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Accepted manuscript

Promoting HPV vaccination at school: a mixed methods study exploring knowledge, beliefs and attitudes of French school staff

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Accepted manuscript

Abstract

Background: HPV vaccine coverage in France remained lower than in most other high-income countries. Within the diagnostic phase of the national PrevHPV program, we carried out a mixed methods study among school staff to assess their knowledge, beliefs and attitudes regarding HPV, HPV vaccine and vaccination in general, and regarding schools' role in promoting HPV vaccination.

Methods: Middle school nurses, teachers and support staff from four French regions participated between January 2020 and May 2021. We combined: (i) quantitative data from self-administered online questionnaires (n = 301), analysed using descriptive statistics; and (ii) qualitative data from three focus groups (n = 14), thematically analysed.

Results: Less than half of respondents knew that HPV can cause genital warts or oral cancers and only 18% that no antiviral treatment exists. Almost 90% of the respondents knew the existence of the HPV vaccine but some misunderstood why it is recommended before the first sexual relationships and for boys; 56% doubted about its safety, especially because they think there is not enough information on this topic. Schools nurses had greater knowledge than other professionals and claimed that educating pupils about HPV was fully part of their job roles; however, they rarely address this topic due to a lack of knowledge/tools. Professionals (school nurses, teachers and support staff) who participated in the focus groups were unfavourable to offering vaccination at school because of parents' negative reactions, lack of resources, and perceived uselessness.

Conclusions: These results highlight the need to improve school staff knowledge on HPV. Parents should be involved in intervention promoting HPV vaccination to prevent their potential negative reactions, as feared by school staff. Several barriers should also be addressed before organizing school vaccination programs in France.

Keywords: Human Papillomavirus, Vaccination, Knowledge, Attitude, Health Education, Middle school professionals, School-based immunization programs, Mixed method study.

Accepted manuscript

Background

Human papillomavirus (HPV) infection is the most common viral infection of the reproductive tract, and a major public health issue [1, 2]. Vaccination is nowadays the most effective strategy to prevent it [2]. As in most high-income countries, HPV vaccination has been included in French vaccination schedules since 2007, initially for girls [3]. In December 2019, the National Authority for Health expanded this recommendation for boys [4]. This recommendation has then been implemented in the French vaccine schedule (and HPV vaccine reimbursed by the Health Insurance for boys) from January 1, 2021 [5]. HPV vaccination is now recommended for all adolescents aged 11-14 years. Despite various efforts by French authorities to promote HPV vaccination these past ten years, vaccine coverage (VC, 24% among 16-year girls in 2018) has remained far lower than in most other high-income countries [3, 6, 7]. In this context, the PrevHPV national research program on the acceptability of HPV vaccination was launched in 2019. It is conducted by a consortium of eight French teams (see list in Additional Table 1) and includes: (i) a “diagnostic” phase, to explore barriers and facilitators to HPV vaccination among different population groups; (ii) a “co-construction” phase, to design a multicomponent intervention to improve HPV VC; and (iii) an “experimental” phase, to evaluate the effectiveness, efficiency and implementation of this intervention.

As part of the PrevHPV program, strengthening the role of schools in promoting HPV vaccination has been identified as a promising way to improve VC [8, 9]. Schools occupy a great part of most adolescents’ life and could play a significant role towards vaccination, from education to vaccine administration [10]. There is currently no nationwide school-based vaccination program in France unlike in most European countries with high HPV VC (e.g., the UK, Scandinavian countries) [3]. Usual pathway to access vaccination in France requires that patients make an appointment with a physician to get the vaccine prescription, go to a

community pharmacy to obtain the vaccine, and finally make another appointment for its administration [3]. Regarding education, French pupils learn some basics about immunization and vaccines between grades 7 and 9 as part of the life science curriculum [11]. Pupils should also benefit from three annual sessions (from grades 6 to 9) on sex education. However, these sessions cover many different aspects (biological, psycho-emotional, juridical and social) and all sexual transmitted infections (particularly HIV) [12].

Strengthening the role of school in promoting HPV vaccination require buy-in from all school stakeholders, including teachers, school health staff (generally a part-time nurse in France), administrative and support staff [10]. Together with other barriers (e.g., limited school and vaccination program resources, competing priorities within the school setting, logistical issues), school staff's poor knowledge about HPV and negative perceptions regarding the HPV vaccine (e.g., concerns about its safety and efficacy) could impair the delivery and effectiveness of school-based HPV vaccination programs [13, 14]. Previous studies conducted abroad (e.g., US, New-Zealand, Italy) have reported a lack of knowledge about HPV among school staff [15–17], including school nurses [18, 19], but French data are lacking to date. Due to the high level of vaccine hesitancy among the French general population [20] as among nurses [21], and controversies that occurred in France around previous vaccination campaigns in schools (e.g., Hepatitis B in the late 1990s [22], influenza A(H1N1) epidemic in 2009 [23]), exploring French school staff knowledge and perceptions about HPV vaccination would be worthwhile.

In this context, as part of the diagnostic phase of the PrevHPV program, we carried out a mixed methods study among school staff to assess their knowledge, beliefs and attitudes regarding HPV, HPV vaccine and vaccination in general, and regarding the role of school in promoting HPV vaccination. The aim was to identify barriers and facilitators, as well as needs

of the different school professionals who could be involved in the development and the implementation of interventions promoting HPV vaccination in French middle schools.

Methods

Design and setting

We conducted a concurrent mixed methods study [24] combining quantitative data coming from self-administered online questionnaires and qualitative data coming from focus groups. Mixed methods studies are used to assess frequency of outcomes and to have also an in-depth understanding of the underlying processes/experiences [24].

This study was conducted among school staff (nurses, teachers and support staff) from middle schools (pupils typically aged 11-14 years, corresponding to grades 6-9 in the US educational system). We selected schools located in four regions (out of 13 regions in mainland France), hereafter called “study regions”, where the PrevHPV teams were settled and representing a diversity of geographical, demographic and socioeconomic contexts as well as HPV vaccine coverage rates [25]: Ile-de-France (HPV VC among 16-year girls in 2018: 19%), Auvergne-Rhône-Alpes (23%), Grand Est (29%) and Pays de la Loire (30%). The study was planned to be conducted from January to April 2020 but was interrupted due to the Covid-19 pandemic and the schools’ closure in March 2020 in France; it lasted until May 2021. Regarding the quantitative data, we planned to collect 300 questionnaires, a sample size calculated to obtain estimates on knowledge, beliefs and attitudes (expected splits about 70:30 [26]) with a 5% precision and considered feasible in terms of the recruitment. Regarding the qualitative data, we planned to perform three to six focus groups (five to eight participants to each) depending on data saturation [27].

