BMJ Open

# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

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| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2021-054419 |
| Article Type: | Original research |
| Date Submitted by the Author: | 13-Jun-2021 |
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| Keywords: | IMMUNOLOGY, Public health < INFECTIOUS DISEASES, PREVENTIVE MEDICINE, PUBLIC HEALTH, SEXUAL MEDICINE |
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# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

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**Word count:**

4154 (exclusive title page, authors' contribution statements, abstract, keywords, strengths and limitations of this study, acknowledgments, ethics approval)

**Key Words:**

HPV vaccine, HPV vaccine awareness, HPV vaccine knowledge, HPV vaccine information sources, HPV vaccine uptake, youth

## ABSTRACT:

**Objectives:** We aimed to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process of youth, both male and female, in Switzerland.

**Design:** With a mixed-methods study design, we conducted quantitative questionnaires and qualitative interviews, which lasted 20-45 minutes.

**Setting and participants:** We recruited participants, 15-26 years of age, in physicians' offices, in a local sexual health clinic, and during military enlistment. We conducted quantitative questionnaires with 1001 youth participants (588 male, 413 female) and qualitative interviews with 31 youth (17 male, 14 female).

**Primary and secondary outcome measures:** We assessed HPV vaccine awareness, knowledge, information sources and vaccination status.

**Results:** In the study's quantitative component, 109 (20%) male and 262 (65%) female participants had received ≥1 dose of HPV vaccine. 697 (70%) participants were knowledgeable about the HPV vaccine. Females were more likely to be knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01). Younger participants in the sample compared to older participants were more likely to be aware about HPV vaccine (135/148 [91%] vs. 695/849 [82%]; p<0.01). The three most mentioned information sources were school health programs (444 [53%]), health care providers (191 [23%]), and participants' social networks (163 [20%]). Overall, 554/711 (78%) participants had a female-gendered perception of HPV vaccine, a finding which was further supported and explained by qualitative data.

**Conclusions:** Despite a male HPV vaccine recommendation being made >4 years prior to the data collection, HPV vaccine knowledge was higher among females than males, and a female-

gendered perception of HPV vaccine remains prevalent. Internet and social media were minor HPV vaccine information sources. Study findings demonstrate that HPV knowledge matters for HPV vaccine uptake and suggest that we should improve HPV information quality and access for youth, particularly by tailoring knowledge campaigns to young men.

## Strengths and limitations of this study:

- One major strength of the study is that it uses a mixed methods approach, allowing for the qualitative data to offer potential explanations to quantitative findings.
- The study included a large number of female and male youth, allowing us to gain gendered differences regarding HPV vaccination information sources.
- One limitation of this study is that we might overestimate HPV vaccination knowledge based on the way we classified answers for the quantitative component.
- Our sampling strategy led to a non-representative sample.

## 1. Introduction

Surprisingly little research has directly examined youth knowledge, awareness, and information sources as determinants of *human papillomavirus (HPV)* vaccine uptake. Furthermore, the research that has been done on youth perspectives has primarily focused on females [1-6], although the vaccine has been recommended for male youth for several years in many countries. Literature on the determinants of HPV vaccine attitudes and uptake among male youth remains limited [7-12]. Furthermore, the false perception that the HPV vaccination concerns only women continues to persist in popular discourse since it has been long known as the "cervical cancer vaccine"[3, 13].

In addition to issues related to access barriers [2, 14], previous reports in male and female youth suggest that low HPV vaccine uptake is also related to limited HPV vaccine awareness and knowledge [11, 15-17], and to the behavioral expectations youth perceive from their parents, family members, and peers [18, 19]. The most consistent predictor of HPV vaccination is having received a recommendation from a health care provider [12, 14, 20].

Previous research has focused on parents' attitudes and information sources towards HPV vaccine since the primary target group are 11-14-year-old adolescents [21-26]. A key component of the Swiss National Vaccination Strategy (NVS), in order to increase HPV vaccination rates, however, is to address insufficient levels of youth vaccination knowledge, e.g. by emphasizing the importance of school vaccination programs [27]. Also, the NVS aims to address insufficient vaccination access, e.g., by removing financial barriers, especially for young adults with limited financial resources. The effective implementation of each of these NVS approaches would benefit from additional research on HPV vaccine awareness, knowledge, and information sources in youth. We have recently documented the validity of measuring vaccine hesitancy (VH) in youth using the Youth Attitudes about Vaccines (YAV) questionnaire, which shows that

VH is an independent predictor of HPV non-immunization in Switzerland in female youth **(Oleraweju V. et al, manuscript in preparation; Kiener L., Schwendener C., et al, manuscript in preparation)**.

The aims of the present study were to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process among youth, both male and female, in Switzerland. We additionally aimed to gain a more current understanding of gendered aspects youth may have around the HPV vaccine. Finally, we examined how these factors contribute to HPV vaccine uptake in both sexes and in younger and older adolescents.

## 2. Methods

### *2.1 The Swiss Context*

The Swiss Federal Office of Public Health (FOPH) and the Federal Vaccination Commission have recommended HPV vaccine since 2007 for female youth [28], and since 2015 for male youth [29]. HPV vaccine uptake has increased in the last decade [30], but lies still below the 80% immunization target [31]. In 2017-2019, the most recent evaluation period, only 20% of 16-year old males and 64% of females, had received ≥1 dose of HPV vaccine on average throughout Switzerland [32]. Regional differences in uptake have been associated with specifics of vaccination policies of local health authorities, limited information access, and the availability and quality of school vaccination programs [33, 34].

### *2.2 Study design*

We applied a convergent mixed-methods design [35], meaning we collected qualitative and quantitative data in parallel. We conducted the study in the context of our Swiss national research program (NRP74) on the determinants of VH in Switzerland regarding childhood and HPV vaccination. The local institutional review board (Ethikkommission Nordwest- und Zentralschweiz) approved the study. All participants provided written informed consent. Full details on our recruitment methods, power calculation, and the questionnaire have been previously published [36].

### *2.3 Study population and recruitment*

Participants were 15-26 years of age, male and female. Of note, youth in Switzerland are legally able to make vaccine decisions starting at age 14 [37], which supports vaccination promotion efforts which focus on youth perspectives on HPV vaccination. Even though the primary target

group is 11-14-year-olds, the vaccine is also recommended as a catch-up vaccine until 26 years in many countries, including Switzerland. We recruited participating youth in the offices of physicians providing biomedicine and sometimes additionally complementary and alternative medicine (CAM), and in a local sexual health clinic. Recruitment was done in urban and rural areas, and in 3 of 4 Swiss language regions, i.e., German, French, Italian. In order to gain more male participants, we also recruited during military enlistment (military service is compulsory for Swiss males, with enlistment being at age 18-24). Since July 1st, 2016 HPV vaccine has been covered by mandatory health insurance for male adolescents 11-14 years of age and as a catch-up vaccination until age 26 in Switzerland. We therefore divided male participants in an older and a younger age group. We refer to male participants born before vs. on/after July 1st, 2002 as the "older" and "younger" participants, respectively, meaning that younger male participants were part of the HPV vaccine target age group when 11-14 years of age. For comparison purposes, we applied the same age cut-offs to female participants.

### *2.4 Patient and public involvement*

We did not include patient or public involvement in designing the study, commenting the outcomes, interpreting the results of this study or reviewing the manuscript.

### *2.5 Quantitative methods*

As previously reported [36], we developed German, French, Italian, and English versions of the questionnaire. We interviewed military participants on site (face-to-face), and the other participants on the phone, after the physician/clinic visit. Quantitative interviews lasted 25-35 minutes and were conducted by medical students with previous training in participant recruitment, informed consent procedures and interview techniques. Interviews were

conducted from January 2019 to April 2020. All data was entered to open data kit (ODK) using tablets [36]. The questionnaire included socio-demographics including language, place of residence, living situation (with parents, with roommates, with partner), age, nationality, and school HPV vaccination program availability.

HPV vaccination status (has received ≥1 dose of HPV vaccination) was assessed based on review of the vaccination booklet of the participant, and, if unavailable, on personal report of being vaccinated.

In order to measure youth *awareness* about the HPV vaccine, we asked all participants if they had heard of the HPV vaccine. To accommodate for a gendered perception, for those who said "no" to the previous question, we asked if they had heard of the "cervical cancer vaccine." To measure youth *knowledge* about the HPV vaccine, we asked participants what the HPV vaccine is intended for. Those who responded correctly were considered to be knowledgeable. We considered an answer to be correct if they mentioned at least one correct aspect about the HPV vaccine, i.e., it protects against "cancer", "cervical cancer", "papilloma virus", or a "sexually transmitted disease". We sought to establish where youth obtained information about the HPV vaccination by asking two questions, each with free text answer options in order to document the most precise responses: (1) "Where have you heard about HPV vaccination?" and (2) "Who did you consult with when deciding whether or not to get the HPV vaccine?". Answers to the second question included consulting people as well as traditional media, the internet, and other forms of information supply.

### *2.6 Qualitative methods*

After completion of the quantitative interviews, participants were invited to participate in an additional qualitative interview. We subsequently contacted interested youth who indicated

willingness in the German- and French-speaking regions of Switzerland. Additional participants were recruited through researcher and participant social networks and by snowball sampling. Our research team collaboratively developed a semi-structured interview guide, which we piloted and revised iteratively for clarity and coherence. The interviews allowed us to gather background information about the youth, their health status and lifestyle, the HPV vaccine decision-making process, including knowledge, awareness, information sources, and the people with whom they discussed the vaccination. Qualitative interviews were conducted face-to-face or online (Skype or Zoom), lasted 20-45 minutes, and were audio-recorded and transcribed verbatim. Qualitative data were analyzed by social scientists Andrea Buhl and Michael J. Deml. Analysis of the qualitative interviews was guided by the Framework Method [38] with support of MAXQDA software. All quotes from interviews have been translated from German or French into English and anonymized.

## 3. Results

For the study's quantitative component, we completed telephone interviews with 1010 youth. Of these, we excluded eight participants because they did not meet the age criteria, and one participant because of missing gender information. Quantitative analyses are therefore based on 1001 participants (588 male, 413 female). Their characteristics are shown in **Table 1**. For the study's qualitative component, we conducted 14 qualitative interviews with female youth and 17 interviews with male youth. Qualitative participants ranged in age from 15 to 26 years in age (average ~21 years). Characteristics of the participants of the qualitative interview are shown in **Table 2**.

In the following sections, we present results regarding: (1) awareness and knowledge about the HPV vaccination, (2) youth HPV vaccination information sources and people with whom they had discussed the vaccination, and (3) youth's gendered perceptions of the HPV vaccine.

### *3.1 Awareness about HPV Vaccination*

For the purpose of this study, we defined *awareness* as having heard of the HPV or "cervical cancer" vaccine. For this analysis four additional quantitative interviews were excluded due to missing answers on HPV awareness and knowledge.

Significantly more female youth were aware of the HPV vaccine than male youth. Of the 997 participants, 461 (46%) had heard of the HPV vaccine; 176/585 (30%) males and 285/412 (69%) females ($p<0.01$). Among the 536 participants who had not heard of HPV vaccine, 369 (69%) had heard of the "cervical cancer vaccine", 255/409 (62%) males and 114/127 (90%) females ($p<0.01$).

Of the 997 participants, 830 (83%) had heard of the HPV or "cervical cancer vaccine", 431/585

(74%) of males and 399/412 (97%) of females (p<0.01). In both awareness of HPV vaccine and awareness of "cervical cancer vaccine", females had more awareness than males. 695/849 (82%) of the older participants and 135/148 (91%) of the younger participants had heard of the HPV or "cervical cancer vaccine" (p<0.01). Details are shown in **Figure 1**.

Of the 1001 participants, 371 (37%) had received ≥1 dose of HPV vaccine. As shown in **Figure 2**, participants with greater awareness had also more often received ≥1 dose of HPV vaccine compared to participants with limited awareness (362/830 [44%] vs. 8/110 [7%]; p<0.01). This effect was manifest in males (102/431 [24%] of aware males vs. 6/106 [6%] of males with limited awareness had received ≥1 HPV vaccine dose; p<0.01), but not in females (260/399 of aware females [65%] vs. 2/4 [50%] of females with limited awareness had received ≥1 HPV vaccine dose; p=0.53), however, only few (4/413) females were unaware of the vaccine.

When we defined HPV vaccine uptake according to availability of a vaccination record, results regarding the associations of awareness and uptake and of knowledge and uptake remained essentially unchanged (**Supplementary Fig. 1 and 2**). Of note, other studies have also assessed HPV vaccine uptake by using self-reported vaccination status [2, 8, 18].

