Vaccine 37 (2019) 7539–7546

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Policy and socio-cultural differences between cantons in Switzerland with high and low adolescent vaccination coverage for hepatitis B and HPV

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ARTICLE INFO

Article history:
Received 29 June 2018
Received in revised form 26 September 2019
Accepted 27 September 2019
Available online 17 October 2019

Keywords:
Vaccination coverage
Vaccine hesitancy
HPV vaccine
Hepatitis B vaccine
Adolescent health
Health system
School health

ABSTRACT

Vaccination recommendations in Switzerland are national, but vaccine coverage varies greatly from one canton to another, particularly for vaccinations recommended in adolescence. To explain these differences, we studied vaccination practices and socio-cultural views from the vantage points of policy makers, healthcare providers and community adolescents and parents in 4 cantons with low (LVC) and 4 cantons with high (HVC) vaccination coverage for hepatitis B (HBV) and human papillomavirus (HPV) vaccines. In-depth semi-structured interviews were administered to a policy maker, a private practitioner and 4 to 7 community members (adolescents and parents of adolescents) from each of the 8 cantons. LVCs were notable for less government involvement in vaccination issues, more autonomy of municipalities for school health, lower density of pediatricians, less information about these vaccines, greater emphasis on individual rather than government responsibility for vaccinations and for anticipated community hesitancy. Doctors in HVCs more actively advocated for vaccines. Community views in HVCs were more collectivistic and reliant on schools as a source of information than in LVCs. In both groups, hesitancy and concerns about efficacy were greater for HPV than for HBV vaccine. Findings suggest more systematic involvement of health and school authorities will be appreciated by adolescents and their parents, and will improve vaccination coverage. Interventions focused only on community awareness and hesitancy are likely to be inadequate without efforts to reach policy makers and doctors.

1. Introduction

Although vaccination recommendations in Switzerland are national [1], vaccine coverage varies greatly from one canton to another [2], particularly for vaccinations recommended in adolescence for hepatitis B (HBV) since 1997 and for human papillomavirus (HPV) since 2007 to prevent cervical cancer [3]. HBV vaccination is recommended for all adolescents between 11 and 15 years old with a 2-dose schedule. A 3-dose schedule for HPV vaccination was initially recommended for girls 11 to 14 years old, with a provision for catch-up vaccination until age 26 years. The 3-dose schedule was reduced in 2012 to a 2-dose schedule for girls younger than 15 years of age. HPV vaccination has also been recommended for boys since 2015.

Infant vaccinations are well accepted with a national coverage of 96% at age 2 years for 3 doses against diphtheria, tetanus, poliomyelitis, pertussis and haemophilus influenza b. Cantonal variations range from 90 to 99% [3]. Boosters for these vaccines tend to be delayed; 4th dose coverage is 89% at age 2 and 94% at age 8. Coverage for other vaccinations are lower (e.g. 87% for measles 2 doses and 80% for pneumococcus at 2 years of age) with wider variations across cantons (e.g. measles 81 to 95%), but steadily increasing over the years (from 71% in 2005–2007 for measles). National coverage for HBV and HPV (for girls) at age 16 reached 71% and 56% respectively in the most recent survey in 2014–2016 [3].

The Swiss Federal Office of Public Health issues the national vaccination recommendations, provides information material, coordinates cantonal surveys of immunization status of children and adolescents, and publishes findings. The cantons are

Abbreviations: LVC, low vaccination coverage canton; HVC, high vaccination coverage canton; HBV, hepatitis B virus; HPV, human papillomavirus.

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https://doi.org/10.1016/j.vaccine.2019.09.085
0264-410X/

responsible for implementing vaccination recommendations to reduce the incidence of vaccine-preventable diseases and have their own implementation policies and strategies. They rely heavily on physicians in private practice. Many cantons also offer school-based vaccinations, but the role and organization of school health systems vary greatly from one canton to another. Nationally recommended vaccinations are reimbursed by mandatory health insurance. Although deductibles are not required for children up to the age of 18 years, insurance coverage requires a co-pay of a 10% retention fee for treatment costs, which is capped at CHF 350 per year for children. School-based vaccinations are generally free of charge for the families. Since no vaccinations are mandated in Switzerland, decisions to vaccinate are made by individuals for themselves or by parents for their children. Socio-cultural differences across Switzerland are notable and likely to affect vaccine acceptance and demand [2]. Sceptical views of vaccinations have been noted in certain areas and among certain groups of the population [4].

Vaccine hesitancy is currently a topic of interest in Europe and globally, often related to questions of confidence, complacency and convenience [5,6]. Acceptance of vaccines for adolescents is especially challenging because they are less likely to visit a doctor than younger children, and increasing autonomy may affect the decision-making process. Furthermore, vaccine target infections are sexually transmitted, and because they manifest much later, they are unlikely to be seen by physicians who vaccinate adolescents.