This study was part of study *C19-54* conducted under the responsibility of Inserm. It was granted approval by Evaluation Committee of Inserm, the Institutional Review Board (IRB00003888, IORG0003254, FWA00005831) on 10 December 2019. All study participants

gave their informed non opposition to participation, in line with French legal guidelines. This study follows the COREQ (COnsolidated criteria for REporting Qualitative research) and the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) reporting guidelines (see completed checklists in Additional Tables 2 and 3).

Participants' recruitment

First, using data from the Ministry of National Education, we selected middle schools located in the study regions to ensure a balanced distribution of urban/rural areas, public/private schools, and, public schools belonging to a high-priority educational network (high level of social deprivation)/others. Then, we contacted the head of each middle school by email/phone to ask him/her to participate in the study. As we aimed to recruit 30 to 40 middle schools, we first selected 80 schools (expected acceptance rate: 50%) and planned to select additional schools if needed.

Heads of the schools who accepted to participate informed all school staff of the study and sent them the link to the online questionnaire (expected duration: 15 min). Participation of the school staff in the online quantitative survey was voluntary and not compensated.

School staff interested in participating in a focus group were invited to contact the research team by email. The participant information sheet attached to the invitation stated that participants to the focus groups would be offered a 20€ shopping voucher.

Data collection

Quantitative data: self-administered online questionnaire

The questionnaire was administered online using LimeSurvey software. It was designed by the PrevHPV multidisciplinary study group based on the existing literature on determinants of HPV vaccination [26, 28-30] and previous studies among school staff [16, 17]. It included closed-ended questions on (Additional Document 1):

- knowledge about HPV infections: 10 items (*yes, no, unsure*) and one item on whether cervical cancer is due to a persistent HPV infection (*yes, no, some cervical cancers only, unsure*);
- knowledge about HPV prevention and vaccination: 12 items (*yes, no, unsure*);
- psychological antecedents of vaccination, assessed using the long-version of the 5C (Confidence, Complacency, Constraints, Calculation and Collective responsibility) scale [31]: 15 items 7-point Likert scale (from 1=*strongly disagree* to 7=*strongly agree*);
- personal vaccination status and attitudes towards HPV vaccination: being vaccinated against HPV (*yes, no, unsure*) and, if *no* or *unsure*, acceptability to receive HPV vaccine if it was possible and recommended for them (5-point Likert scale from 1=*strongly disagree* to 5=*strongly agree*); appropriate period to propose HPV vaccination among pupils (*before middle school, grade 6, grade 7, grade 8, grade 9, never*).

We also collected data on demographic personal and professional characteristics (age, gender, profession) and practices, i.e. the frequency (*always, often, sometimes, never*) they discuss with pupils each of nine different public health topics, including vaccination.

Qualitative data: focus groups

The focus groups followed an interview guide (Additional Document 2) composed of open-ended questions exploring participants' (i) knowledge about HPV and HPV vaccination; (ii) attitudes, preferences and barriers regarding HPV vaccination; and (iii) views regarding the role of school in promoting HPV vaccination. The interview guide was developed through an informal consensus by the study group, based on its expertise in qualitative research regarding attitudes towards HPV vaccination and results from the literature.

We planned to conduct face-to-face focus groups in some selected middle schools but had to propose also one virtual meeting due to the Covid-19 pandemic (expected duration: 1h30). Each focus group was conducted by two members of the study group (MB, M.Soc.S.,

JB, Ph.D.; and/or CJ, Ph.D.) trained in qualitative research interviews. After an oral consent, all the focus groups were recorded and transcribed.

Data analysis and interpretation

Descriptive statistics were used to describe characteristics of the participants and their responses to the online questionnaire. Quantitative variables are presented as means and standard deviations and categorical variables as numbers and percentages. Knowledge, beliefs and attitudes are presented overall and by profession which are compared by using Chi2 or exact Fisher tests and ANOVA for respectively categorical and quantitative variables. A p value of <0.05 for two-sided tests was considered significant. All analyses were performed with SAS V.9.4 (SAS Institute, Cary, North Carolina, USA).

A thematic analysis was used to analyse transcripts of the focus groups. An analysis grid was developed by members of the study group (MB, SB, CJ and AG). Each theme and subtheme were discussed until a consensus was reached. Each focus group was then coded according to this grid.

Finally, this mixed approach used a merging data approach [24] to combine the quantitative data in the form of numeric information with the qualitative data in the form of texts for the main themes of the study.

Results

Participants' characteristics

Three hundred and one participants from 17 different schools completed the online questionnaire (average number of participants per school: 18 ± 26 ; average duration: 10 ± 6 min). About half of them were teachers and one third school nurses. Most (84%) respondents were women and 49% were older than 45 years (Table 1). To reach this sample size, we contacted a total of 83 middle schools. Heads of 35 (42%) schools accepted to participate and then to forward to their staff the link to access to the online questionnaire (see characteristics

in Additional Table 4); in 18/35 schools, no school staff completed the questionnaire. Heads of 31 schools refused (main reasons: too heavy workload, especially in the context of the Covid-19 pandemic), and 17 did not answer.

Three focus groups (14 professionals) were conducted (duration: 50 min to 2 hours). Most participants (11/14) were women; 5 were school nurses, 4 teachers and 5 support staff (Table 1).

Knowledge, beliefs and attitudes towards HPV infections and vaccination

Knowledge about HPV infections

Most (80%) respondents to the questionnaire knew that HPV is a sexually transmitted infection that concerns both female and male (Table 2). Less than half knew that HPV can cause genital warts or oral cancers and are responsible for all cervical cancers. Only 18% knew that there is no antiviral treatment against HPV infections.

Participants to the focus groups felt very poorly informed about HPV (Table 3 and Additional Table 5), that they often perceived as an infection concerning mainly females. Participants often cited their own general practitioner (GP) as their main source of information about HPV, but media was also mentioned.

Knowledge, beliefs and attitudes towards HPV vaccination

Almost 90% of the respondents to the questionnaire knew the existence of the HPV vaccine and 56% knew that it is recommended for heterosexual boys in France (Table 4). Regarding HPV vaccine efficacy and safety, 76% of respondents knew that it protects against HPV-related cancers, but far fewer knew protection against genital warts; 56% were unsure about its safety or thought that it has many side effects. Only 21% were aware that condoms do not protect against HPV (Table 4). Ninety-six percent declared to be unvaccinated against HPV (for 82% because the vaccine did not exist at the time they were 11-14 years old).

Participants to the focus groups were also aware that a vaccine against HPV exists but had some misunderstandings about its schedule, especially the reason why it is recommended before the first sexual relationships and for boys (Table 3 and Additional Table 5). Some participants reported doubts about vaccine efficacy because it protects only against a few types of HPV; some had heard about side effects in the media or wondered whether there is enough information about vaccine safety.

Psychological antecedents and perspectives on vaccination in general

Respondents to the questionnaire showed high confidence in vaccination and had positive attitudes towards collective benefits of vaccination (mean scores >5, on a scale of 1-7).