### *3.2 Knowledge about HPV Vaccination and Implications for Uptake*

We defined *knowledge* as being able to give a correct answer to what the HPV vaccine is for or for the association of HPV with cervical cancer. For this analysis, four additional quantitative interviews were excluded due to missing answers on HPV awareness and knowledge. 697/997 (70%) participants had knowledge of HPV vaccine or the "cervical cancer vaccine", while 300/997 (30%) participants did not. Females were more knowledgeable than males (342/412

[83%] vs. 355/585 [61%]; p<0.01) which is also shown in **Figure 1**. We did not find a significant difference regarding knowledge between younger and older participants (94/148 [64%] vs. 603/849 [71%]; p=0.07).

As shown in **Figure 3**, more knowledgeable participants had received ≥1 dose of HPV vaccine compared to participants with limited knowledge (298/697 [43%] vs. 72/243 [30%]; p<0.01), and there was no evidence that this difference was limited to either sex (77/355 [22%] knowledgeable males vs. 31/182 [17%] males with limited knowledge had received ≥1 HPV vaccine dose; p=0.20), and 221/342 knowledgeable females [65%] vs. 41/61 [67%] females with limited knowledge had received ≥1 HPV vaccine dose; p=0.70).

For the study's qualitative component, although the youth had agreed to participate in qualitative interviews explicitly about their HPV vaccination decisions, many participants were not able to tell us what specifically the HPV vaccine was intended to protect against. When asked about recommendations for improvements to HPV vaccination campaigns in Switzerland, almost all youth mentioned desiring more and better information. The following dialogue demonstrates how knowledge and awareness served as barriers for a 22-year-old male who had not received the vaccine:

> Researcher: So, I see [from your vaccination certificate] that you didn't get the HPV vaccine.
>
> Participant: No.
>
> Researcher: Was it a choice?
>
> Participant: No, it was an issue of information. I don't know what [HPV] is.

### *3.3 Youth Information Sources about HPV Vaccination*

We assessed if and where adolescents had heard about HPV vaccination and who they may have turned to when deciding whether to get vaccinated against HPV. As shown in **Figure 4**, the three most commonly mentioned information sources by youth in the quantitative questionnaire were school health programs (53%), health care providers (23%), and participants' social networks (20%). The most mentioned information sources were similar for males and females. Internet and social media were mentioned infrequently as information sources (1% of all participants; 2% of males, 1% of females). Concerning the information sources used for deciding whether or not to vaccinate, most participants consulted their social networks (42%) and/or their healthcare provider (38%), as shown in **Figure 5**. Many participants (38%) did not talk to anyone about the HPV vaccine. We found this result predominantly with male participants (61%) and less with female participants (13%). Internet and social media were also infrequently mentioned for vaccine decision-making (3% of participants; 2% of males, 1% of females).

Qualitative interviews with youth showed that very few had actively sought out information about the HPV vaccination during the initial recommended age for the first dose (11-14 years). Primary explanations for this from the youths' perspectives included that they were too young when the HPV vaccine was offered via school programs or by their pediatricians, and that their parents had made the decision without being involved in the decision-making process. The few youth who reported having had discussions about the HPV vaccination described having talked to family members, primarily mothers or older siblings, or doctors (pediatricians if the vaccine was offered during the initial recommended age, gynecologists for older female participants who had not been vaccinated, and sexual health doctors for young men who have sex with men (MSM)). Apart from the MSM in the qualitative study sample, young men reported not having

discussed the HPV vaccine with anybody. Several of the young women we interviewed recalled their parents' skepticism when the HPV vaccine was first introduced. A 26-year-old female who had not received the HPV vaccine explained, "It was one of the first years when it came out. 2009 or something like that. I was still a minor and still in high school. We needed our parents' permission. My mother, who is a nurse, simply decided [against it because] it was a new vaccine, and we didn't yet know the side effects."

When asked about where information about the HPV vaccine should come from, many youth suggested better information campaigns via schools. This was particularly clear among youth whose parents chose against the vaccine when they were in the initial recommended target age. Despite not being vaccinated against HPV, an 18-year-old female described her views on the added value of having HPV vaccination information campaigns and programs in schools, particularly once youth are able to make their own health decisions:

> "I think it helped me a lot that that there was information at school and that the vaccine was offered there. We were at an age when we started to make our own decisions and that's why I liked the fact that we talked about it in school. That helped me a lot. […] because our parents had decided on everything before. And this is, I think, the first time that we decide or shared decisions about our health."

A 19-year-old female participant who had received the vaccine described the roles schools played in explaining the rationale behind the HPV vaccine, "I think I find it very important that there is an education and not just 'get vaccinated' and 'it's good for you or it helps you', but rather also a 'why' and 'what is it about' and 'what would it look like if you weren't vaccinated', what would be the consequence'? I think such a relatively educated attitude is also extremely useful."

### *3.4 Youth's female-gendered perception of the HPV Vaccine*

Given the HPV vaccination's association with cervical cancer in popular discourse, we analyzed if and to what extent participants had a gendered perception of HPV vaccine. From the quantitative sample, after excluding 290 of 1001 participants without knowledge of HPV or the "cervical cancer vaccine," 554 of 711 (78%) participants perceived the HPV vaccine as being only targeted towards women and not men (female-gendered answer) (**Supp. Table 1**). For example, many participants only mentioned cervical cancer when asked what the HPV vaccine is for and only few youth mentioned that the HPV vaccine protects also males from diseases. 290/361 (80%) males and 264/350 (75%) females (p=0.12) gave a female-gendered answer. While both older and younger participants had a female-gendered perception on the purpose of the HPV vaccination, significantly more older youth had female-gendered perceptions (496/611 (81%) older vs. 58/100 (58%) younger participants (p<0.01)). In addition, 277/331 (84%) older males vs. 13/30 (43%) younger males gave a female-gendered answer (p<0.01); 219/278 (78%) older females vs. 45/70 (64%) younger females gave a female-gendered answer (p=0.02).

During qualitative interviews, we asked youth if they saw any differences for HPV vaccination between men and women. These questions elicited two types of responses: (1) youth noting the vaccination as being beneficial for females only, and (2) discourses about females bearing the brunt of responsibility for sexual health. For the first type of response, some youth were not aware that males could get vaccinated against HPV. A 20-year-old female who had received the vaccine discussed her memories of getting the vaccine in school, "If I remember correctly, boys didn't get vaccinated [when I was in school]." An 18-year-old male who had not received the vaccine, when asked who the HPV vaccine was for, responded, "Women. Could that be? To be honest, that's all I know right now." Others complained that they now realize how limited their

information about the vaccination and its benefits for young males was. A 19-year-old man explained:

> "Well, I really haven't heard about [the HPV vaccination for boys] from anyone until now. And I don't think this is my personal fault that I don't know anything about it. Until now, it was only a topic for women, and now it's suddenly not anymore."

Other youth talked about female responsibility for sexual health. A 26-year-old female who had not been vaccinated against HPV explained how she saw the HPV vaccine for males as providing protection to the females with whom young men had sexual encounters, "Girls are going to take it more seriously. For boys, it doesn't concern them directly. It's protection for [girls]." A 20-year-old female who had not been vaccinated against HPV echoed this sentiment:

> "I mean, for [girls], we know that (…), if we're going to be in a relationship where we have sexual intercourse with somebody, we know that we have to protect ourselves. First of all, to not get pregnant. Second of all, we know that having any types of STDs and viruses would make our lives miserable. (…) But for boys, it's like, "Ok, I'll have to wear protection. But what's the worst that can happen?"

## 4. Discussion

Our study on HPV vaccine awareness, knowledge, information sources, and gendered perception among young males and females in Switzerland has four main findings. First, young females had more HPV vaccine awareness and knowledge than young males. This confirms previous reports, consistent with HPV vaccine having been introduced initially and worldwide as a vaccine designed only for females [15, 39, 40]. Even though awareness of HPV vaccine was higher in our study in females than in males, a recent Swiss national study found limited HPV awareness among 24–26-year-old women, suggesting opportunities for intervention also in women, including those that are older than the primary target age group [41].

Second, increased knowledge was associated with higher HPV vaccine uptake, in both females and males, suggesting that knowledge matters. This confirms results from previous reports [11, 15-17]. In our study we only saw a trend towards a small difference in HPV vaccine knowledge between the younger and older age groups. [15, 40]. Encouragingly, younger participants were more aware of HPV vaccine compared to older participants, in contrast to other studies [15, 42].

Third, the internet and social media played a surprisingly minor role as HPV vaccine information sources for youth in our study. This stands in contrast to other studies that found social media to increasingly become a source of health information worldwide [43-46]. Another US study described the internet as being one of the most frequently mentioned sources of vaccine information among adolescents [47]. Currently, the potential of internet/ social media information for HPV prevention/ vaccination uptake seems not to be used in Switzerland.

Fourth, despite the male HPV vaccine recommendation was introduced more than four years

prior to our interviews, both female and male youth in our study associated HPV vaccine predominantly with cervical cancer, consistent with the gendered views of HPV vaccine documented in previous reports [3, 13]. That said, it is encouraging to see a slight shift in the younger age group from a female gendered perspective to a gender-neutral perspective on HPV vaccine.

## 4.1 Strengths and limitations

One of the major strengths of our study is that it is a mixed-methods study. Our qualitative work adds some description and explanation to our quantitative findings. Furthermore, we have a large number of male participants in our study. The Swiss context in particular lacks data on HPV vaccine awareness, knowledge, and information sources from male youth. Our study addresses this research gap. Previous studies have predominantly focused on parents and their knowledge on HPV vaccine [21-26]. Our study included youth, and this allowed us to gain important insights on who youth turn to when deciding on HPV vaccination. Since the vaccine is recommended as a catch-up vaccine until 26 years in many countries, including Switzerland, we have to ensure that youth are aware of the HPV vaccine and that they have the necessary knowledge to make an informed HPV vaccination decision.

One limitation of this study is that we might overestimate knowledge based on the way we classified answers for the quantitative component. For example, if participants had heard of the HPV vaccine, we simply asked them if they know what it is for but added no further questions. In addition, for participants who have only heard of the “cervical cancer vaccine,” we did not ask any follow-up questions on HPV knowledge. Other studies have assessed knowledge in more depth, asking participants more knowledge specific questions [3, 18, 19]. Since our

questionnaire already lasted 25-35 minutes with questions on VH **(Jafflin K., manuscript in preparation),** CAM use **(Jafflin K., manuscript in preparation, Kiener L., Schwendener C., et al, manuscript in preparation)** and moral foundations **(Jafflin K., manuscript in preparation)** we opted to not include more questions to further assess participants' knowledge. Another limitation to this study was that our sampling strategy led to a non-representative sample. Additionally, potential sources of bias arise from us not being able to get in contact with participants who do not visit a physicians' office. Our sampling strategy however allowed us to recruit a more diverse sample regarding biomedical and CAM providers.

## 5. Conclusion

This study underlines the importance of HPV awareness and knowledge given the association between HPV awareness and knowledge and HPV vaccine uptake. However, males still have limited awareness and knowledge about HPV vaccine. Future strategies to increase HPV vaccine uptake, especially among males, should focus on better and more information supply to youth explaining them the benefit of the HPV vaccine. School vaccination programs have proven to be effective and should be further expanded [30]. Parents play an important role in youth' decision making process when it comes to HPV vaccine and they should be equally informed about the benefits and importance of the HPV vaccine. Efforts should be made to underline the effectiveness of the HPV vaccine for males and females to reach a gender-neutral perception of the HPV vaccine. Targeted public health efforts should consider exploring internet and social media as potential information distribution platforms. HPV vaccine uptake has improved over the years, but there is substantial room for improvement, particularly in terms of increasing knowledge and awareness among young men and women alike.

## Acknowledgements

We would like to express our gratitude to all participating youth, young adults and providers for their time and effort as well as the Swiss National Science Foundation for their financial support.

## Disclosure of Potential Conflict of Interest

All authors: no conflicts.

## Funding

This work was supported by the Swiss National Science Foundation (National research program NRP74, grant 407440_167398, recipient: PET). The study received supplementary postdoctoral fellowship funding (to M.J.D.) from the Nora van Meeuwen-Haefliger-Foundation. We did not receive funding from vaccine manufacturers or the Swiss Federal Office of Public Health.