To identify factors that may explain differences in vaccination coverage across cantons we examined policies, health system approaches and socio-cultural community views in low and high vaccine coverage cantons. Our objectives were (1) to describe the vaccination delivery system, particularly for adolescent HBV and HPV vaccinations, (2) to examine health professional and community vaccine awareness, priorities and practices; and (3) to compare low-vaccination coverage (LVC) and high-vaccination coverage (HVC) cantons.

2. Materials and methods

Our qualitative study was designed to examine in distinctively high- and low-coverage cantons the views of three stakeholder groups that collectively influence the effectiveness of vaccination programmes: policy makers, vaccinating doctors and community members. The design was based on the WHO health system building blocks framework [7] and a stakeholder framework for vaccine acceptance and demand [8].

2.1. Setting

The study was carried out in 2014–2015. We planned to conduct it in the 4 cantons with the lowest and the 4 cantons with the highest mean of HBV coverage for both sexes and HPV coverage for girls according to the national immunization coverage survey in 2010–2012 for 16 year-olds [3] (Fig. 1).

2.2. Design

In-depth interviews were conducted in each of the cantons with cantonal health authorities responsible for policy regarding communicable diseases (cantonal physician), healthcare providers who vaccinate children and adolescents, and both adolescents and parents of adolescents who had recently become eligible for the HBV and HPV vaccines according to the national recommendations [1]. We planned to interview 8 community members in each canton: two girls and two boys, two parents of girls and two parents of boys. In these interviews we asked about respondents' background information, and the interview included questions about awareness, priority and practices regarding HBV and HPV vaccination, and questions about structures and operations of health systems to vaccinate children and adolescents.

In each of the cantons, the cantonal health authority was asked to suggest healthcare providers (private clinicians and/or school doctors) to be interviewed. Directors of educational institutions in each canton assisted in identifying adolescents aged 16 to 19 and parents of adolescents in that age group, though not parents of the adolescent respondents. These community respondents were interviewed, and vaccination records of the adolescents were requested.

Interviews were conducted by VMS (who did all the policy maker and clinician interviews as well as a portion of the interviews of community members in French) and four female students (studying public health, psychology or biomedical sciences). All were trained together in a one-day workshop including role-play interviews. Interviews were done at the interviewee's workplace, school or home.

Semi-structured interviews were recorded and transcribed. Thematic analysis based on study aims and interview content was facilitated by use of MAXQDA software [9]. Data were extracted from the vaccination records to assess actual vaccination status of the adolescents—both adolescent respondents and children of parental respondents; these data were compared with the vaccination status reported in the interviews. Cantonal documents were also used to review vaccine implementation policies and strategies, with particular attention to the role of school-health.

The study was approved by the Ethics Commission for North-Western and Central Switzerland. Participants signed a consent form.

2.3. Analytical framework

The analysis of vaccination delivery systems was based on the WHO health system building blocks framework [7,10], focusing here on health governance, health service delivery and health information. Analysis of the socio-cultural context was based on questions about awareness of disease and its prevention; experience and prior use; and priority, hesitancy and acceptance of vaccines for HBV and HPV. This framework was used for the analysis of interview data from health authorities, clinicians and community respondents. Both frameworks enabled us to identify and compare characteristic features of HVC and LVC cantons.

3. Results

Among the cantons with the lowest mean of HBV and HPV coverage Obwalden, Schwyz, Thurgau and Zug (LVC cantons) agreed to participate. Cantonal authorities in Appenzell Innenrhoden and Appenzell Ausserrhoden did not reply to our request for their participation after 3 attempts, and Thurgau was chosen instead of Uri for better geographical diversity. Participating HVC cantons (Basel-Landschaft, Fribourg, Geneva and Vaud) were among those with the highest mean of HBV and HPV coverage; Basel-Stadt was excluded for comparability because it is a city canton. All LVC cantons were German speaking, three of the HVC were French speaking. Selected features of the study cantons are shown in Table 1. Although vaccination coverage was lower in LVC than in HVC cantons for many vaccines, the mean-percent coverage differences were most striking for HPV and HBV vaccines (Table 2).