Barriers to vaccination for themselves (complacency and perceived constraints) were low with mean scores <2.5 (Additional Table 6).

The importance of vaccination for public health was also reported in focus groups. Some participants mentioned past health controversies that occurred in France around vaccination (e.g., Hepatitis B school vaccination campaign in the late 1990s suspended by the French government after suspected cases of multiple sclerosis [22], management of the A(H1N1) epidemic in 2009 [23]) and wondered about skills of French authorities in that field. Participants perceived a high level of vaccine reluctance among the French general population (Table 3 and Additional Table 5).

Differences in knowledge, beliefs and attitudes by profession

The questionnaire results showed greater knowledge about HPV and HPV vaccination among nurses (Tables 2 and 4). Nurses also had a higher level of confidence in vaccination in general (Additional Table 6).

Nurses learned about HPV during their initial training but regretted not receiving any other information as part of their work (even during training about sex education or meetings

with other school nurses). They get new information through personal research or the media (Table 3 and Additional Table 5).

The role of school in promoting HPV vaccination

Practices and target population

The questionnaire results showed that vaccination was the public health topic least frequently discussed at school, including by nurses (55% of nurses discussed it often or always with pupils vs 90% for screens' addiction, diet and sexuality, the most commonly topics discussed, Additional Table 7). For the respondents, grade 8 (age: 13-14 years) was more appropriate to propose HPV vaccination than grade 6 (age: 11-12 years) (Additional Table 8).

Many participants to the focus groups stated it is very complicated to discuss about HPV vaccination with young pupils aged 11 because of the link with sexuality (Table 3 and Additional Table 5).

The role of school in informing/educating pupils

In the focus groups, nurses claimed that educating pupils about HPV was fully part of their job roles (Table 3 and Additional Table 5) even if some acknowledged that they never (or only briefly) talk about HPV during sessions about sexuality, mainly because of a lack of knowledge/tools.

Views were more mixed among teachers and support staff. Some felt that it should be the role of school to provide such education and others were more reluctant because they feared parents' reactions or substantial additional workload. Those supporting the involvement of schools in education about HPV perceived that only nurses, teachers in life sciences or external experts were legitimate to deliver such education.

The role of school in offering access to HPV vaccination

There was some agreement between professionals that offering HPV vaccination at school does not fall within the schools' role (Table 3 and Additional Table 5). Perceived barriers

related to parents' negative reactions, stigmatization of vaccinated/non-vaccinated pupils by their peers, and lack of human and material resources (e.g., no physician in schools). Some participants also argued that vaccination is a personal matter that should involve the GP and that other places are available in France to get vaccinated. Participants acknowledged that vaccination at school already occurred in the past in France (e.g., when they were young for the vaccine against tuberculosis, for hepatitis B in the late 1990s or influenza A(H1N1) in 2009) but were not favorable to it, except in exceptional situations like the current Covid-19 pandemic.

Discussion

This mixed methods study showed a lack of knowledge towards HPV among staff from French secondary schools. A majority of respondents doubted about HPV vaccine safety and some misunderstood why it is recommended before the first sexual relationships and for boys. Schools nurses had greater knowledge than other professionals and claimed that educating pupils about HPV was fully part of their job roles. There was some agreement between professionals that offering HPV vaccination at school does not fall within the schools' role. Perceived barriers related to parents' negative reactions, lack of human and material resources, and perception that other places than schools exist in France to get vaccinated.

Study's strengths and limitations

This study adds evidence to the few quantitative studies on school staff's knowledge, beliefs and attitudes towards HPV vaccination [15–19] and, to the best of our knowledge, is the first French study on this topic. Its mixed methods design allowed us to estimate the prevalence of the main outcomes (e.g., knowledge, beliefs, attitudes) and to explore their sources of information and the barriers they perceived regarding HPV education and vaccination at school. This study has also some limitations. First, the multi-level recruitment process (acceptance by the head of the school then by school staff) probably induced a selection bias.

Respondents to the quantitative survey are likely to be more interested in health topics than non-respondents and they may be more favorable to HPV vaccination. Our results may thus overestimate actual French school staff's knowledge and positive beliefs towards HPV vaccination due to selection bias. However, the proportion of respondents who doubted about vaccine safety in our study (56%) is close to that found among a representative sample of French parents of girls aged 11-19 in 2016 (60%) [26]. Besides, as volunteers to participate in the focus groups had to contact the research team, they were likely to be particularly interested in the HPV topic and to have opinions that cannot be generalized to all school professionals. However, we found some variability in participants' opinions. Our sample also included mostly women, which is consistent with sex balance in such population groups in France (teachers and school nurses) [32]. Finally, we considered teachers as a one group, while those teaching life sciences probably have better knowledge about HPV and vaccination than the others. However, our sample size prevented us to test this hypothesis.

Implications for the PrevHPV program and for public health

Consistent with findings from previous studies conducted in other countries [15–19], we found a lack of knowledge about HPV and some misunderstanding about HPV vaccination among school staff in France. As better knowledge is associated with more positive attitudes towards HPV vaccine [33], improving school staff access to evidence-based HPV and vaccine information (e.g., *via* eLearning) should be a prerequisite for educating pupils on this topic. Beyond knowledge, improving school staff's awareness of their influential position regarding pupils' and parents' attitudes is worthwhile [33]. As expected, school nurses had better knowledge about HPV and more positive attitudes towards the role of school in health education than teachers/school staff. However, French school nurses are often responsible for a large area including several schools, and work only part-time in each middle school. Thus, efforts should be made to improve knowledge and attitudes of school staff who have more

frequent contacts with pupils. In particular, they should be better informed about the role that school has to play in health education as part of the official “educational health pathway” included in “education for citizenship” [34].

HPV school-based vaccination programs have shown to be effective to achieve high vaccine coverage [3] but school staff in our study had somewhat unfavourable attitudes towards such strategy. Perceived barriers included the lack of human and material resources in school; thus, potential future school vaccination programs would require partnerships between the National Education and external professionals to organize vaccination days on school premises. Barriers also included the perception that vaccination in school is not necessary because other places exist in France to get vaccinated. School staff should be made aware that French vaccination pathway remains complex and that offering HPV vaccine in schools can improve accessibility (e.g., no appointment needed and no need for parents to take time off of work) [35]. Besides, school based programs can increase equity in HPV vaccine uptake [35] in a context of persistent social inequalities towards this vaccination in France [36].

As already reported in Canada [13], fear of parents’ negative reactions was a significant barrier to HPV promotion at school in our study. Parents (especially mothers) play a major role in HPV vaccination decision-making [37] and should be involved in interventions promoting HPV vaccination in schools. Parents could be invited to meetings planned outside of school time by school staff and/or local health professionals to get information about HPV and its vaccine [38].