## Ethics approval

The study was approved by the local ethics committee (Ethikkommission Nordwest- und Zentralschweiz, EKNZ; project ID number 2017-00725). The ethics approval covers all study participants, which includes adolescent and adult patients as well as biomedical and CAM providers. Informed consent was provided by all participants after the nature and possible consequences of the study had been fully explained.

## Data sharing statement

Data is available upon reasonable request to the corresponding author.

**Contributors' Statement Page**

Ms. Kiener and Ms. Schwendener recruited participating youth, conducted interviews, carried out the analysis, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Jafflin conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

Ms. Rouached, Ms. Juillerat and Mr. Meier recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Schärli, Dr. Muggli, Dr. Gültekin and Dr. Gruillot recruited participating youth, and reviewed and revised the manuscript.

Mr. Baumann and Ms. Debergh recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Huber conceptualized and designed the study, recruited participating providers, and reviewed and revised the manuscript.

Dr. Merten conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, and reviewed and revised the manuscript.

Dr. Buhl designed the data collection instruments, recruited participating youth, conducted interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Deml conceptualized and designed the study, designed the data collection instruments, recruited participating providers and youth, conducted qualitative interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Tarr conceptualized and designed the study, designed the data collection instruments, recruited participating providers, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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**Table 1. Participant Characteristics (quantitative questionnaire)**

| | All Participants (n = 1001) | Male (n = 588) | Female (n = 413) |
|---|---|---|---|
| **Age** | | | |
| Age (years), median (IQR) | 19 (18-21) | 19 (19-20) | 20 (17-23) |
| Born before July 1st, 2002, n (%) | 850 (85) | 526 (89) | 324 (78) |
| Born on/ after July 1st, 2002, n (%) | 151 (15) | 62 (11) | 89 (22) |
| **Nationality** | | | |
| Swiss, n (%) | 916 (92) | 549 (93) | 367 (89) |
| **Language** | | | |
| German, n (%) | 671 (67) | 451 (77) | 220 (53) |
| French, n (%) | 168 (17) | 47 (8) | 121 (30) |
| Italian, n (%) | 156 (16) | 86 (15) | 70 (17) |
| English, n (%) | 6 (1) | 4 (1) | 2 (0.5) |
| **Recruitment setting** | | | |
| Biomedical provider, n (%) | 405 (40) | 146 (25) | 259 (63) |
| Military service, n (%) | 376 (38) | 372 (63) | 4 (1) |
| CAM provider, n (%) | 151 (15) | 57 (10) | 94 (23) |
| Adolescent clinic, n (%) | 69 (7) | 13 (2) | 56 (14) |
| **Living situation** | | | |
| With parents, n (%) | 821 (82) | 500 (85) | 321 (78) |
| **School vaccination program** | | | |
| School program available, n (%) | 449 (54) | 269 (67) | 180 (42) |
| **Vaccination status** | *n = 941* | *n = 538* | *n = 403* |
| Has received ≥1 does of HPV vaccine, n (%) | 371 (39) | 109 (20) | 262 (65) |

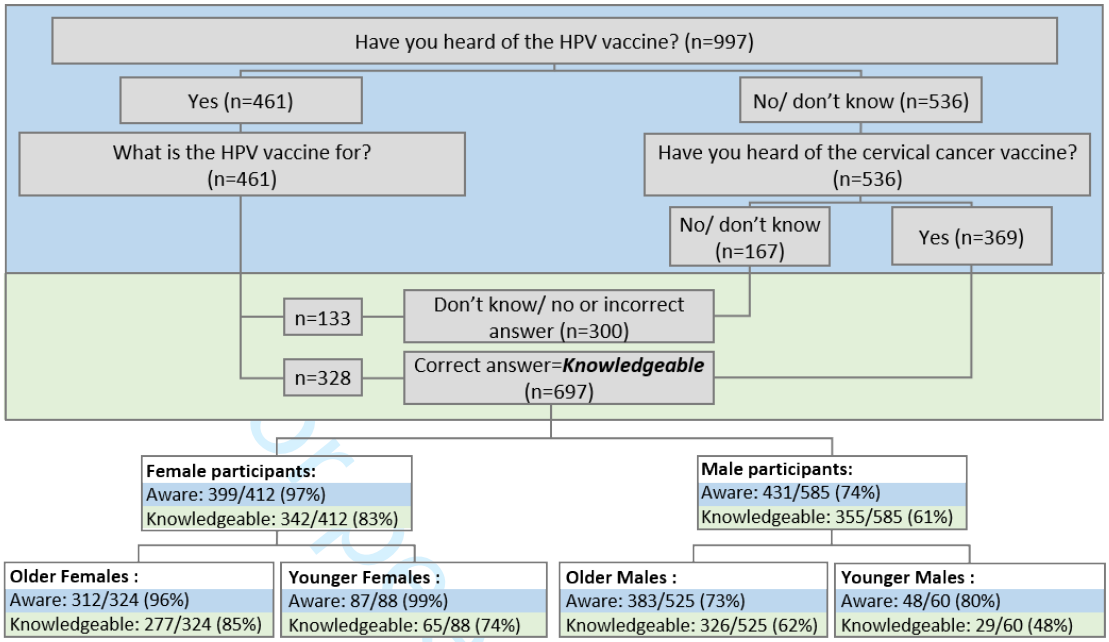
**Note.** All data shown are number (%) of participants, unless otherwise indicated. Due to rounding, total numbers may not add up to 100%.

**Abbreviations**. CAM, complementary and alternative medicine; IQR, interquartile range

**Table 2. Participant Characteristics (qualitative interview)**

| | | |
|---|---|---|
| **French-Speaking Region** | | |
| Female | | N= 6 |
| | Age | 15-26 years, $\bar{x}$=19.6 years |
| | Received at least 1 dose of HPV vaccination | N=4(66%) |
| | Informed through school vaccination program | N=6(100%) |
| Male | | N=8 |
| | Age | 15-26 years, $\bar{x}$=22.4 years |
| | Received at least 1 dose of HPV vaccination | N=4(50%) |
| | Informed through school vaccination program | N=1(13%) |
| **German-Speaking Region** | | |
| Female | | N=8 |
| | Age | 15-26 years, $\bar{x}$=20.9 years |
| | Received at least 1 dose of HPV vaccination | N=4(50%) |
| | Informed through school vaccination program | N=7(88%) |
| Male | | N=9 |
| | Age | 15-26 years, $\bar{x}$= 20.6years |
| | Received at least 1 dose of HPV vaccination | N=1(11%) |
| | Informed through school vaccination program | N=1(11%) |

**Figure 1. Awareness and Knowledge of HPV Vaccine**




**Note.** All data in blue stands for awareness and all data in green for knowledge.

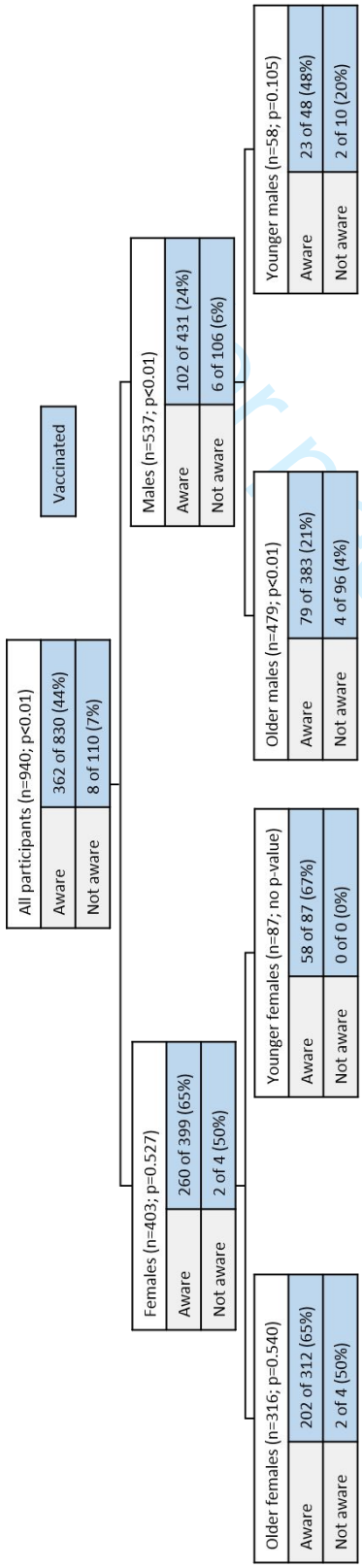


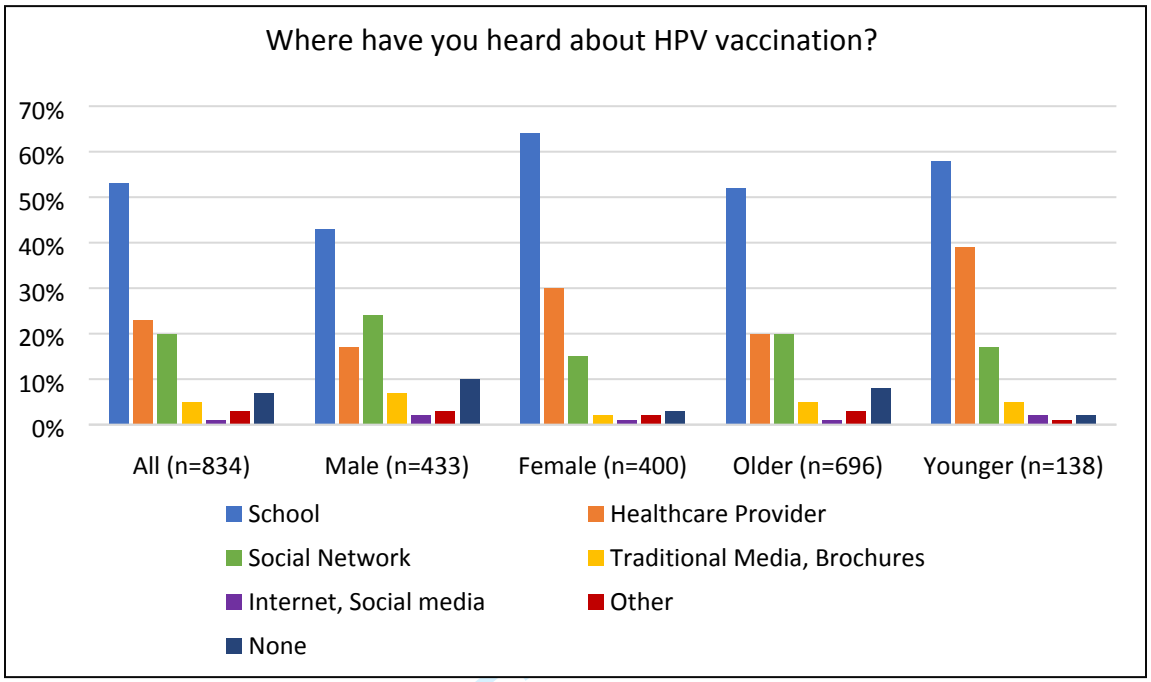

**Figure 2. Awareness and HPV Vaccine Uptake**

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.