Our findings are based on interviews with the cantonal physician and a clinician in private practice also serving as school doctor

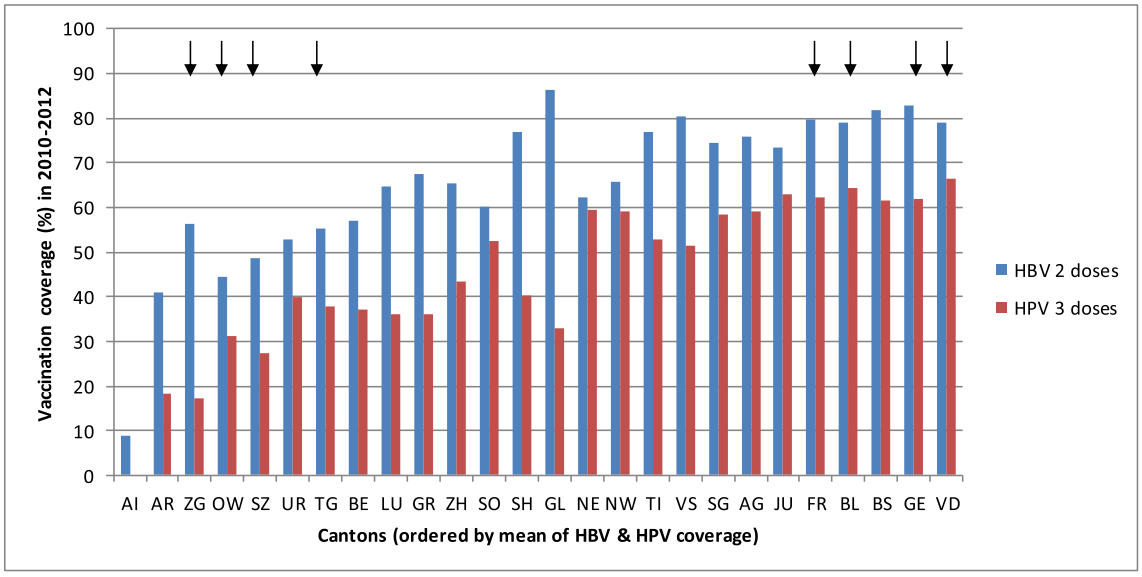

Fig. 1. Distribution of vaccination coverage for HBV vaccine (2 doses) and HPV vaccine (3 doses, girls only) at age 16 by canton (2010–2012, according to the national survey [3]). HBV, hepatitis B virus; HPV, human papillomavirus. Study cantons are indicated by arrows. The most widely used languages—German (G), French (F) and Italian (I)—are indicated for each canton: AI, Appenzell Innenrhoden (G); AR, Appenzell Ausserrhoden (G); ZG, Zug (G); OW, Obwalden (G); SZ, Schwyz (G); UR, Uri (G); TG, Thurgau (G); BE, Bern (G); LU, Luzern (G); GR, Graubünden (G); ZH, Zürich (G); SO, Solothurn (G); SH, Schaffhausen (G); GL, Glaris (G); NE, Neuchâtel (F); NW, Nidwalden (G); TI, Ticino (I); VS, Valais (F); SG, Sankt Gallen (G); AG Argau (G); JU, Jura (F); FR, Fribourg (F); BL, Basel-Landschaft (G); BS, Basel-Stadt (G); GE, Geneva (F); VD, Vaud (F).

Table 1
Selected features of the study cantons.

	LVC				HVC			
	OW	SZ	TG	ZG	BL	FR	GE	VD
Population in 1000	36.5	151.4	260.3	118.1	278.7	297.6	469.6	749.4
Density per km^2	75.9	177.8	301.6	570.3	538.4	186.7	1909.7	265.5
Urban population (%)	0	80.3	50.1	96.3	91.8	55.8	99.2	74.3
Foreign nationals (%)	14.0	19.6	23.4	25.9	20.7	20.8	40.4	32.8
Main language	G	G	G	G	G	F	F	F
Without post-compulsory education (aged 25 and over) (%)	22.6	23.3	20.8	15.1	18.7	28.9	26.4	25.7
Physicians in private practice per 100,000 inhabitants	115	137	159	201	232	130	374	239
Area km^2	491	908	991	239	518	1671	282	3212
Settlement and urban area[a] (%)	3.8	6.1	12.3	13.8	17.4	8.4	33.3	9.3

Data source: Federal Statistical Office 2015. LVC, low vaccination coverage cantons; HVC, high vaccination coverage cantons; OW, Obwald; SZ, Schwyz; TG, Thurgau; ZG, Zug; BL, Basel-Landschaft; FR, Fribourg; GE, Geneva; VD, Vaud; G, German; F, French.

[a] Settlement and urban area refers to the percentage of habitable land area with building and transport infrastructure.

Table 2
Vaccination coverage at age 2 for vaccinations recommended for infants and toddlers (DiTePer and measles) and at age 16 for vaccinations recommended at 11–15 years (HBV, HPV, DiTe), in 2010–2012.