Finally, our results suggest that school staff (especially nurses) have a high level of confidence in vaccination in general. However, we also found that past controversies around vaccination fueled doubts about vaccines safety and impaired trust towards French authorities. Restoring trust in vaccination remains challenging and “one size fit all intervention” does not

exist [39], but French authorities should be aware of this situation and make efforts to address it.

Conclusions

This mixed methods study highlighted the need to improve school staff knowledge on HPV and its vaccination, and the perceptions of teachers and support staff about the role of schools in educating pupils on this topic in France. It also provides key findings on the barriers that should be addressed before organizing HPV school vaccination programs in France.

Declarations

Ethics approval and consent to participate

This study was granted approval by Evaluation Committee of Inserm, the Institutional Review Board (IRB00003888, IORG0003254, FWA00005831) on 10 December 2019. All study participants gave their informed non opposition to participation, in line with French legal guidelines. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the French National Institute for Health and Medical Research (Inserm) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Inserm.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Aurélie Bocquier: Data analysis, Writing - Original Draft Marion Branchereau: Investigation, Data analysis, Writing - Review & Editing Aurélie Gauchet: Conceptualization, Methodology, Data analysis, Writing - Review & Editing Stéphanie Bonnay: Conceptualization, Project administration, Data analysis, Writing - Review & Editing Maïa Simon: Data analysis, Writing - Review & Editing Marie Ecollan: Writing - Review & Editing Judith E. Mueller: Conceptualization, Writing - Review & Editing Karine Chevreul: Conceptualization, Writing - Review & Editing Amandine Gagneux-Brunon: Conceptualization, Methodology, Writing - Review & Editing Nathalie Thilly: Conceptualization, Methodology, Project administration, Writing - Original Draft

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The PrevHPV Study group includes the authors of the present manuscript and members listed in Additional Document 3.

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Table 1 Characteristics of the participants to the study

Respondents to the self-administered online questionnaire (n = 301)			
Characteristics	N	%	
<i>Participants' school characteristics</i>			
Location			
Rural	184	61	
Urban	113	38	
NA	4	1	
Status			
Public	281	94	
Private	16	5	
NA	4	1	
High-priority educational network ^a			
Yes	40	14	
No	241	86	
<i>Professional characteristics</i>			
Teachers ^b	143	47	
School nurses	105	35	
Support staff	53	18	
<i>Personal characteristics</i>			
Gender			
Women	254	84	
Men	47	16	
Age (years)			
< 30	18	6	
[30-45]	136	45	
>45	147	49	
Participants to the focus groups (n = 14)			
Participant ID	Age (years)	Gender	Profession
<i>Focus group 1 (March 2020, face-to-face^c)</i>			
P1	55	Woman	Teacher
P2	60	Man	Support staff (educational)
P3	53	Woman	Support staff (administrative)
P4	38	Woman	Support staff (administrative)
<i>Focus group 2 (September 2020, face-to-face^c)</i>			
P5	43	Man	Teacher
P6	54	Man	Support staff (administrative)
P7	45	Woman	Teacher
P8	44	Woman	Support staff (administrative)
P9	41	Woman	Teacher
<i>Focus group 3 (February 2021, virtual^d)</i>			
P10	40	Woman	School nurse
P11	44	Woman	School nurse
P12	38	Woman	School nurse
P13	62	Woman	School nurse
P14	48	Woman	School nurse

NA = not available.

^a According to the social deprivation level (for public schools only).

^b Main disciplines taught: French (21%), mathematics (14%) and life sciences (13%).

^c Participants worked in the same school.

^d Participants worked in five different schools.

Table 2 Knowledge about HPV among respondents to the self-administered online questionnaire and by profession (n = 295^a) – in decreasing order of % of correct answer among all participants

Item	All participants (%)			Nurses (%)	Teachers (%)	Support staff (%)	<i>p</i> ^b
	Correct answer	Incorrect answer	Unsure	Correct answer	Correct answer	Correct answer	
HPV is a sexually transmitted virus (T)	83	4	13	98	76	75	<.001
HPV also concerns boys and men (T)	79	7	14	94	71	68	<.001
Different types of HPV exist; only some of them cause cancers (T)	63	3	34	83	52	51	<.001
HPV infection is always symptomatic (F)	62	7	31	87	48	49	<.001
More than half men and women are infected by HPV during their life course (T)	47	7	46	70	34	38	<.001
HPV causes genital warts (T)	47	9	44	74	34	30	<.001
Cervical cancer is due to a persistent HPV infection (T)	38	47	15	37	33	51	0.068
HPV can also cause oral cancers (T)	36	13	51	56	23	34	<.001
Most HPV infections can be eliminated spontaneously by our immune system (T)	28	24	48	40	21	25	0.005
There is no antiviral treatment against HPV infections (T)	18	20	62	25	13	19	0.043

F = false; T = true.

^a Missing data: n = 6.

^b Chi2 or exact Fisher test.

Table 3 Selection of the most illustrative verbatim of participants to the focus groups (n = 3 focus groups, 14 participants)

Theme	Verbatim
Knowledge about HPV infections	
Poorly informed	<i>"We lack a lot of information and even more on boys but also on girls in general"</i> (P14, nurse)
A female problem	<i>"Yes, we need to have figures on the risks for boys who do not get vaccinated, I learned it from my gynaecologist who said that it caused oral cancers in boys, well, it's true that I didn't know"</i> (P14, nurse)
Sources of information	<i>"I follow the news very regularly [...] that's how I heard about the papillomavirus"</i> (P5, teacher)
Knowledge, beliefs and attitudes towards HPV vaccination	
Vaccination schedule	<i>"But once he had his first intercourse, it was no longer effective, well, maybe I'm wrong, that's what I understood"</i> (P4, support staff)
Vaccination for boys	<i>"And why vaccinate boys, what is the point of vaccinating boys? [...] we say at the beginning 10 years ago it was girls, now we say boys [...] what has changed now it would be boys?... it's unclear"</i> (P11, nurse)
Vaccine efficacy / safety	<i>"Because there are so many papillomaviruses and this vaccine concerns only one kind of papillomavirus so is it useful?"</i> (P11, nurse) <i>"I'm afraid that it [the HPV vaccine] will lead to something else because we don't have enough hindsight"</i> (P9, teacher)
Antecedents of vaccination in general	
Collective Responsibility	<i>"Yes it's a public health problem [...] I don't know if this vaccination would really eradicate the virus completely if we were all vaccinated [...] but in any case it would greatly reduce the number of cancer risks for both girls and boys"</i> (P14, nurse)
Confidence	<i>"We have already seen vaccines that have, heu, caused, heu, multiple sclerosis [referring to the hepatitis B vaccination]"</i> (P3, support staff)
Target population	<i>"Ha bah papillomavirus equals sexuality in everyone's head euh that's it and inevitably ask a little boy/girl who's entering 6th grade, well, let's think about your sexuality, well, it's taboo for many families, right? I'm not sure if we in the 6th grade can talk about this it's complicated"</i> (P11, nurse)
Schools' role in promoting HPV vaccination	
Informing/educating pupils	<u>A positive attitude among nurses and some teachers/support staff</u> <i>"Even as part of our teaching, I think it could be interesting [...] Ah I think of the sciences, in particular... yes life sciences [...] even an external worker euh I think that it could be interesting "</i> (P6, support staff) <i>"It's fully within our job, we're not here for minor medical care essentially we're also here for information and prevention"</i> (P13, nurse) <u>But some reluctance among teachers/support staff</u> <i>"Well, the school is not necessarily the place to get information about vaccinations [...] I think we already do quite a lot"</i> (P1, teacher)
Offering access to HPV vaccination	<i>"I don't think it's the school's role [...] I think it's the role of the family's health professionals"</i> (P4, support staff) <i>"Be careful, the school is not a place of care so euh vaccinate, we are alone that is to say that there is no doctor..."</i> (P11, nurse) <i>"I would tend to say that this is not the place and that our country allows us to be vaccinated, I mean we have other places"</i> (P14, nurse)