**Figure 3. Knowledge and HPV Vaccine Uptake**

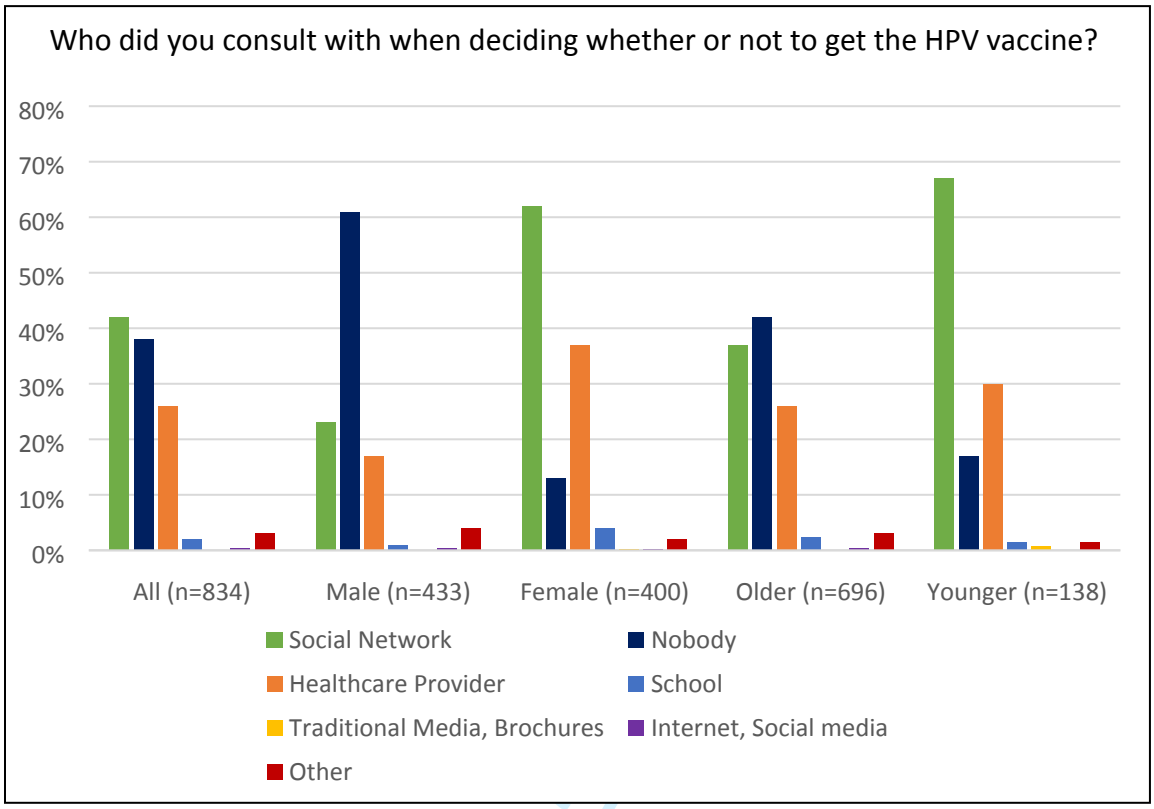
**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 4. Information Sources**



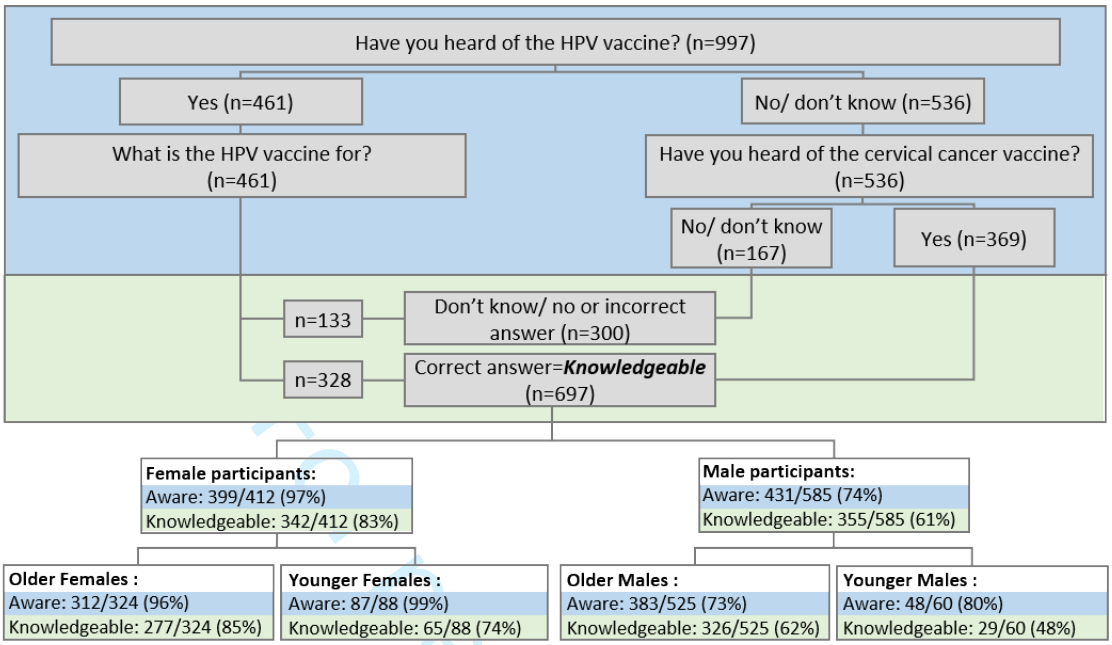

**Note**. 167/1001 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Figure 5. HPV Vaccine Consulting Behavior**




**Note**. 167/1001 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Figure 1. Awareness and Knowledge of HPV Vaccine**



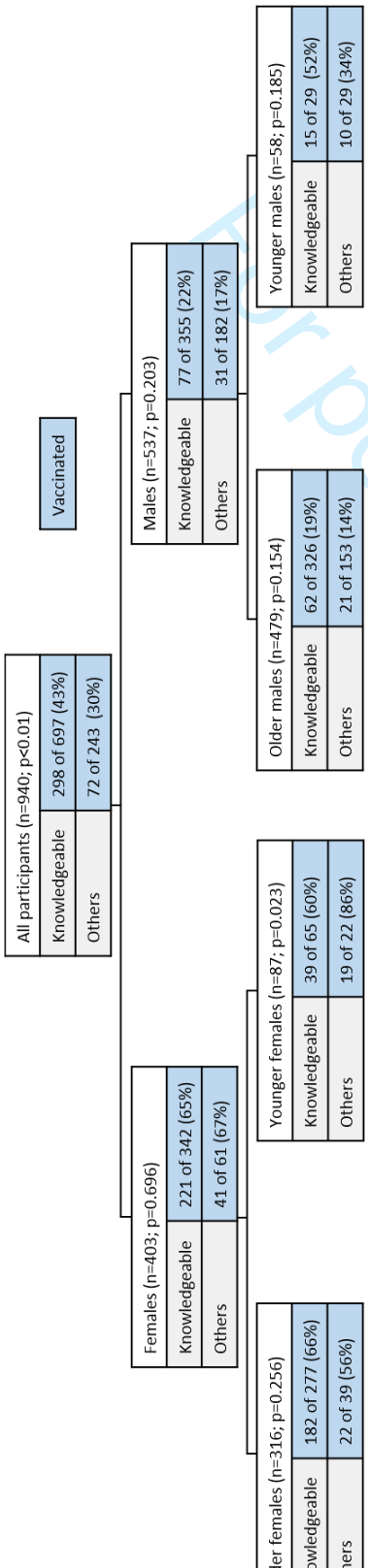

**Note.** All data in blue stands for awareness and all data in green for knowledge.

**Figure 2. Awareness and HPV Vaccine Uptake**



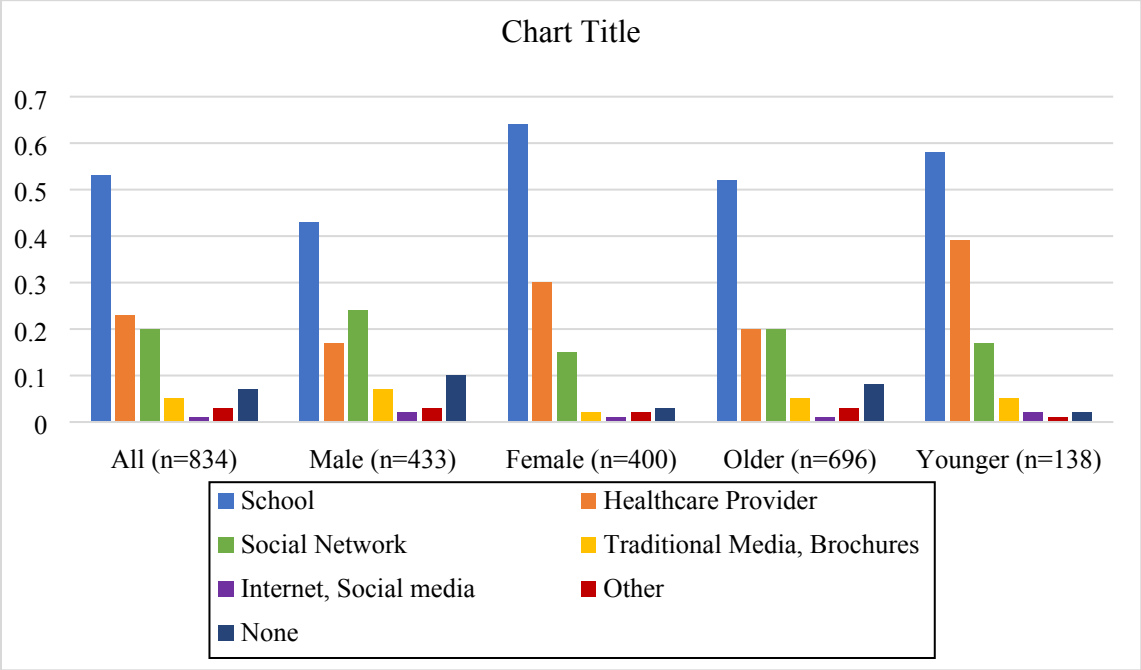

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 3. Knowledge and HPV Vaccine Uptake**