Vaccination, number of doses	Vaccine coverage, mean percent (range)	
	LVC	HVC
Early childhood vaccinations		
DiTePer, 3 doses	92 (89–95)	97 (96–99)
DiTePer, 4 doses	84 (82–87)	90 (89–92)
Measles, 1 dose	89 (85–92)	95 (93–98)
Measles, 2 doses	82 (79–87)	88 (85–93)
Adolescent vaccinations		
HBV, 2 doses	51 (44–56)	80 (79–83)
HPV, 3 doses (girls only)	28 (17–38)	64 (62–66)
DiTe, 6 doses	54 (40–61)	70 (61–80)

Data source: Swiss National Vaccination Coverage Survey [2,3] in study cantons. LVC, low vaccination coverage cantons (Obwald, Schwyz, Thurgau and Zug); HVC, high vaccination coverage cantons (Basel-Landschaft, Fribourg, Geneva and Vaud). DiTePer, diphtheria, tetanus, pertussis (3 doses recommended in the first year of life, 4th dose in the 2nd year, 5th dose at 4–7 years, 6th dose DiTe at 11–15 years); measles (1st dose recommended at 1 year, 2nd dose in the 2nd year); HBV, hepatitis B virus (vaccination recommended at 11–15 years in 2 doses 6-months apart); HPV, human papilloma virus (vaccination recommended for girls at 11–14 years in 3 doses at 0, 1 and 6 months during the period of this survey, and reduced to a 2-dose schedule after 2012).

(7 pediatricians and 1 general practitioner) in each of the 8 participating cantons. Relevant features of the vaccine delivery systems are presented with reference to governance, health service delivery and information access (Table 3). Interviews were also completed with 4 to 7 community members in each canton, including 28 adolescents and 14 parents (Table 4). Key findings with reference to awareness, priority and vaccine-related practices are summarized in Table 5 for these three groups of stakeholders.

3.1. Health systems for vaccination

3.1.1. Governance

Two HVC cantons have a vaccination implementation strategy, which includes HBV and HPV, but among LVC cantons only one has a strategy, and it is for measles and HPV. In contrast with HVCs, in LVCs vaccinations are regarded more as an individual than as a public responsibility. The difference in these priorities is reflected in less direct access to information about immunizations on the websites of LVC cantons. Furthermore, implementation of school health laws is coordinated by cantons in 3 HVCs, and in 2 of them the school doctors are appointed by the canton based on proposals of the municipalities. In these 3 HVCs co-operation between the health and education sectors at the cantonal level involves the can-

Table 3
Characteristic features of vaccination delivery systems.

	LVC	HVC
Governance		
Policy & political commitment	Rarely have a cantonal strategy, vaccination considered as an individual responsibility	More often have a cantonal strategy, clear commitment of state with political support
Oversight and coordination	Autonomy of the municipalities for school health	Coordination of school health at the cantonal level Co-operation between health and education sectors at the cantonal level
Regulatory policy	Mandatory medical check-up for school admission, no attestation requested	Mandatory medical check-up for school admission, attestation requested
Services		
Main vaccinators for children	Often general practitioners (pediatricians 0.8/10,000 inhab.)	Most often pediatricians (1.7/10,000 inhab.). Mainly in school for adolescents.
School health services	Vaccinations rarely provided at school, and neither HBV nor HPV	All provide vaccinations at school, including HBV and HPV
School vaccination staff	Rarely school nurses are employed by the canton to vaccinate	Frequently school nurses are employed by the canton to vaccinate
Vaccination status check-up	Vaccination status not systematically checked at school	Vaccination status often systematically checked at school
Information		
Website of the canton	3–4 clicks necessary to find information on vaccinations, fragmented, not up-to-date	Easy to find information on vaccinations, in 2 clicks, structured (3 of 4 cantons)
Information of parents	Rarely provided systematically through school	Provided systematically through school in all
Information of adolescents	Rarely provided in the classroom	Frequently provided in the classroom

LVC, low vaccination coverage cantons (Obwald, Schwyz, Thurgau and Zug); HVC, high vaccination coverage cantons (Basel-Landschaft, Fribourg, Geneva and Vaud)

Table 4
Characteristics of adolescent and parent respondents.

	LVC N = 21	HVC N = 21
Number of adolescent respondents	18 (10 female, 8 male)	10 (6 female, 4 male)
Number of parent respondents	3 (of males)	11 (6 of females, 5 of males)
Age of adolescents in years (mean and range)	17.5 (16.2–19.7)	17.9 (16.2–19.7)
Number with migration background	3*	8**
Adolescents reported being vaccinated against HBV	12/21 (57%)	14/21 (66%)
Adolescent girls reported being vaccinated against HPV	1/10 (10%)	7/12 (58%)
Adolescents vaccinated against HBV according to vaccination cards received	4/7 (57%)	17/19 (89%)
Adolescent girls vaccinated against HPV according to vaccination cards received	NA	8/12 (66%)

LVC, low vaccination coverage canton (Obwald, Schwyz, Thurgau and Zug); HVC, high vaccination coverage canton (Basel-Landschaft, Fribourg, Geneva and Vaud); HBV, hepatitis B virus; HPV, human papillomavirus; NA, not available.
* Swiss nationality with father of Iraqi, Vietnamese or Italian origin;
** One each of Filipino, Spanish and Algerian nationality, others Swiss with either father or mother of Italian, French, German, Portuguese or English origin.

tonal physician, department heads or a steering committee. Only one LVC has a comparable level of co-operation with a working group involving the cantonal physician. In the 3 other LVCs the implementation and financing of school health is entirely under the responsibility of the municipalities.