Table 4 Knowledge about prevention of HPV infections and HPV vaccination among respondents to the self-administered online questionnaire and by profession (n = 289^a) – in decreasing order of % of correct answer among all participants

	All participants (%)			Nurses (%)	Teachers (%)	Support staff (%)	<i>p</i> ^b
	Correct answer	Incorrect answer	Unsure	Correct answer	Correct answer	Correct answer	
There is a vaccine against HPV (T)	88	2	10	99	83	79	<.001
Getting vaccinated against HPV prone young girls to have sexual relationships (F)	88	1	11	97	83	85	<.001
Cervical screening remains recommended among vaccinated women (T)	87	1	12	97	83	77	<.001
HPV vaccine protects against virus which cause cancers (T)	76	5	19	93	72	58	<.001
HPV vaccine is effective to prevent precancerous lesions of the cervix (T)	63	4	33	79	55	54	<.001
After the first sexual intercourse, it's too late to get vaccinated against HPV (F)	57	19	24	67	49	58	0.019
HPV vaccine is recommended for heterosexual boys (T)	56	9	35	81	42	46	<.001
HPV vaccine is responsible for many side effects (F)	43	8	49	69	30	29	<.001
HPV vaccine is recommended for MSM or bisexual boys until 26 years old (T)	33	7	60	51	24	23	<.001
HPV vaccine can help eliminate an HPV infection that already exists (F)	32	13	55	49	21	29	<.001
HPV vaccine protects against genital warts (T)	27	16	57	38	24	15	0.008
Condom protects against HPV infections (F)	21	60	19	24	15	29	0.061

F = false; MSM = men who have sex with men; T = true.

^a Missing data: n = 12.

^b Chi2 or exact Fisher test.

Additional Material

Additional Table 1 Teams conducting the PrevHPV program (The PrevHPV Consortium)

Team n°	Contact/scientific leader	Field of expertise
1	EA 4360 APEMAC - Université de Lorraine 9 av. de la Forêt de Haye - BP 20199 - 54505 VANDOEUVRE LES NANCY Cedex Scientific leader, principal investigator: Pr THILLY Nathalie (email: n.thilly@chru-nancy.fr)	Epidemiology and Public health
2	Département de Médecine Générale - Université Paris - 24 rue du Faubourg Saint-Jacques -75679 PARIS Cedex 14 Scientific leader: Pr GILBERG Serge (email: sergegilberg@gmail.com)	Primary Care
3	Laboratoire Interuniversitaire de Psychologie - UFR Sciences de l'Homme et de la Société - Université Grenoble Alpes BP 47 - 38040 GRENOBLE Cedex 9 Scientific leader: Dr GAUCHET Aurélie (email: aurelie.gauchet@univ-grenoble-alpes.fr)	Health Psychology
4	CRCDC Pays de la Loire 5 rue des Basses Fouassières - 49000 ANGERS Scientific leader: Dr LE DUC-BANASZUK Anne- Sophie (email: as.banaszuk@depistagecancers.fr)	Public Health, Cancer prevention
5	Campus Santé Innovations - Faculté de Médecine Jacques Lisfranc 10 rue de la Marandière - 42270 SAINT-PRIEST-EN- JAREZ Scientific leader: Dr GAGNEUX-BRUNON Amandine (email: amandine.gagneux-brunon@chu-st-etienne.fr)	Infection Diseases
6	INSERM UMR 1123 ECEVE, Université de Paris,75010 PARIS Scientific leader: Pr CHEVREUL Karine (email: karine.chevreul@inserm.fr)	Health Economics
7	Institut Pasteur - 25 rue du Dr Roux - 75724 Paris cedex 15 Scientific leader: Dr MUELLER Judith (email: judith.mueller@ehesp.fr)	Epidemiology and Public health
8	CHRU de Tours - Centre d'investigation Clinique Bretonneau - 37044 Tours cedex 9 Scientific leader: Pr GIRAUDEAU Bruno (email: bruno.giraudeau@univ-tours.fr)	Biostatistics

Additional Table 2 COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal Characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	8
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	8
Occupation	3	What was their occupation at the time of the study?	8
Gender	4	Was the researcher male or female?	1, 17
Experience and training	5	What experience or training did the researcher have?	8
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	6-7
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	6
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	8
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	6-7
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	6-7
Sample size	12	How many participants were in the study?	9
Non-participation	13	How many people refused to participate or dropped out? Reasons?	N/A
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	8
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	N/A
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	Table 1
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	8 and Additional

			Document 2
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	N/A
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	8
Field notes	20	Were field notes made during and/or after the interview or focus group?	N/A
Duration	21	What was the duration of the interviews or focus group?	9
Data saturation	22	Was data saturation discussed?	9
Transcripts returned	23	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: Analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	9
Description of the coding tree	25	Did authors provide a description of the coding tree?	N/A
Derivation of themes	26	Were themes identified in advance or derived from the data?	9
Software	27	What software, if applicable, was used to manage the data?	N/A
Participant checking	28	Did participants provide feedback on the findings?	N/A
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Table 3 and Additional Table 5
Data and findings consistent	30	Was there consistency between the data presented and the findings?	10-12
Clarity of major themes	31	Were major themes clearly presented in the findings?	10-12
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	10-12

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Additional Table 3 STROBE (STrengthening the Reporting of OBServational studies in Epidemiology) Statement — checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1	“a mixed methods study”
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3	See Methods and Results section
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5	N/A
Objectives	3	State specific objectives, including any prespecified hypotheses	5	“to assess their knowledge, beliefs and attitudes regarding HPV, HPV vaccine and vaccination in general, and regarding the role of school in promoting HPV vaccination”
Methods				
Study design	4	Present key elements of study design early in the paper	5-6	“quantitative data coming from self-administered online questionnaires”
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6	“The study was planned to be conducted from January to April 2020 but [...] lasted until May 2021.”
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6-7	“Heads of the schools who accepted to