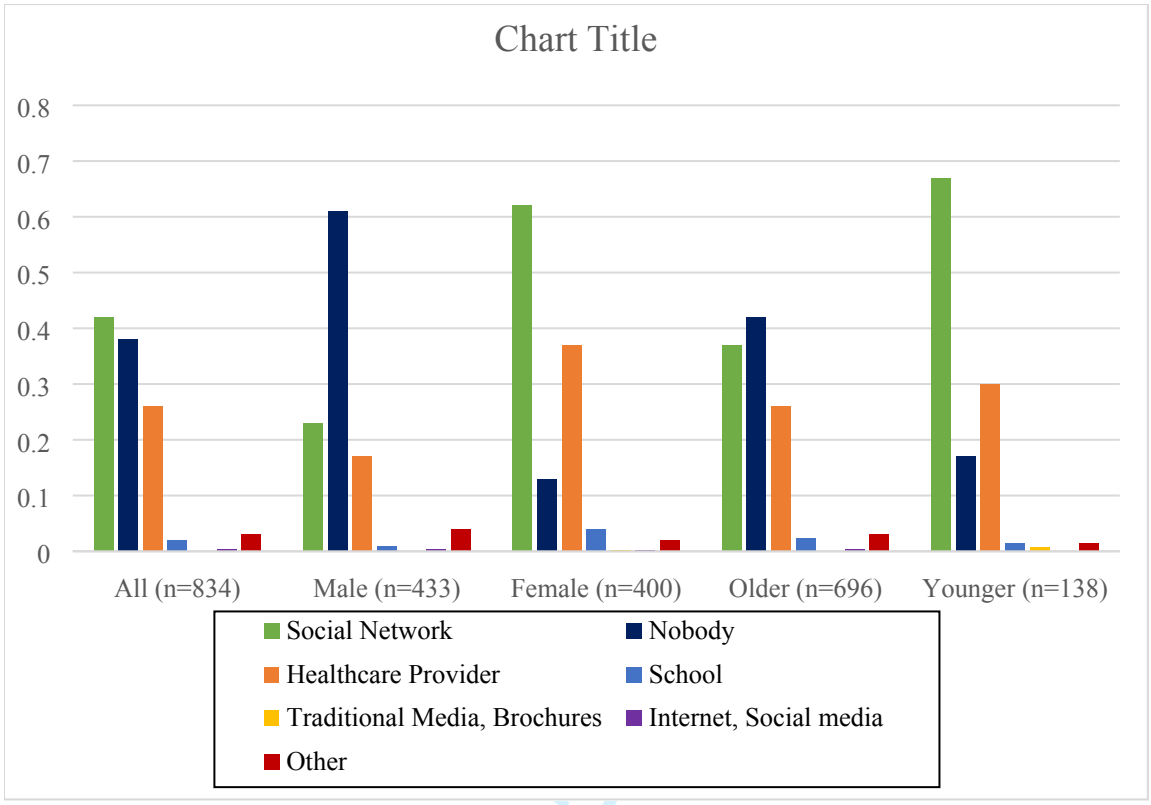

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 4. Information Sources**




**Note**. 167/1001 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Figure 5. HPV Vaccine Consulting Behavior**



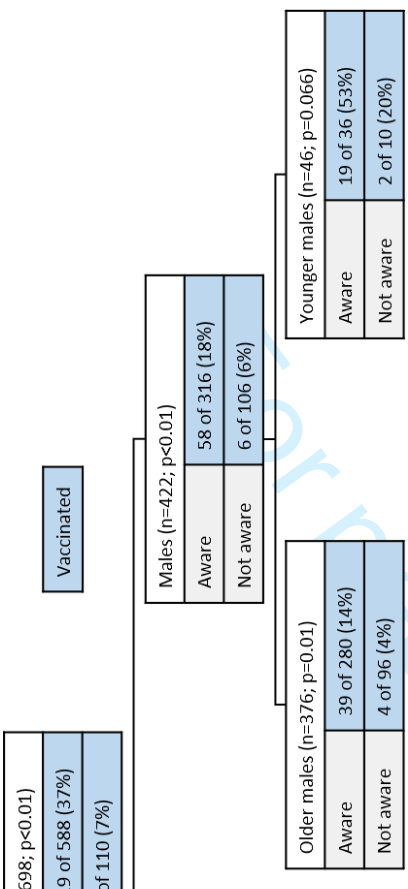

**Note**. 167/1001 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

# Schwendener et al, HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study: Supplementary Material

## Supplementary Table 1. Survey questions concerning gendered perceptions of HPV Vaccine

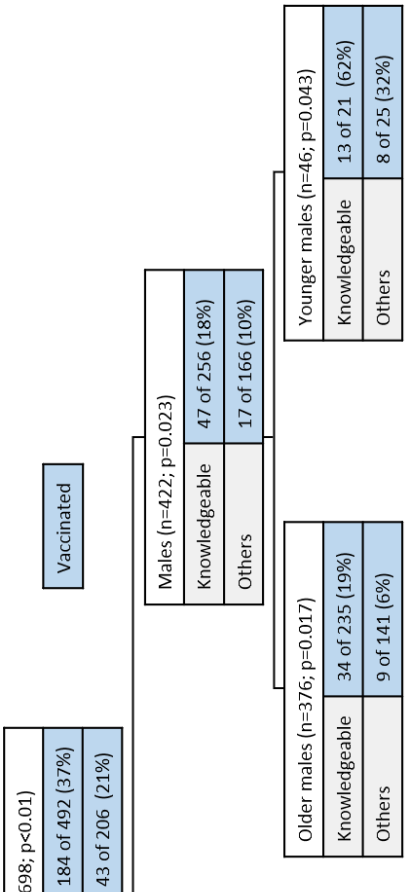
| | | By gender | | By age groups | |
|---|---|---|---|---|---|
| | **All participants** | **Male** | **Female** | **Born before 1.7.02** | **Born on/ after 1.7.02** |
| **Have you heard of the HPV vaccine?** | *(n = 997)* | *(n = 585)* | *(n = 412)* | *(n = 849)* | *(n = 148)* |
| Yes, n (%) | 461 (46) | 176 (30) | 285 (69) | 359 (42) | 102 (69) |
| No/ don't know, n (%) | 536 (54) | 409 (70) | 127 (31) | 490 (58) | 46 (31) |
| **Have you heard of the cervical cancer vaccine?** | *(n = 535)* | *(n = 409)* | *(n = 126)* | *(n = 489)* | *(n = 46)* |
| Yes, n (%) | 369 (69) | 255 (62) | 114 (90) | 336 (69) | 33 (72) |
| No/ don't know, n (%) | 166 (31) | 154 (38) | 12 (10) | 153 (31) | 13 (28) |
| **What is the HPV vaccine for?** | *(n = 461)* | *(n = 176)* | *(n = 285)* | *(n = 359)* | *(n = 102)* |
| Only female, n (%) | 185 (40) | 35 (20) | 150 (53) | 160 (45) | 25 (25) |
| All other answers, n (%) | 276 (60) | 141 (80) | 135 (47) | 199 (55) | 77 (75) |
| **Combination of all questions** | *(n = 711)* | *(n = 361)* | *(n = 350)* | *(n = 611)* | *(n = 100)* |
| Only female, n (%) | 554 (78) | 290 (80) | 264 (75) | 496 (81) | 58 (58) |
| All other answers, n (%) | 157 (22) | 71 (20) | 86 (25) | 115 (19) | 42 (42) |

**Supplementary Figure 1. Awareness and HPV**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

**Supplementary Figure 2. Knowledge and HPV**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

# Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

## Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

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| | | Reporting Item | Page Number |
|---|---|---|---|
| **Title and abstract** | | | |
| Title | #1a | Indicate the study's design with a commonly used term in the title or the abstract | 1 |

| | | | |
|---|---|---|---|
| Abstract | #1b | Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background / rationale | #2 | Explain the scientific background and rationale for the investigation being reported | 5 |
| Objectives | #3 | State specific objectives, including any prespecified hypotheses | 5,6 |
| **Methods** | | | |
| Study design | #4 | Present key elements of study design early in the paper | 7 |
| Setting | #5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7,8 |
| Eligibility criteria | #6a | Give the eligibility criteria, and the sources and methods of selection of participants. | 7-10 |
| | #7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | n/a |
| 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. Give information separately for for exposed and unexposed groups if applicable. | 8-10 |

| | | | |
|---|---|---|---|
| Bias | #9 | Describe any efforts to address potential sources of bias | n/a |
| Study size | #10 | Explain how the study size was arrived at | 7-11 |
| Quantitative variables | #11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why | 7-9 |
| Statistical methods | #12a | Describe all statistical methods, including those used to control for confounding | 8-10 |
| Statistical methods | #12b | Describe any methods used to examine subgroups and interactions | 7-10 |
| Statistical methods | #12c | Explain how missing data were addressed | n/a |
| Statistical methods | #12d | If applicable, describe analytical methods taking account of sampling strategy | n/a |
| Statistical methods | #12e | Describe any sensitivity analyses | n/a |
| **Results** | | | |
| Participants | #13a | 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. Give information separately for for exposed and unexposed groups if applicable. | 11 |
| Participants | #13b | Give reasons for non-participation at each stage | 11 |

| | | | |
|---|---|---|---|
| Participants | #13c | Consider use of a flow diagram | n/a |
| Descriptive data | #14a | Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable. | 11,27,28 |
| Descriptive data | #14b | Indicate number of participants with missing data for each variable of interest | 11,12,16 |
| Outcome data | #15 | Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable. | 11-17 |
| Main results | #16a | 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 |
| Main results | #16b | Report category boundaries when continuous variables were categorized | 11-17 |
| Main results | #16c | If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | n/a |
| Other analyses | #17 | Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses | n/a |
| **Discussion** | | | |
| Key results | #18 | Summarise key results with reference to study objectives | 18,19 |

| | | | |
|---|---|---|---|
| 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. | 19,20 |
| Interpretation | #20 | Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence. | 18-20 |
| Generalisability | #21 | Discuss the generalisability (external validity) of the study results | 18-20 |
| **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 | 21 |

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# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2021-054419.R1 |
| Article Type: | Original research |
| Date Submitted by the Author: | 01-Oct-2021 |
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| Primary Subject Heading: | Public health |
| Secondary Subject Heading: | Sexual health, Immunology (including allergy) |
| Keywords: | IMMUNOLOGY, Public health < INFECTIOUS DISEASES, PREVENTIVE MEDICINE, PUBLIC HEALTH, SEXUAL MEDICINE |

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# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

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**Word count:**

4235 (exclusive title page, authors' contribution statements, abstract, keywords, strengths and limitations of this study, acknowledgments, ethics approval)

**Key Words:**

HPV vaccine, HPV vaccine awareness, HPV vaccine knowledge, HPV vaccine information sources, HPV vaccine uptake, youth

## ABSTRACT:

**Objectives:** We aimed to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process of youth, both male and female, in Switzerland.

**Design:** With a mixed-methods study design, we conducted quantitative questionnaires and qualitative interviews, which lasted 20-45 minutes.

**Setting and participants:** We recruited participants, 15-26 years of age, in physicians' offices, in a local sexual health clinic, and during military enlistment. We conducted quantitative questionnaires with 997 youth participants (585 male, 412 female) and qualitative interviews with 31 youth (17 male, 14 female).

**Primary and secondary outcome measures:** We assessed HPV vaccine awareness, knowledge, information sources and vaccination status.

**Results:** In the study's quantitative component, 108 (20%) male and 262 (65%) female participants had received ≥1 dose of HPV vaccine. 697 (70%) participants were knowledgeable about the HPV vaccine. Females were more likely to be knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01). Younger participants in the sample compared to older participants were more likely to be aware about HPV vaccine (135/148 [91%] vs. 695/849 [82%]; p<0.01). The three most mentioned information sources were school health programs (442 [53%]), health care providers (190 [23%]), and participants' social networks (163 [20%]). Overall, 554/710 (78%) participants had a female-gendered perception of HPV vaccine, a finding which was further supported and explained by qualitative data.

**Conclusions:** Despite a male HPV vaccine recommendation being made >4 years prior to the data collection, HPV vaccine knowledge was higher among females than males, and a female-

gendered perception of HPV vaccine remains prevalent. Internet and social media were minor HPV vaccine information sources. Study findings demonstrate that HPV knowledge matters for HPV vaccine uptake and suggest that we should improve HPV information quality and access for youth, particularly by tailoring knowledge campaigns to young men.

## Strengths and limitations of this study:

- One major strength of the study is that it uses a mixed methods approach, allowing for the qualitative data to offer potential explanations to quantitative findings.
- The study included a large number of female and male youth, allowing us to gain gendered differences regarding HPV vaccination information sources.
- One limitation of this study is that we might overestimate HPV vaccination knowledge based on the way we classified answers for the quantitative component.
- Our sampling strategy led to a non-representative sample.

## 1. Introduction

Surprisingly little research has directly examined youth knowledge, awareness, and information sources as determinants of *human papillomavirus (HPV)* vaccine uptake. Furthermore, the research that has been done on youth perspectives has primarily focused on females [1-6], although the vaccine has been recommended for male youth for several years in many countries. Literature on the determinants of HPV vaccine attitudes and uptake among male youth remains limited [7-12]. Furthermore, the false perception that the HPV vaccination concerns only women continues to persist in popular discourse since it has been long known as the "cervical cancer vaccine"[3, 13].

In addition to issues related to access barriers [2, 14], previous reports in male and female youth suggest that low HPV vaccine uptake is also related to limited HPV vaccine awareness and knowledge [11, 15-17], and to the behavioral expectations youth perceive from their parents, family members, and peers [18, 19]. The most consistent predictor of HPV vaccination is having received a recommendation from a health care provider [12, 14, 20].

Previous research has focused on parents' attitudes and information sources towards HPV vaccine since the primary target group are 11-14-year-old adolescents [21-26]. A key component of the Swiss National Vaccination Strategy (NVS), in order to increase HPV vaccination rates, however, is to address insufficient levels of youth vaccination knowledge, e.g. by emphasizing the importance of school vaccination programs. Also, the NVS aims to address insufficient vaccination access, e.g., by removing financial barriers, especially for young adults with limited financial resources. Accordingly, HPV vaccine is now covered by the state when given until the age of 26 to men and women in the setting of a state vaccination program, thereby addressing such financial barriers to HPV vaccination in youth [27]. The effective implementation of each of these NVS approaches would benefit from additional research on HPV vaccine awareness,

knowledge, and information sources in youth. We have recently documented the validity of measuring vaccine hesitancy (VH) in youth using the Youth Attitudes about Vaccines (YAV) questionnaire, which shows that VH is an independent predictor of HPV non-immunization in Switzerland in female youth [28]**(Kiener L., Schwendener C., et al, manuscript submitted)**. The aims of the present study were to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process among youth, both male and female, in Switzerland. We additionally aimed to gain a more current understanding of gendered aspects youth may have around the HPV vaccine. Finally, we examined how these factors contribute to HPV vaccine uptake in both sexes and in younger and older adolescents.

## 2. Methods

### *2.1 The Swiss Context*

The Swiss Federal Office of Public Health (FOPH) and the Federal Vaccination Commission have recommended HPV vaccine since 2007 for female youth [29], and since 2015 for male youth [30]. HPV vaccine uptake has increased in the last decade [31], but lies still below the 80% immunization target [32]. In 2017-2019, the most recent evaluation period, only 20% of 16-year old males and 64% of females, had received ≥1 dose of HPV vaccine on average throughout Switzerland [33]. Regional differences in uptake have been associated with specifics of vaccination policies of local health authorities, limited information access, and the availability and quality of school vaccination programs [34, 35].

### *2.2 Study design*

We applied a convergent mixed-methods design [36], meaning we collected qualitative and quantitative data in parallel. We conducted the study in the context of our Swiss national research program (NRP74) on the determinants of VH in Switzerland regarding childhood and HPV vaccination. The local institutional review board (Ethikkommission Nordwest- und Zentralschweiz) approved the study. All participants provided written informed consent. Full details on our recruitment methods, power calculation, and the questionnaire have been previously published [37].