A medical examination is required for school admission in 3 of the HVCs, documented either by a doctor of parental choice or a school doctor. The 4th HVC provides a visit to a school nurse on enrolment in the school. A medical examination is also compulsory before starting school in 3 LVCs, but documentation is required in only in one of them. One LVC without school doctors provides a voucher to pay for the pre-school medical examination, and in the 2 others parents can choose between their doctor and the school doctor. In the 4th LVC, most children opt for examination by the school doctor. Review of vaccination status is explicit in the guidelines for school medical examinations in all cantons except one LVC canton.

3.1.2. Vaccination service delivery

In the 4 HVCs adolescents are mainly vaccinated for HBV and HPV by school health services, of which 2 also offer other booster and catch-up vaccinations. In contrast, only one LVC has a school vaccination programme, which does not provide HBV and HPV vaccines. In 2 other LVCs, school doctors may vaccinate in the course of school medical visits but it is not the rule.

In 2 HVCs school nurses employed by the canton regularly work in schools and organize the vaccination sessions with the school doctor; in another HVC it is organized by the municipalities, and some employ a school nurse; in the 4th HVC a nurse employed by the canton goes to schools for HBV and HPV vaccinations. In one LVC, two school nurses employed by the canton organize vaccinations with school doctors. School health staff review the vaccination status for all students in 3 HVCs and in 1 LVC.

Vaccinations by private practitioners are typically arranged by parents. The main out-of-school vaccinators for children are pediatricians in 4 HVCs and 2 LVCs. In rural areas of one HVC and in two LVCs with relatively fewer pediatricians, children are mainly vaccinated by general practitioners. The average density of pediatricians is 1.7/10,000 inhabitants in HVCs and 0.8/10,000 in LVCs, and the national average is 1.2/10,000 (source: Federal Statistical Office 2015).

3.1.3. Information access and dissemination

Systematic information about recommended vaccinations is provided for parents in all HVCs and in 2 LVCs. In 3 HVCs structured information with links can be found easily on the canton's

Table 5
Views of the authorities, of clinicians and of parents and adolescents.

	LVC	HVC
Cantonal health authorities		
Government role and responsibility	Public interventions should remain as limited as possible, they interfere with autonomy	Public interventions reinforce public acceptance
	Ensuring access to vaccination is responsibility of the private doctors	Ensuring access to vaccination is fully part of school activities, subsidiary to the private sector
Vaccine acceptance and hesitancy	Population considered critical, defensive towards what comes from the authorities	Population considered favourable, has confidence in the authorities and sense of collective responsibility
Adolescent vaccinations	Important, but more clearly for HBV; for HPV national and international priorities are less clear, more difficult to convey the meaning and importance	
Clinicians		
Responsibility and commitment	More passive	More engaged
	Responsibility to reach the population lies primarily with doctors, state has a role in disseminating information	More recognition of responsibility of state in ensuring that population is reached, including by informing doctors of recommendations
Vaccine acceptance and hesitancy	Population more critical; appreciate information from school health but prefer vaccination by private doctor	Wider acceptance by the population; parents appreciate vaccination at school
HBV vaccination	Recommend it but regard adolescents as feeling unconcerned	No doubts about its benefit
HPV vaccination	Favourable, but more data would be needed; doesn't prevent all cancers; rarely see diseases prevented by the vaccine; parents embarrassed by the sexual associations	
Parents and adolescents		
Priority and awareness	More individualistic and selective	More collective and comprehensive
	Doctor is main source of information; other sources count as well	School and doctor are main sources of information
Vaccine acceptance and hesitancy	Believe it is better to rely on one's own defences; concerned about how we know vaccines work	Preferable to protect oneself if possible; would like to know how vaccines work
HBV vaccination	Severity of disease recognized; weakness of immune system considered a risk for acquiring. Little knowledge about vaccine. Acceptability linked with perceived risk	Unsure about disease and its severity. Little knowledge about vaccine. Acceptability linked with perceived risk
HPV vaccination	Vaccine regarded as not yet investigated well enough; adverse effects; doubts about usefulness	Good to be able to reduce the risk of a cancer; doubts because of rumours about harms of vaccine; uncertain about its usefulness

LVC, low vaccination coverage cantons (Obwald, Schwyz, Thurgau and Zug); HVC, high vaccination coverage cantons (Basel-Landschaft, Fribourg, Geneva and Vaud).

website with 2 clicks under the heading "health". In LVCs, however, it takes 3 to 4 clicks to find information on vaccinations, which appears under various headings: "cantonal physician's office", "communicable diseases" or "school health". Structured overviews are lacking; information is fragmented and out-dated, and search engines locate few documents. Parents receive letters about vaccinations through the school in all HVCs and in the one LVC that provides vaccinations in the schools. In one LVC without school doctors, parents receive information about health issues, including recommended vaccinations, on school entry. In 2 other LVCs information that is provided varies according to the municipality doctor or school doctor.