		<p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p>		participate informed all school staff of the study and sent them the link to the online questionnaire”
		<p>(b) <i>Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case</p>	N/A	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8	See “Quantitative data: self-administered online questionnaire” section
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8	See “Quantitative data: self-administered online questionnaire” section
Bias	9	Describe any efforts to address potential sources of bias	6	“we selected middle schools located in the study area to insure a balanced distribution of urban/rural areas, public/private schools...”
Study size	10	Explain how the study size was arrived at	6	“We planned to collect 300 questionnaires (a sample size judged appropriate to obtain descriptive statistics on knowledge, beliefs and attitudes with enough precision)”
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8	See “Data analysis and interpretation” section

Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8	See “Data analysis and interpretation” section
		(b) Describe any methods used to examine subgroups and interactions	8	See “Data analysis and interpretation” section
		(c) Explain how missing data were addressed	Tables 2, 4	N/A
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	N/A	N/A
		<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed		
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy		
		(e) Describe any sensitivity analyses	N/A	N/A
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9	See Additional Table 4
		(b) Give reasons for non-participation at each stage	9	“31 refused (main reasons: too heavy workload, especially in the context of the Covid-19 pandemic)”
		(c) Consider use of a flow diagram	N/A	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9	See “Participants’ characteristics” section
		(b) Indicate number of participants with missing data for each variable of interest	Tables 2, 4	N/A
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	N/A	N/A
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	N/A	N/A
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	N/A	N/A
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	N/A	N/A
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A	N/A

		(b) Report category boundaries when continuous variables were categorized	N/A	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11	See “Differences in knowledge, beliefs and attitudes by profession” section
Discussion				
Key results	18	Summarise key results with reference to study objectives	13	“This mixed methods study showed...”
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13	See “Study’s strengths and limitations” section
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15	See “Implications for the PreVHPV program and for public health” section
Generalisability	21	Discuss the generalisability (external validity) of the study results	13	See “Study’s strengths and limitations” section
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16	See “Funding” section

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Additional Table 4 Characteristics of the middle schools invited to participate in the study and of those which accepted to participate

Characteristics	Schools contacted to participate (n = 83) N (%)	Schools which accepted to participate to the study (n = 35) N (%)	Schools with at least one staff member who completed the online questionnaire (n = 17) N (%)
Location			
Rural	17 (20)	10 (29)	6 (35)
Urban	66 (80)	25 (71)	10 (59)
NA	/	/	1 (6)
Status			
Public	69 (83)	30 (86)	13 (76)
Private	14 (17)	5 (14)	3 (18)
NA	/	/	1 (6)
High-priority educational network^a			
Yes	19 (28)	6 (20)	3 (23)
No	50 (72)	24 (80)	10 (77)
Region			
Ile de France	20 (24)	8 (23)	1 (6)
Auvergne-Rhône-Alpes	33 (40)	13 (37)	7 (41)
Grand Est	13 (16)	7 (20)	3 (18)
Pays de Loire	17 (20)	7 (20)	5 (29)
NA	/	/	1 (6)

NA = not available.

^a According to the social deprivation level (for public schools only).

Additional Table 5 Additional illustrative verbatim of participants to the focus groups (n = 3 focus groups, 14 participants)

Theme	Verbatim
<i>Knowledge about HPV infections</i>	
Poorly informed	<i>"I had the impression [...] only a few people were affected by this kind of diseases, I realize that it's perhaps not the case, I don't know"</i> (P2, support staff)
A female problem	<i>"It's an infection mostly in girls not in boys for me"</i> (P3, support staff)
Sources of information	<i>"During a consultation with our general practitioner, she clearly told me and my daughter about it, she explained to us what this infection was"</i> (P4, support staff) <i>"[...] even in our training sessions on sex education, they don't talk to us about it, they already talk to us about AIDS, but [...] HPV they don't talk about it"</i> (P11, nurse)
<i>Knowledge, beliefs and attitudes towards HPV vaccination</i>	
Vaccination schedule	<i>"But once he had his first intercourse, it was no longer effective, well, maybe I'm wrong, that's what I understood"</i> (P4, support staff)
Vaccination for boys	<i>"I was surprised some time ago after a visit to my general practitioner for my son to learn that boys could also be vaccinated"</i> (P1, teacher)
Vaccine efficacy / safety	<i>"Because there are so many papillomaviruses and this vaccine concerns only one kind of papillomavirus so is it useful?"</i> (P11, nurse) <i>"I thought that at one time the vaccine has even been called into question [...] we were not sure that the vaccine was not finally harmful"</i> (P2, support staff) <i>"I'm afraid that it [the HPV vaccine] will lead to something else because we don't have enough hindsight"</i> (P9, teacher)
<i>Antecedents of vaccination in general</i>	
Collective Responsibility	<i>"Yes it's a public health problem [...] I don't know if this vaccination would really eradicate the virus completely if we were all vaccinated [...] but in any case it would greatly reduce the number of cancer risks for both girls and boys"</i> (P14, nurse)
Confidence	<i>"The famous [H1N1] flu where finally there were heu I don't know how many tens of millions of vaccine stocks that were thrown away [...] to show that our leaders are not necessarily very..."</i> (P2, support staff) <i>"I have the impression that there are more and more of them and honestly, it scares me because I have also had people against vaccines in the teachers"</i> (P14, nurse)
Target population	<i>"And it's young... she [her 11 year old daughter] was embarrassed when I told her about sexual intercourse and she looked at me with big eyes"</i> (P4, support staff)
<i>Schools' role in promoting HPV vaccination</i>	
Informing/educating pupils	<u>A positive attitude among nurses and some teachers/support staff</u> <i>"I'm thinking of middle school as well [as a way to educate pupils about HPV]. Because they are quite sensitive to what they are told in schools"</i> (P9, teacher) <i>"If I had more knowledge about HPV, if I could talk about it more convincingly, I would be able to add it as an unavoidable topic to my sex education activities"</i> (P14, nurse) <u>But some reluctance among teachers/support staff</u> <i>"I think, perhaps, that parents would be surprised to have public health information coming into the school"</i> (P4, support staff) <i>"We've to be very careful not to enter the parental sphere"</i> (P2, support staff)

Offering access to HPV vaccination	<p><i>“Well, then I think it's the parents who are going to, euh, step up to the plate” (P5 and P7, teachers)</i></p> <p><i>“if it [the vaccination] is done at school, I think that it should also be a little, not anonymous, but not everyone should see who is going to be vaccinated and who is not, so that it is not [...] Yeah, stigmatizing” (P9, teacher)</i></p> <p><i>“if we're told we have to vaccinate for the Covid, well, because it's supervised, because that's how it is, because there's a doctor not far away, okay, we've already done it for the H1N1 flu, but to be part of a vaccination policy, to vaccinate, well, I don't know if that's really our role in fact” (P11, nurse)</i></p>
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Additional Table 6 Psychological antecedents of vaccination (5C scale^a) among participants to the self-administered online questionnaire and by profession (n = 301)