### *2.3 Study population and recruitment*

Participants were 15-26 years of age, male and female. Of note, youth in Switzerland are legally able to make vaccine decisions starting at age 14 [38], which supports vaccination promotion efforts which focus on youth perspectives on HPV vaccination. Even though the primary target

group is 11-14-year-olds, the vaccine is also recommended as a catch-up vaccine until 26 years in many countries, including Switzerland. We recruited participating youth in the offices of physicians providing biomedicine and sometimes additionally complementary and alternative medicine (CAM), and in a local sexual health clinic. Recruitment was done in urban and rural areas, and in 3 of 4 Swiss language regions, i.e., German, French, Italian. In order to gain more male participants, we also recruited during military enlistment (military service is compulsory for Swiss males, with enlistment being at age 18-24). Since July 1st, 2016 the cost of HPV vaccine has been covered by mandatory health insurance for male adolescents 11-14 years of age and as a catch-up vaccination until age 26 in Switzerland. We therefore divided male participants in an older and a younger age group. We refer to male participants born before vs. on/after July 1st, 2002 as the "older" and "younger" participants, respectively, meaning that younger male participants were part of the HPV vaccine target age group when 11-14 years of age. For comparison purposes, we applied the same age cut-offs to female participants.

### *2.4 Patient and public involvement*

We did not include patient or public involvement in designing the study, commenting the outcomes, interpreting the results of this study or reviewing the manuscript.

### *2.5 Quantitative methods*

As previously reported [37], we developed German, French, Italian, and English versions of the questionnaire. We interviewed military participants on site (face-to-face), and the other participants on the phone, after the physician/clinic visit. Quantitative interviews lasted 25-35 minutes and were conducted by medical students with previous training in participant recruitment, informed consent procedures and interview techniques. Interviews were

conducted from January 2019 to April 2020. All data was entered to open data kit (ODK) using tablets [37]. The questionnaire included socio-demographics including language, place of residence, living situation (with parents, with roommates, with partner), age, nationality, and school HPV vaccination program availability.

HPV vaccination status (has received ≥1 dose of HPV vaccination) was assessed based on review of the vaccination booklet of the participant, and, if unavailable, on personal report of being vaccinated.

In order to measure youth *awareness* about the HPV vaccine, we asked all participants if they had heard of the HPV vaccine. To accommodate for a gendered perception, for those who said "no" to the previous question, we asked if they had heard of the "cervical cancer vaccine." To measure youth *knowledge* about the HPV vaccine, we asked participants what the HPV vaccine is intended for. Those who responded correctly were considered to be knowledgeable. We considered an answer to be correct if they mentioned at least one correct aspect about the HPV vaccine, i.e., it protects against "cancer", "cervical cancer", "papilloma virus", or a "sexually transmitted disease". We sought to establish where youth obtained information about the HPV vaccination by asking two questions, each with free text answer options in order to document the most precise responses: (1) "Where have you heard about HPV vaccination?" and (2) "Who did you consult with when deciding whether or not to get the HPV vaccine?". Answers to the second question included consulting people as well as traditional media, the internet, and other forms of information supply.

### *2.6 Qualitative methods*

After completion of the quantitative interviews, participants were invited to participate in an additional qualitative interview. We subsequently contacted interested youth who indicated

willingness in the German- and French-speaking regions of Switzerland. Additional participants were recruited through researcher and participant social networks and by snowball sampling. Our research team collaboratively developed a semi-structured interview guide, which we piloted and revised iteratively for clarity and coherence. The interviews allowed us to gather background information about the youth, their health status and lifestyle, the HPV vaccine decision-making process, including knowledge, awareness, information sources, and the people with whom they discussed the vaccination. Qualitative interviews were conducted (March 2019-September 2020), either face-to-face or online (Skype or Zoom), they lasted 20-45 minutes, and were audio-recorded and transcribed verbatim. Qualitative data were analyzed by social scientists Andrea Buhl and Michael J. Deml. Analysis of the qualitative interviews was guided by the Framework Method [39] with support of MAXQDA software. All quotes from interviews have been translated from German or French into English and anonymized.

## 3. Results

For the study's quantitative component, we completed telephone (n=622) or face-to-face (n=375) interviews with 1010 youth. Of these, we excluded eight participants because they did not meet the age criteria, one participant because of missing gender information, and four additional interviews due to missing answers on awareness and knowledge. Quantitative analyses are therefore based on 997 participants (585 male, 412 female). Their characteristics are shown in **Table 1**. For the study's qualitative component, we conducted 14 qualitative interviews with female youth and 17 interviews with male youth. Qualitative participants ranged in age from 15 to 26 years in age (average ~21 years). Characteristics of the participants of the qualitative interview are shown in **Table 2**.

In the following sections, we present results regarding: (1) awareness and knowledge about the HPV vaccination, (2) youth HPV vaccination information sources and people with whom they had discussed the vaccination, and (3) youth's gendered perceptions of the HPV vaccine.

### *3.1 Awareness about HPV Vaccination*

For the purpose of this study, we defined *awareness* as having heard of the HPV or "cervical cancer" vaccine. Significantly more female youth were aware of the HPV vaccine than male youth. Of the 997 participants, 461 (46%) had heard of the HPV vaccine; 176/585 (30%) males and 285/412 (69%) females ($p<0.01$). Among the 536 participants who had not heard of HPV vaccine, 369 (69%) had heard of the "cervical cancer vaccine", 255/409 (62%) males and 114/127 (90%) females ($p<0.01$).

Of the 997 participants, 830 (83%) had heard of the HPV or "cervical cancer vaccine", 431/585 (74%) of males and 399/412 (97%) of females ($p<0.01$). In both awareness of HPV vaccine and

awareness of “cervical cancer vaccine”, females had more awareness than males. 695/849 (82%) of the older participants and 135/148 (91%) of the younger participants had heard of the HPV or “cervical cancer vaccine” (p<0.01). Details are shown in **Figure 1**.

Of the 997 participants, 370 (39%) had received ≥1 dose of HPV vaccine. As shown in **Figure 2**, participants with greater awareness had also more often received ≥1 dose of HPV vaccine compared to participants with limited awareness (362/830 [44%] vs. 8/110 [7%]; p<0.01). This effect was manifest in males (102/431 [24%] of aware males vs. 6/106 [6%] of males with limited awareness had received ≥1 HPV vaccine dose; p<0.01), but not in females (260/399 of aware females [65%] vs. 2/4 [50%] of females with limited awareness had received ≥1 HPV vaccine dose; p=0.53), however, only few (4/413) females were unaware of the vaccine.

When we defined HPV vaccine uptake according to availability of a vaccination record, results regarding the associations of awareness and uptake and of knowledge and uptake remained essentially unchanged (**Supplementary Fig. 1 and 2**).

### *3.2 Knowledge about HPV Vaccination and Implications for Uptake*

We defined *knowledge* as being able to give a correct answer to what the HPV vaccine is for or for the association of HPV with cervical cancer. 697/997 (70%) participants had knowledge of HPV vaccine or the “cervical cancer vaccine”, while 300/997 (30%) participants did not. Females were more knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01) which is also shown in **Figure 1**. We did not find a significant difference regarding knowledge between younger and older participants (94/148 [64%] vs. 603/849 [71%]; p=0.07).

As shown in **Figure 3**, more knowledgeable participants had received ≥1 dose of HPV vaccine compared to participants with limited knowledge (298/697 [43%] vs. 72/243 [30%]; p<0.01), and there was no evidence that this difference was limited to either sex (77/355 [22%] knowledgeable males vs. 31/182 [17%] males with limited knowledge had received ≥1 HPV vaccine dose; p=0.20), and 221/342 knowledgeable females [65%] vs. 41/61 [67%] females with limited knowledge had received ≥1 HPV vaccine dose; p=0.70).

For the study's qualitative component, although the youth had agreed to participate in qualitative interviews explicitly about their HPV vaccination decisions, many participants were not able to tell us what specifically the HPV vaccine was intended to protect against. When asked about recommendations for improvements to HPV vaccination campaigns in Switzerland, almost all youth mentioned desiring more and better information. The following dialogue demonstrates how knowledge and awareness served as barriers for a 22-year-old male who had not received the vaccine:

> Researcher: So, I see [from your vaccination certificate] that you didn't get the HPV vaccine.
>
> Participant: No.
>
> Researcher: Was it a choice?
>
> Participant: No, it was an issue of information. I don't know what [HPV] is.

### *3.3 Youth Information Sources about HPV Vaccination*

We assessed if and where adolescents had heard about HPV vaccination and who they may have turned to when deciding whether to get vaccinated against HPV. As shown in **Figure 4**, the three most commonly mentioned information sources by youth in the quantitative questionnaire

were school health programs (53%), health care providers (23%), and participants' social networks (20%). The most mentioned information sources were similar for males and females. Internet and social media were mentioned infrequently as information sources (1% of all participants; 2% of males, 1% of females). Concerning the information sources used for deciding whether or not to vaccinate, most participants consulted their social networks (42%) and/or their healthcare provider (27%), as shown in **Figure 5**. Many participants (38%) did not talk to anyone about the HPV vaccine. We found this result predominantly with male participants (61%) and less with female participants (12%). Internet and social media were also infrequently mentioned for vaccine decision-making (0.4% of participants; 0.5% of males, 0.3% of females).

Qualitative interviews with youth showed that very few had actively sought out information about the HPV vaccination during the initial recommended age for the first dose (11-14 years). Primary explanations for this from the youths' perspectives included that they were too young when the HPV vaccine was offered via school programs or by their pediatricians, and that their parents had made the decision without being involved in the decision-making process. The few youth who reported having had discussions about the HPV vaccination described having talked to family members, primarily mothers or older siblings, or doctors (pediatricians if the vaccine was offered during the initial recommended age, gynecologists for older female participants who had not been vaccinated, and sexual health doctors for young men who have sex with men (MSM)). Apart from the MSM in the qualitative study sample, young men reported not having discussed the HPV vaccine with anybody. Several of the young women we interviewed recalled their parents' skepticism when the HPV vaccine was first introduced. A 26-year-old female who had not received the HPV vaccine explained, "It was one of the first years when it came out. 2009 or something like that. I was still a minor and still in high school. We needed our parents'

permission. My mother, who is a nurse, simply decided [against it because] it was a new vaccine, and we didn't yet know the side effects."

When asked about where information about the HPV vaccine should come from, many youth suggested better information campaigns via schools. This was particularly clear among youth whose parents chose against the vaccine when they were in the initial recommended target age. Despite not being vaccinated against HPV, an 18-year-old female described her views on the added value of having HPV vaccination information campaigns and programs in schools, particularly once youth are able to make their own health decisions:

> "I think it helped me a lot that that there was information at school and that the vaccine was offered there. We were at an age when we started to make our own decisions and that's why I liked the fact that we talked about it in school. That helped me a lot. […] because our parents had decided on everything before. And this is, I think, the first time that we decide or shared decisions about our health."

A 19-year-old female participant who had received the vaccine described the roles schools played in explaining the rationale behind the HPV vaccine, "I think I find it very important that there is an education and not just 'get vaccinated' and 'it's good for you or it helps you', but rather also a 'why' and 'what is it about' and 'what would it look like if you weren't vaccinated', what would be the consequence'? I think such a relatively educated attitude is also extremely useful."

### *3.4 Youth's female-gendered perception of the HPV Vaccine*

Given the HPV vaccination's association with cervical cancer in popular discourse, we analyzed if and to what extent participants had a gendered perception of HPV vaccine. From the quantitative sample, after excluding 287 of 997 participants without knowledge of HPV or the

"cervical cancer vaccine," 554 of 710 (78%) participants perceived the HPV vaccine as being only targeted towards women and not men (female-gendered answer) (**Supp. Table 1**). For example, many participants only mentioned cervical cancer when asked what the HPV vaccine is for and only few youth mentioned that the HPV vaccine protects also males from diseases. 290/361 (80%) males and 264/349 (75%) females (p=0.13) gave a female-gendered answer. While both older and younger participants had a female-gendered perception on the purpose of the HPV vaccination, significantly more older youth had female-gendered perceptions (496/611 (81%) older vs. 58/99 (59%) younger participants (p<0.01)). In addition, 277/331 (84%) older males vs. 13/30 (43%) younger males gave a female-gendered answer (p<0.01); 219/280 (78%) older females vs. 45/69 (65%) younger females gave a female-gendered answer (p=0.02).