Information about adolescent immunizations in the classroom is systematically provided in 3 HVCs, either in a sexual education curriculum or in a session by the school nurse or by the school doctor. In the 4th HVC and in one LVC, such information is provided only on request in the context of discussion of a self-administered health questionnaire. In the other LVCs no information on immunizations is in the curriculum.

3.2. Awareness, priorities and practices

Awareness, priority and practices of health authorities, clinicians and community adolescents and parents regarding adolescent vaccines are summarized in Table 5.

3.2.1. Cantonal health authorities

In HVC cantons health authorities regard vaccinations as a major responsibility and indicate that public interventions increase public support. The LVC authorities acknowledge the importance of vaccinations but deemphasize the role of school-health interventions. In HVCs, vaccination is considered a component of school activities complementing personal doctor-patient relationships. Thus, health authorities also endeavour to engage clinicians with information and training to ensure the priority of vaccines. LVC authorities emphasize the role of healthcare providers in the community, indicating concern that they should not interfere with private community-based services. They also hold physicians responsible for keeping themselves informed. In one LVC, the cantonal authority explained that letters from the schools about vaccinations are regarded by parents as interference with their parental autonomy.

HVC health authorities, on the other hand, consider the population of their cantons to be 95% favourable to vaccination, confident in health authorities and accepting of a sense of collective responsibility for vaccination. An HVC authority said that students whose parents were opposed typically accept vaccination when they can decide for themselves if the rationale has been explained to them. In LVCs authorities estimate that 10% of the population is opposed to vaccinations and in some cases vociferous in their objections. The LVC populations are described as conservative, influenced by religion and confident in the protection afforded by their mountainous environment and their healthy lifestyle. They are considered self-reliant and resistant to policies imposed by their own canton, the federal government and international bodies. The account of an LVC health official illustrates the point:

> "I think basically the attitude of the people here towards vaccinations is rather critical, because they consider themselves a healthy mountain people... We are not concerned. We live in our closed valley, and what happens beyond it doesn't actually concern us at all."

Although the importance of adolescent immunizations is acknowledged by the authorities of both groups, in one LVC information on HPV vaccine is regarded as too sensitive to be provided in the school and rather a matter for bilateral discussion with a private doctor.

3.2.2. Clinicians

Doctors in both groups of cantons acknowledged the importance of vaccines, especially the recommended basic vaccinations. HVC doctors regarded immunization as a major activity and responsibility, and they indicated their commitment to providing information and overcoming refusals. LVC clinicians were more passive, acknowledging their responsibility to inform patients about vaccinations but less likely to question refusals. One physician in each group indicated concern about the possibility that some vaccines may be overemphasized, possibly influenced by financial interests.

Doctors in both groups of cantons accepted the rationale of HPV vaccination but acknowledged a need for clearer evidence that it will prevent cervical cancer in 10–20 years. They indicated concern that the HPV vaccine may have been introduced too soon in the absence of such evidence. As a practical matter, they could not speak authoritatively from their own clinical experience. Doctors noted that parents seemed embarrassed by discussion of HPV transmission through sexual activity, believing that their child is too young for such considerations. LVC doctors also explained that parents were sceptical of the HPV vaccine because it is offered at an age when they do not want to hear about sexually transmitted diseases affecting their children.

3.2.3. Adolescents and parents

Teens and parents in HVC cantons appreciated vaccination information from the school. Some respondents also recognized the role of the government and school because of the collective value of vaccination, protecting others from contagious diseases and preventing epidemics. A mother explained that if it were not offered at school, it would be too easy to forget about it. The doctor is the most trustworthy person in case of questions. Some respondents also valued official guidance even without requiring information to justify it. In LVC cantons, some respondents reported never having received any information apart from being advised to get vaccinated. They desired information, mainly from their doctor, but they valued information from other sources, including from the school or the government. They regarded both as having a legitimate role in encouraging vaccinations by providing information and free services, so that everyone receives the same information, but without imposing requirements. Without that, one parent explained, they would not know or would only have a vague idea about when the next vaccination is due. Though they might have a vaccination record, they nevertheless relied on a doctor's advice.