Item	Mean (standard deviation)				
	All participants	Nurses	Teachers	Support staff	<i>p</i> ^b
Confidence					
I am completely confident that vaccines are safe	5.5 (1.6)	5.9 (1.2)	5.5 (1.6)	4.8 (2.0)	<.001
Vaccinations are effective	6.0 (1.3)	6.2 (1.0)	6.0 (1.3)	5.3 (1.7)	<.001
Regarding vaccines, I am confident that public authorities decide in the best interest of the community	5.4 (1.6)	5.6 (1.5)	5.4 (1.6)	4.9 (1.8)	0.020
Complacency					
Vaccination is unnecessary because vaccine-preventable diseases are not common anymore	1.9 (1.3)	1.8 (1.2)	1.8 (1.2)	2.3 (1.6)	0.089
My immune system is so strong; it also protects me against diseases	2.2 (1.5)	2.1 (1.4)	2.0 (1.4)	2.5 (1.8)	0.097
Vaccine-preventable diseases are not so severe that I should be vaccinated	1.9 (1.3)	1.7 (1.1)	1.9 (1.3)	2.5 (1.6)	0.001
Constraints					
Everyday stress prevents me from being vaccinated	1.9 (1.3)	1.8 (1.2)	1.8 (1.2)	2.2 (1.6)	0.167
For me, it is inconvenient to be vaccinated	2.1 (1.5)	2.0 (1.5)	2.2 (1.4)	2.3 (1.5)	0.290
Visiting the doctor makes me feel uncomfortable; this keeps me from being vaccinated	1.6 (1.1)	1.6 (0.8)	1.6 (1.1)	1.8 (1.4)	0.262
Calculation					
When I think about being vaccinated, I weigh its benefits and risks to make the best decision possible	5.5 (1.7)	5.7 (1.6)	5.3 (1.7)	5.4 (1.6)	0.158
For each and every vaccination, I closely consider whether it is useful for me	5.4 (1.6)	5.7 (1.5)	5.3 (1.6)	5.1 (1.8)	0.026
It is important for me to fully understand the topic of vaccination before I get vaccinated	5.9 (1.3)	6.1 (1.2)	5.7 (1.5)	5.8 (1.2)	0.059
Collective responsibility					
When everyone else is vaccinated, I don't have to be vaccinated, too (R)	6.3 (1.2)	6.3 (1.0)	6.3 (1.2)	6.2 (1.4)	0.760
I get vaccinated because I can also protect people with a weaker immune system	5.4 (1.8)	5.3 (1.7)	5.5 (1.7)	5.1 (2.1)	0.300
Vaccination is a collective action to prevent the spread of diseases	6.3 (1.2)	6.4 (1.0)	6.3 (1.3)	6.1 (1.4)	0.273

^a Instruction for the 5C scale: "Please evaluate how much you disagree or agree with the following statements." (1=*strongly disagree*, 2=*moderately disagree*, 3=*slightly disagree*, 4=*neutral*, 5=*slightly agree*, 6=*moderately agree*, 7=*strongly agree*). Item with (R) is reverse-coded: as all items are scored in such a way that a higher score indicates a higher degree of the "C" assessed, the item "When everyone else is vaccinated, I don't have to be vaccinated, too" of the "Collective responsibility" subscale is reverse-coded.

^b ANOVA.

Additional Table 7 Public health topics discussed with pupils by participants to the self-administered online questionnaire and by profession (n = 301) - % of “often” or “always”

	All participants (%)	Nurses (%)	Teachers (%)	Support staff (%)	<i>p</i>^a
Screens	57	92	34	53	<.001
Diet	55	90	33	47	<.001
Health risks in general	47	82	23	42	<.001
Physical activity	45	74	30	28	<.001
Sexuality	45	90	19	26	<.001
Tobacco consumption	42	70	22	36	<.001
Drug consumption	39	64	20	40	<.001
Alcohol consumption	36	60	17	36	<.001
Vaccination	28	55	13	13	<.001

^a Chi2 or exact Fisher test.

Additional Table 8 Appropriate period to propose HPV vaccination among pupils according to participants to the self-administered online questionnaire and by profession (n = 283) - % of “yes”

	All participants (%)	Nurses (%)	Teachers (%)	Support staff (%)	<i>p</i>^a
Before middle school	6	7	4	6	0.038
Grade 6	26	39	20	18	0.001
Grade 7	39	45	36	31	0.192
Grade 8	52	46	61	39	0.013
Grade 9	37	33	39	39	0.636
Never	4	4	3	4	0.076

^aChi2 or exact Fisher test.

Additional Document 1 Self-administered online questionnaire

1. How old are you?
 - <30
 - 30-45
 - >45

2. You are:
 - A woman
 - A man

3. When did you finish your studies?
 - Before 1990
 - Between 1990 and 2000
 - Between 2000 and 2010
 - Between 2010 and now

4. What is your profession?
 - Teacher
 - If you are a teacher, which discipline(s) do you teach?: French / Mathematics / History-Geography / Foreign language / Life sciences / Physics-Chemistry / Technology / Music / Art / Physical activity
 - Nurse
 - Physician
 - Other

5. Do you usually address the following prevention topics with pupils?

	Always	Often	Sometimes	Never
a) Tobacco consumption				
b) Diet				
c) Physical activity				
d) Alcohol consumption				
e) Vaccination				
f) Sexuality				
g) Drugs consumption				
h) Screens				
i) At-risk behaviors in general				

Vaccination and you

6. Please evaluate how much you disagree or agree with the following statements

	<i>Strongly disagree</i>	<i>Moderately disagree</i>	<i>Slightly disagree</i>	<i>Neutral</i>	<i>Slightly agree</i>	<i>Moderately agree</i>	<i>Strongly agree</i>
a) I am completely confident that vaccines are safe							
b) Vaccinations are effective							
c) Regarding vaccines, I am confident that public authorities decide in the best interest of the community							
d) Vaccination is unnecessary because vaccine-preventable diseases are not common anymore							
e) My immune system is so strong; it also protects me against diseases							
f) Vaccine-preventable diseases are not so severe that I should be vaccinated							
g) Everyday stress prevents me from being vaccinated							
h) For me, it is inconvenient to be vaccinated							
i) Visiting the doctor makes me feel uncomfortable; this keeps me from being vaccinated							
j) When I think about being vaccinated, I weigh its benefits and risks to make the best decision possible							
k) For each and every vaccination, I closely consider whether it is useful for me							

l) It is important for me to fully understand the topic of vaccination before I get vaccinated							
m) When everyone else is vaccinated, I don't have to be vaccinated, too (R)							
n) I get vaccinated because I can also protect people with a weaker immune system							
o) Vaccination is a collective action to prevent the spread of diseases							