During qualitative interviews, we asked youth if they saw any differences for HPV vaccination between men and women. These questions elicited two types of responses: (1) youth noting the vaccination as being beneficial for females only, and (2) discourses about females bearing the brunt of responsibility for sexual health. For the first type of response, some youth were not aware that males could get vaccinated against HPV. A 20-year-old female who had received the vaccine discussed her memories of getting the vaccine in school, "If I remember correctly, boys didn't get vaccinated [when I was in school]." An 18-year-old male who had not received the vaccine, when asked who the HPV vaccine was for, responded, "Women. Could that be? To be honest, that's all I know right now." Others complained that they now realize how limited their information about the vaccination and its benefits for young males was. A 19-year-old man explained:

> "Well, I really haven't heard about [the HPV vaccination for boys] from anyone until now. And I don't think this is my personal fault that I don't know anything about it. Until

now, it was only a topic for women, and now it's suddenly not anymore."

Other youth talked about female responsibility for sexual health. A 26-year-old female who had not been vaccinated against HPV explained how she saw the HPV vaccine for males as providing protection to the females with whom young men had sexual encounters, "Girls are going to take it more seriously. For boys, it doesn't concern them directly. It's protection for [girls]." A 20-year-old female who had not been vaccinated against HPV echoed this sentiment:

"I mean, for [girls], we know that (…), if we're going to be in a relationship where we have sexual intercourse with somebody, we know that we have to protect ourselves. First of all, to not get pregnant. Second of all, we know that having any types of STDs and viruses would make our lives miserable. (…) But for boys, it's like, "Ok, I'll have to wear protection. But what's the worst that can happen?"

## 4. Discussion

Our study on HPV vaccine awareness, knowledge, information sources, and gendered perception among young males and females in Switzerland has four main findings. First, young females had more HPV vaccine awareness and knowledge than young males. This confirms previous reports, consistent with HPV vaccine having been introduced initially and worldwide as a vaccine designed only for females [15, 40, 41]. Even though awareness of HPV vaccine was higher in our study in females than in males, a recent Swiss national study found limited HPV awareness among 24–26-year-old women, suggesting opportunities for intervention also in women, including those that are older than the primary target age group [42]. We might hypothesize that lower awareness of the older females in our sample is related to the amount of time that has passed since they received HPV vaccination during their early adolescence. In other words, lower awareness in the group of older females might be due to memory recall bias and perhaps less developed vaccination implementation programs at the time they would have been exposed to them.

Second, increased knowledge was associated with higher HPV vaccine uptake, in both females and males, suggesting that knowledge matters. This confirms results from previous reports [11, 15-17]. In our study we only saw a trend towards a small difference in HPV vaccine knowledge between the younger and older age groups. Other studies however, found a higher knowledge score in older compared to younger participants [15, 41]. Encouragingly, younger participants were more aware of HPV vaccine compared to older participants, in contrast to other studies [15, 43].

Third, the internet and social media played a surprisingly minor role as HPV vaccine information

sources for youth in our study. This stands in contrast to other studies that found social media to increasingly become a source of health information worldwide [44-47]. Another US study described the internet as being one of the most frequently mentioned sources of vaccine information among adolescents [48]. Currently, the potential of internet/ social media information for HPV prevention/ vaccination uptake seems not to be used in Switzerland.

Fourth, despite the male HPV vaccine recommendation was introduced more than four years prior to our interviews, both female and male youth in our study associated HPV vaccine predominantly with cervical cancer, consistent with the gendered views of HPV vaccine documented in previous reports [3, 13]. That said, it is encouraging to see a slight shift in the younger age group from a female gendered perspective to a gender-neutral perspective on HPV vaccine.

### 4.1 Strengths and limitations

One of the major strengths of our study is that it is a mixed-methods study. Our qualitative work adds some description and explanation to our quantitative findings. Furthermore, we have a large number of male participants in our study. The Swiss context in particular lacks data on HPV vaccine awareness, knowledge, and information sources from male youth. Our study addresses this research gap. Previous studies have predominantly focused on parents and their knowledge on HPV vaccine [21-26]. Our study included youth, and this allowed us to gain important insights on who youth turn to when deciding on HPV vaccination. Since the vaccine is recommended as a catch-up vaccine until 26 years in many countries, including Switzerland, we have to ensure that youth are aware of the HPV vaccine and that they have the necessary knowledge to make an informed HPV vaccination decision.

One limitation of this study is that we might overestimate knowledge based on the way we classified answers for the quantitative component. For example, if participants had heard of the HPV vaccine, we simply asked them if they know what it is for but added no further questions. In addition, for participants who have only heard of the "cervical cancer vaccine," we did not ask any follow-up questions on HPV knowledge. Other studies have assessed knowledge in more depth, asking participants more knowledge specific questions [3, 18, 19]. Since our questionnaire already lasted 25-35 minutes with questions on VH **(Jafflin K., manuscript in preparation),** CAM use **(Jafflin K., manuscript in preparation, Kiener L., Schwendener C., et al, manuscript submitted)** and moral foundations **(Jafflin K., manuscript in preparation)** we opted to not include more questions to further assess participants' knowledge. Another limitation to this study was that our sampling strategy led to a non-representative sample. Additionally, potential sources of bias arise from us not being able to get in contact with participants who do not visit a physicians' office. Our sampling strategy however allowed us to recruit a more diverse sample regarding biomedical and CAM providers.

## 5. Conclusion

This study underlines the importance of HPV awareness and knowledge given the association between HPV awareness and knowledge and HPV vaccine uptake. However, males still have limited awareness and knowledge about HPV vaccine. Future strategies to increase HPV vaccine uptake, especially among males, should focus on better and more information supply to youth explaining them the benefit of the HPV vaccine. School vaccination programs have proven to be effective and should be further expanded [31]. Parents play an important role in youth' decision making process when it comes to HPV vaccine and they should be equally informed about the benefits and importance of the HPV vaccine. Efforts should be made to underline the

effectiveness of the HPV vaccine for males and females to reach a gender-neutral perception of the HPV vaccine. Targeted public health efforts should consider exploring internet and social media as potential information distribution platforms. HPV vaccine uptake has improved over the years, but there is substantial room for improvement, particularly in terms of increasing knowledge and awareness among young men and women alike.

**Acknowledgements**

We would like to express our gratitude to all participating youth, young adults and providers for their time and effort as well as the Swiss National Science Foundation for their financial support.

**Disclosure of Potential Conflict of Interest**

All authors: no conflicts.

**Funding**

This work was supported by the Swiss National Science Foundation (National research program NRP74, grant 407440_167398, recipient: PET). The study received supplementary postdoctoral fellowship funding (to M.J.D.) from the Nora van Meeuwen-Haefliger-Foundation. We did not receive funding from vaccine manufacturers or the Swiss Federal Office of Public Health.

**Ethics approval**

The study was approved by the local ethics committee (Ethikkommission Nordwest- und Zentralschweiz, EKNZ; project ID number 2017-00725). The ethics approval covers all study participants, which includes adolescent and adult patients as well as biomedical and CAM providers. Informed consent was provided by all participants after the nature and possible

consequences of the study had been fully explained.

## Data sharing statement

Data is available upon reasonable request to the corresponding author.

**Contributors' Statement Page**

Ms. Kiener and Ms. Schwendener recruited participating youth, conducted interviews, carried out the analysis, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Jafflin conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

Ms. Rouached, Ms. Juillerat and Mr. Meier recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Schärli, Dr. Muggli, Dr. Gültekin and Dr. Gruillot recruited participating youth, and reviewed and revised the manuscript.

Mr. Baumann and Ms. Debergh recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Huber conceptualized and designed the study, recruited participating providers, and reviewed and revised the manuscript.

Dr. Merten conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, and reviewed and revised the manuscript.

Dr. Buhl designed the data collection instruments, recruited participating youth, conducted interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Deml conceptualized and designed the study, designed the data collection instruments, recruited participating providers and youth, conducted qualitative interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Tarr conceptualized and designed the study, designed the data collection instruments, recruited participating providers, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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**Figures:**

1. Awareness and Knowledge of HPV Vaccine

2. Awareness and HPV Vaccine Uptake

3. Knowledge and HPV Vaccine Uptake

4. Information Sources

5. HPV Vaccine Consulting Behavior

**Table 1. Participant Characteristics (quantitative questionnaire)**

| | All Participants (n = 997) | Male (n = 585) | Female (n = 412) |
|---|---|---|---|
| **Age** | | | |
| Age (years), median (IQR) | 19 (18-21) | 19 (19-20) | 20 (17-23) |
| Born before July 1st, 2002, n (%) | 849 (85) | 525 (90) | 324 (79) |
| Born on/ after July 1st, 2002, n (%) | 148 (15) | 60 (10) | 88 (21) |
| **Nationality** | | | |
| Swiss, n (%) | 913 (92) | 547 (94) | 366 (89) |
| **Language** | | | |
| German, n (%) | 667 (67) | 448 (77) | 229 (53) |
| French, n (%) | 168 (17) | 47 (8) | 121 (29) |
| Italian, n (%) | 156 (16) | 86 (15) | 70 (17) |
| English, n (%) | 6 (1) | 4 (1) | 2 (0.5) |
| **Recruitment setting** | | | |
| Biomedical provider, n (%) | 405 (41) | 146 (25) | 259 (63) |
| Military service, n (%) | 375 (38) | 371 (63) | 4 (1) |
| CAM provider, n (%) | 148 (15) | 55 (9) | 93 (23) |
| Adolescent clinic, n (%) | 69 (7) | 13 (2) | 56 (14) |
| **Living situation** | | | |
| With parents, n (%) | 817 (82) | 497 (85) | 320 (78) |
| **School vaccination program** | | | |
| School program available, n (%) | 448 (45) | 180 (31) | 268 (65) |
| **Vaccination status** | *n = 940* | *n = 537* | *n = 403* |
| Has received ≥1 does of HPV vaccine, n (%) | 370 (39) | 108 (20) | 262 (65) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated. Due to rounding, total numbers may not add up to 100%.

**Abbreviations**. CAM, complementary and alternative medicine; IQR, interquartile range

635 **Table 2. Participant Characteristics (qualitative interview)**

| | | |
|---|---|---|
| **French-Speaking Region** | | |
| Female | | N= 6 |
| | Age | 15-26 years, $\bar{x}$=19.6 years |
| | Received at least 1 dose of HPV vaccination | N=4(66%) |
| | Informed through school vaccination program | N=6(100%) |
| Male | | N=8 |
| | Age | 15-26 years, $\bar{x}$=22.4 years |
| | Received at least 1 dose of HPV vaccination | N=4(50%) |
| | Informed through school vaccination program | N=1(13%) |
| **German-Speaking Region** | | |
| Female | | N=8 |
| | Age | 15-26 years, $\bar{x}$=20.9 years |
| | Received at least 1 dose of HPV vaccination | N=4(50%) |
| | Informed through school vaccination program | N=7(88%) |
| Male | | N=9 |
| | Age | 15-26 years, $\bar{x}$= 20.6years |
| | Received at least 1 dose of HPV vaccination | N=1(11%) |
| | Informed through school vaccination program | N=1(11%) |