Among parents who valued vaccination, a mother explained that it is easier to take responsibility for side effects of the vaccine than for complications of the disease. In HVCs we were told, "If there is a way to avoid a disease, I do it," and "It is better to prevent than to regret." In the LVC cantons, the general opinion was also that vaccinations make sense, though more likely qualified as primarily for severe illnesses and for people at risk. A weak immune system was a frequently mentioned cause of illness. In LVCs, however, concerns were noted that too much vaccination may reduce one's natural capacity to overcome diseases. But we also heard never-vaccinated adolescents in LVCs say they would get vaccinated to avoid being sick and infecting others. Both adolescents and parents in HVCs were interested in information about the rationale for vaccines, confirmation of their necessity and how the vaccines worked. In LVCs, respondents were especially eager to know which vaccines were most important.

Adolescents in HVCs appeared more likely to be vaccinated for HBV because they were informed at school. In HVCs, however, there were also some doubts about HPV vaccine regarding rumours of risks and uncertainties about the usefulness. In LVCs, we were also told that the HPV vaccine has not yet been adequately investigated, that it has side effects, and there were doubts about whether it is useful. Some of the adolescent girls told us they were vaccinated only "because others did."

4. Discussion

Our study has identified important differences in contexts of vaccination coverage across cantons in Switzerland with reference to both health system and socio-cultural factors. More collectivist and engaged orientations in HVCs and more individualistic and disengaged orientations in LVCs were notable. These differences are particularly relevant for adolescent immunisations, but likely also for all recommended vaccinations as variations of vaccination coverages across cantons show similar trends. Furthermore, the understanding of socio-cultural factors among policy makers may also influence health systems and vaccination policies. The involvement and vaccination activities implemented by cantonal health authorities reflect their perceptions and assumptions about their population's needs and preferences. Policy makers may justify limited priority of vaccination policy and action by projecting their own ideas and attributing them to community views. Although school-based vaccination programs are known to improve HPV vaccination coverage in Switzerland and globally [11,12], some LVC policy makers suggest these programs may not be welcome in their canton.

Despite relevant questions regarding community concerns about childhood vaccination and vaccine hesitancy [13], our findings suggest that policy makers in LVCs may overestimate community concerns and hesitancy regarding HBV and HPV vaccines. Policy maker hesitancy, which limits vaccine coverage, may result from a misreading of exaggerated community hesitancy. Our findings show that healthcare providers and community stakeholders regard these actions as appropriate so long as personal preferences are respected, especially if the rationale for use is explained.

4.1. Health system factors

Distinguishing features of HVC cantons vis-à-vis LVC cantons include better cooperation of educational and health sectors and between public health authorities and private doctors. System-wide provision of information about recommended vaccinations through schools to parents and students, and systematic checking of vaccination status in the schools improve vaccination coverage [11,14]. Studies in low and middle income countries suggest about 45% of vaccination shortfalls are related to immunization delivery systems [15]; our findings show the importance of health system factors in Switzerland, a high-income country, as well [16]. Several findings from a national survey of Swiss women on HPV vaccination provides additional evidence for that: it shows that uptake is higher in regions with school vaccination programmes; most vaccinations of 11–14-year-olds are done in school; the main reason for being vaccinated at that age is a recommendation through the school or from a school doctor; and the main reason for not being vaccinated is lack of information [17,18]. Although access to affordable vaccines may be a significant limitation in low- and middle-income countries, access to information about vaccines is also important and perhaps critical in high-income countries [15].

Access to information may even be a limiting factor for health professionals, especially among general practitioners. Studies in Switzerland and Belgium have shown that non-pediatricians are less likely both to follow the official immunization recommendations and to use the more recently licensed vaccines for their own children than pediatricians are [19–21]. The higher density of pediatricians in HVCs is therefore likely to contribute to better coverage. Experience in a nurse vaccination programme that

improved immunization for HBV in a Swiss HIV Clinic suggests the value of an integrated multidisciplinary team in health systems [22]. Nurses are allowed to vaccinate under the responsibility of a medical doctor. Study of pediatricians and family doctors before the introduction of universal HBV adolescent vaccination in Switzerland had previously noted needs for more information about the epidemiology of infection, and the effectiveness and safety of the HBV vaccine [23].

4.2. Socio-cultural context

Community members in LVCs appear less likely than those in HVCs to accept vaccinations as a matter of course; they may pose more questions, take a more selective approach and want to know more about their individual risks rather than collective benefits of vaccinations. As in other Swiss studies [4], we found they regarded risk of disease more as a personal matter of weakness of an individual's immune system, and some suggested that over-vaccination may itself compromise one's ability to defend against disease. They also wanted multiple sources of information before taking a decision. This scepticism of parents and adolescents matches perceptions from LVC health authorities, who regarded immunization as a private issue. Nevertheless, the view suggested by these health authorities that the population opposes information from health authorities and that letters distributed by schools would be regarded by parents as unwelcome interference with their autonomy was not supported by findings from community members we interviewed. Parents and adolescents wanted more information and valued government services so long as vaccinations were not made mandatory.