HPV infection and vaccination – knowledge

7. For each of the following statement, please choose one answer:

- | | Yes | No | Unsure |
|--|-----|----|--------|
| a) HPV is a sexually transmitted virus | | | |
| b) HPV also concerns boys and men | | | |
| c) More than half men and women are infected by HPV during their life course | | | |
| d) HPV infection is always symptomatic | | | |
| e) HPV causes genital warts | | | |
| f) Different types of HPV exist; only some of them cause cancers | | | |
| g) HPV can also cause oral cancers | | | |
| h) Most HPV infections can be eliminated spontaneously by our immune system | | | |
| i) There is no antiviral treatment against HPV infections | | | |
| j) There is a vaccine against HPV infections | | | |

8. Cervical cancer is due to a persistent HPV infection

- Yes
- No
- Partially (some cervical cancers only)
- Unsure

9. For each of the following statement, please choose one answer:

- | | Yes | No | Unsure |
|---|-----|----|--------|
| a) HPV vaccine protects against virus which cause cancers | | | |
| b) HPV vaccine protects against genital warts | | | |
| c) HPV vaccine can help eliminate an HPV infection that already exists | | | |
| d) Cervical screening remains recommended among vaccinated women | | | |
| e) HPV vaccine is recommended for girls and boys aged 11-14 years with a possible catch-up until 19 years | | | |
| f) HPV vaccine is recommended for MSM or bisexual boys until 26 years old | | | |
| g) Condom protects against HPV infections | | | |
| h) HPV vaccine is responsible for many side effects | | | |
| i) After the first sexual intercourse, it's too late to get vaccinated against HPV | | | |
| j) HPV vaccine is effective to prevent precancerous lesions of the cervix | | | |
| k) HPV vaccine is recommended for heterosexual boys | | | |
| l) Getting vaccinated against HPV prone young girls to have sexual relationships | | | |

HPV infection and vaccination – Attitude

10. Do you have a vaccination booklet and /or a health booklet?

- Yes
- No
- Unsure

11. Have you heard about the electronic vaccination booklet?

- Yes
 - If yes, do you have an electronic vaccination booklet? Yes / No / Unsure.
- No
- Unsure

12. Are you vaccinated against HPV?

- Yes
- No
- Unsure
 - If you are not vaccinated, please indicate why (several choices possible): The vaccine was not recommended for me / By personal choice / I did have my parents' agreement / For religious reasons / Because of a lack of time / I did not know that a vaccine exist / I followed my doctor's recommendation / I preferred to wait / I need additional information / I did not want this vaccine / I was not at risk regarding HPV infection / I was afraid of shots / I was afraid of

potential side effects / This vaccine was not effective / The vaccine did not exist at that time

- Please indicate why you have been vaccinated against HPV or whether you would have been vaccinated if it has been recommended for you (several choices possible): By personal choice / Because of my parents' recommendation / Because of my doctor's recommendation / I felt at risk towards HPV / I wanted to avoid a cancer / I did not want to transmit HPV to my sexual partner / I did not want to get vaccinated

13. In which class do you think it is appropriate to propose HPV vaccination?

- In 6ème
- In 5ème
- In 4ème
- In 3ème
- Before middle school
- Never

14. Please evaluate how much you disagree or agree with the following statements

Strongly Disagree Disagree Neutral Agree Strongly agree

- a) I recommend to my family and friends targeted by the recommendations to get vaccinated against HPV
- b) If it was possible and recommended for me, I would like to get vaccinated against HPV
- c) Before getting the HPV vaccine or encouraging a relative to get the vaccine, I ask my doctor for advice
- d) Before getting the HPV vaccine or encouraging a relative to get the vaccine, I look for information on the internet

Additional Document 2 Focus groups' interview guide

Theme	Questions
Knowledge/beliefs	<p>Starting question: What do you know about HPV and its vaccine?</p> <ul style="list-style-type: none"> ○ <i>Knowledge about the new recommendations: Who should be offered vaccination?</i> ○ <i>Sources of information: How and when have heard about the HPV vaccine?</i> ○ <i>Understanding of the vaccine: What questions do you still have about this vaccine?</i>
Attitudes, preferences and barriers to HPV vaccination	<p>Starting question: What do you think of this vaccine in terms of public health?</p> <ul style="list-style-type: none"> ○ <i>Universal vaccination: Do you think that HPV vaccination for boys is warranted?</i> ○ <i>Acceptability of the vaccine: Why do you think adolescents should be vaccinated?</i> ○ <i>Barriers: What are the barriers to HPV vaccination?</i>
Decision making process	<p>Starting question: In your experience, are pupils involved in the decision to get vaccinated?</p> <ul style="list-style-type: none"> ○ To what extent are pupils seeking information about HPV vaccination? ○ In your opinion, do parents take into account their child's point of view? ○
School's mobilization and participation	<p>Starting question: What would you suggest to improve HPV vaccination coverage?</p> <ul style="list-style-type: none"> ○ <i>The role of school: How can schools help promote HPV vaccination?</i> <ul style="list-style-type: none"> ○ What are your experiences in that field? ○ Do you think the school can have an informational/educational role? ○ What do you think about vaccination at school? ○ <i>Anti-Vax : How do you deal with the Anti-vax position?</i> <p>Do you have anything to add?</p>

Additional Document 3 Names of the PrevHPV Study Group's members

The PrevHPV Study group includes the authors of the present manuscript and: For the team 1: Nelly AGRINIER¹, Estelle FALL¹, Céline PULCINI^{1,13}; for the team 2: Sébastien BRUEL⁵, Serge GILBERG⁵, Josselin LE BEL⁵, Henri PARTOUCHE⁵, Juliette PINOT⁵, Louise ROSSIGNOL⁵, Arthur TRON⁵, Minghui ZUO⁵; for the team 3: Julie BROS^{3,4}, Olivier EPAULARD¹⁴, Catherine JUNEAU^{3,4}, Gaëlle VAREILLES¹⁵; for the team 4: Anne-Sophie LE DUC-BANASZUK²; for the team 5: Elisabeth BOTELHO-NEVERS¹¹, Florian JEANLEBOEUF¹¹, Julie KALECINSKI^{16,17}, Christine LASSET^{18,19,20}, Laetitia MARIE DIT ASSE¹⁹, Mabrouk NEKAA²¹; for the team 6: Morgane MICHEL^{6,7,8}; for the team 7: Anne-Sophie BARRET²², Isabelle BONMARIN²², Sandra CHYDERIOTIS⁹, Daniel LEVY-BRUHL²², Jocelyn RAUDE¹⁰, Jonathan SICSIC²³; for the team 8: Bruno GIRAUDEAU²⁴, Clémence CASTAGNET^{25,26} and Mélanie SIMONY²⁶.

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