland is a small, relatively ethnically homogenous country (although there is considerable socio-economic inequality). These factors may limit the application of these findings to other programmes and settings. However, we believe that this approach could act as a general framework for the implementation of new immunisation programmes in other European countries

## Conclusion

We conclude that a structured, managed approach to preparation for delivery of new immunisation programmes is essential in achieving high and inclusive uptake. This structured approach allowed for transparency of process, accountability for decision making and provided a process that could be reviewed at key stages..

Introduction of the HPV immunisation programme in Scotland was successful in achieving high uptake. This success was sustained in year 2, despite coincident with the influenza A(H1N1)pdm09 pandemic and implementation of the influenza A(H1N1)pdm09 vaccination programme – which fell between doses one and two of the schedule.

Further analyses and discussion on HPV uptake rates within Scotland are in preparation. The HPV immunisation campaign continues in Scotland for girls aged 12–13 years. Our current surveillance work focuses on identifying the effects of vaccination on HPV infections identified through attendance at first cervical screening appointment. In Scotland, cervical screening currently begins at age 20 years, and in 2012 we estimate around 70% of girls attending screening at age 20 will have received three doses of HPV vaccine [29].

## Acknowledgements

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We thank Kevin Pollock at HPS for helpful comment and discussion during preparation of this manuscript.

## Conflict of interest

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None declared.

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