The value of informing adolescents in sexual health curricula about vaccines for diseases that are sexually transmitted was recognized in 1998 when the recommendation for universal adolescent HBV vaccination was introduced and subsequently for HPV vaccination for girls [12,24,25]. This has been somewhat less problematic for HBV because there are other well-recognized modes of transmission. Although the need for and the challenges of clear information about the value of vaccination before sexual activity begins are well-recognized [26], we found that parents are more willing to consider vaccination against a sexually transmitted infection than previously anticipated [27].

Other studies in Switzerland show that hesitancy and absence of school-based vaccination limit HPV vaccination coverage [17,28]. Our findings suggest that in those cantons where vaccine hesitancy was identified, it appeared to be malleable. Doctors explained that teenagers and parents who might initially be reluctant to vaccinate could eventually be convinced. Consequently, it is important that effective strategies should engage communities, rather than yielding to presumed intransigence and thereby perpetuating under-immunization. Community respondents expressed their desire for better access to information, indicating that relevant evidence-based information affected their decision-making.

These findings contribute to a more nuanced and practical understanding of hesitancy, both in the community and among health professionals [5,16,29], and are likely to be relevant for acceptance and demand not only for HBV and HPV but also for other vaccines. In 2017 the Swiss Federal Council adopted a national immunization strategy developed in cooperation with the cantons and other stakeholders. It is a framework strategy planning several actions aimed at engaging all involved stakeholders and improving access to adequate information and vaccinations [30].

5. Limitations

This study covers 8 of Switzerland's 26 cantons with a limited number of qualitative interviews. Only one healthcare provider physician per canton was interviewed and, although we planned to interview as many parents as adolescents in each group of canton, fewer parents were available for interviews in the LVCs. There were more community participants with migration background in HVCs, although the relevance of that is uncertain. Additional consideration of socio-cultural and structural features of the French and German-speaking cantons would also be useful. The clarity and consistency of findings in the comparison groups was notable, however, even though not definitive.

6. Conclusion

Differences in the structural links between private and school health systems and the positive impact on vaccination of adolescents for HBV and HPV were identified in our study of HVC and LVC cantons of Switzerland. LVCs were notable for less government involvement in vaccination issues, more autonomy of municipalities for school health, lower density of pediatricians, less information about these vaccines, greater emphasis on individual rather than government responsibility for vaccinations and for anticipated community hesitancy. Doctors in HVCs more actively advocated for vaccines. Community views in HVCs were more collectivistic and reliant on schools as a source of information than in LVCs. The relatively higher priority of community autonomy and parental individualism, with more passivity in promoting vaccination by both policy makers and clinicians in LVC cantons, suggests a relatively coherent pattern of social and cultural values in the three stakeholder groups. Findings, however, show that views of policy makers in LVCs may overestimate community hesitancy and underestimate the desire for official information about these vaccines.

Effective adolescent vaccination coverage relies on complementary roles and responsibilities of policy makers, clinician-vaccinators and communities. Findings indicate the importance not only of improving awareness in all three groups, but also of ensuring that awareness is linked through a politically sensitive decision-making process to priorities and practices that improve vaccine acceptance, access and coverage. Further research based on this stakeholder framework, integrating qualitative and quantitative survey designs, should contribute to guide policy and action for better adolescent vaccination coverage.

7. Authors' contributions

The research team was led by VMS, who is a pediatrician and specialist in infectious diseases and vaccinology. She also leads a team in charge of infection control and vaccination programmes at the Swiss Federal Office of Public Health. MGW guided development of the study. He is a health social scientist with experience in qualitative and integrated research methods used in studies of vaccine acceptance and demand, and he was a member of WHO's Immunization and Vaccine related Implementation Research Advisory Committee (IVIR-AC) for eight years through December 2018.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We gratefully acknowledge Professor Marcel Tanner, former director of the Swiss Tropical and Public Health Institute (SwissTPH) in Basel, for arranging institutional support. Elisabeth Zemp,

Constanze Pfeiffer, Christian Schätti Zundel, Xavier Bosch-Capblanch and Don de Savigny of SwissTPH advised and commented on the scientific work; Joseph Giduthuri programmed the interviews for administration with Android tablet devices running Open Data Kit (ODK) software and Meike-Kathrin Zuske, Sabrina Doering, Alessandra Fleurent and Lara Courty conducted interviews. We thank all participants in the study and cantonal officials who helped enrol them and enabled the study to proceed.

Funding

This work was supported by a sabbatical scholarship from the Swiss School of Public Health (SSPH+).

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