636

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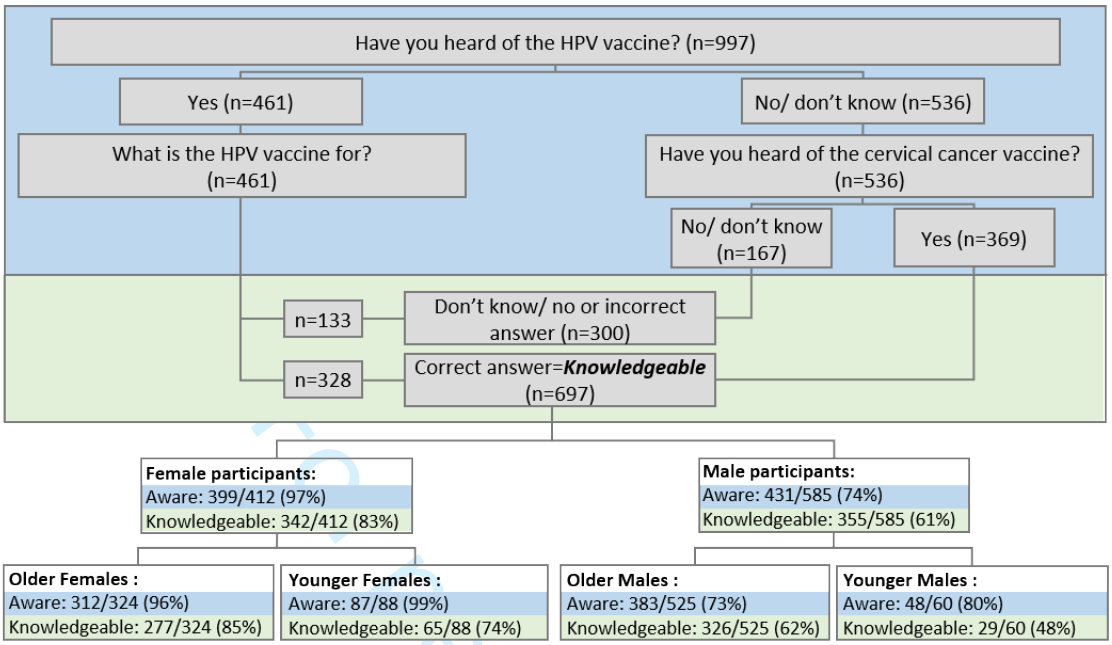
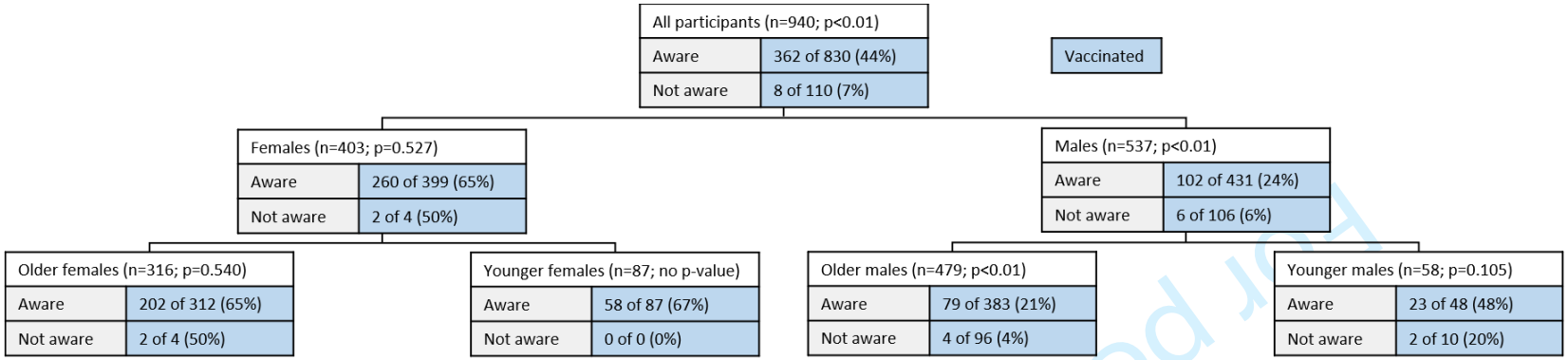
**Figure 1. Awareness and Knowledge of HPV Vaccine**




**Note.** All data in blue stands for awareness and all data in green for knowledge.

**Figure 2. Awareness and HPV Vaccine Uptake**



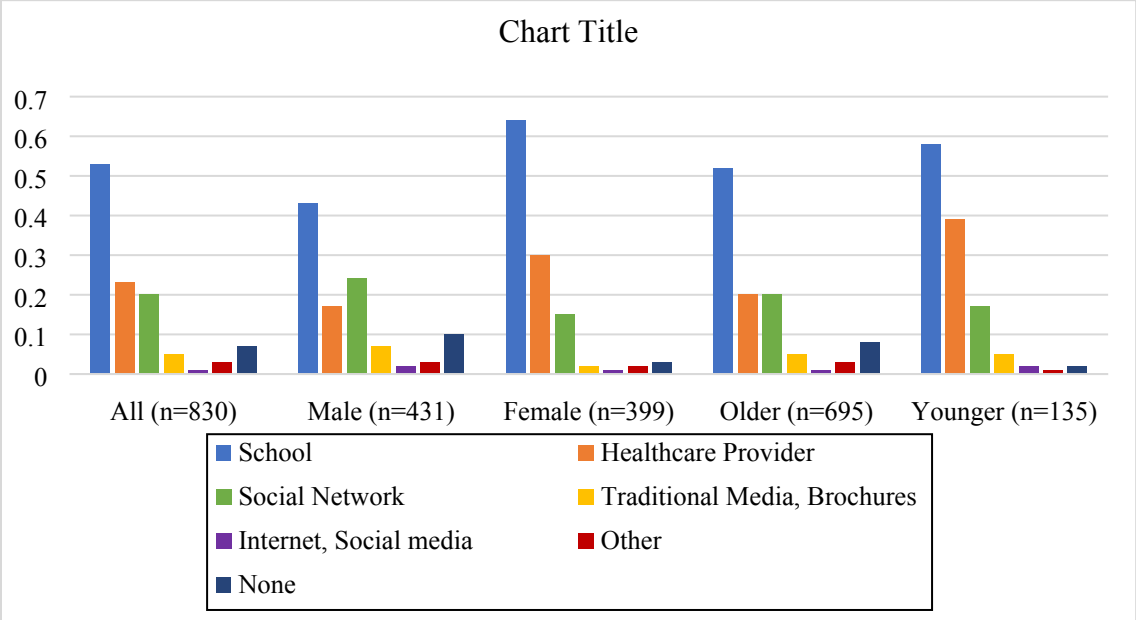

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 3. Knowledge and HPV Vaccine Uptake**



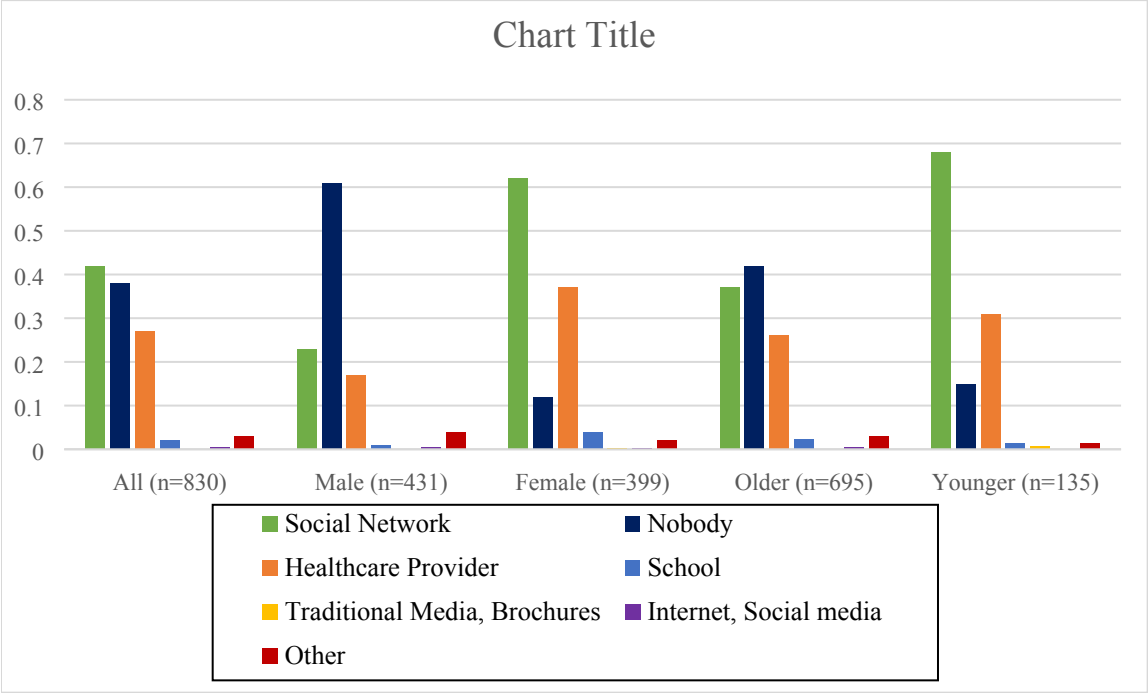

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 4. Information Sources**




**Note**. 167/997 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Figure 5. HPV Vaccine Consulting Behavior**



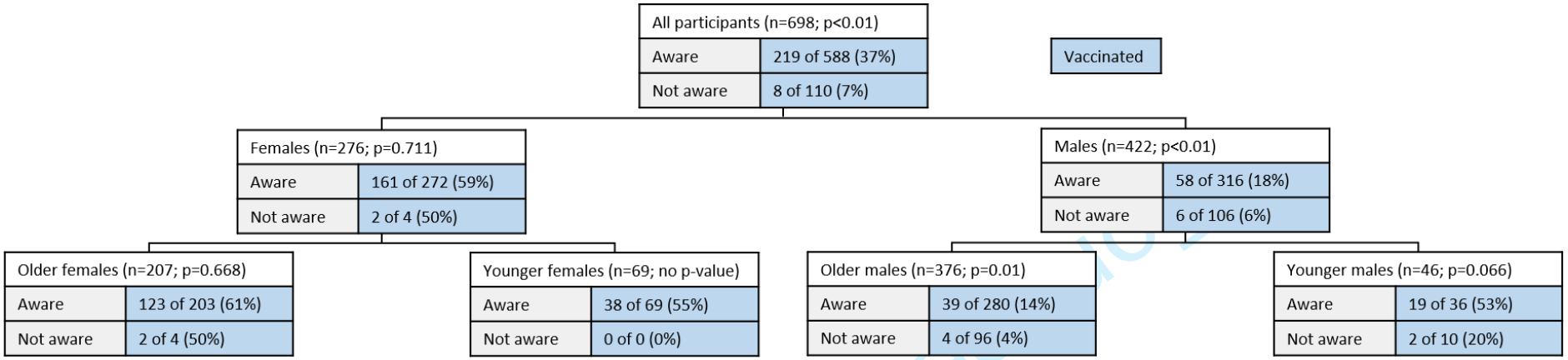

**Note**. 167/997 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

## Supplement

### Supplementary Table 1. Survey questions concerning gendered perceptions of HPV Vaccine

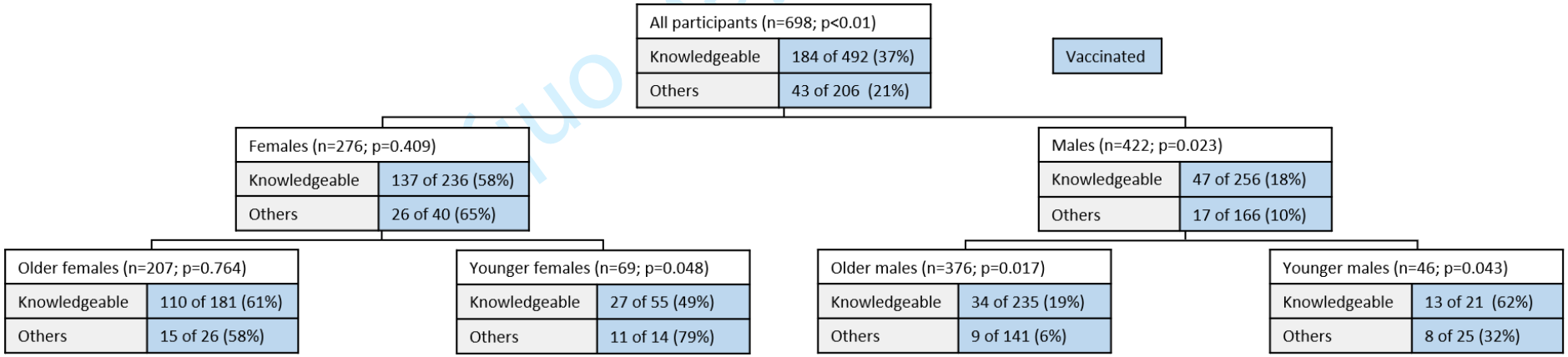
| | | By gender | | By age groups | |
|---|---|---|---|---|---|
| | **All participants** | **Male** | **Female** | **Born before 1.7.02** | **Born on/ after 1.7.02** |
| **Have you heard of the HPV vaccine?** | *(n = 997)* | *(n = 585)* | *(n = 412)* | *(n = 849)* | *(n = 148)* |
| Yes, n (%) | 461 (46) | 176 (30) | 285 (69) | 359 (42) | 102 (69) |
| No/ don't know, n (%) | 536 (54) | 409 (70) | 127 (31) | 490 (58) | 46 (31) |
| **Have you heard of the cervical cancer vaccine?** | *(n = 535)* | *(n = 409)* | *(n = 126)* | *(n = 489)* | *(n = 46)* |
| Yes, n (%) | 369 (69) | 255 (62) | 114 (90) | 336 (69) | 33 (72) |
| No/ don't know, n (%) | 166 (31) | 154 (38) | 12 (10) | 153 (31) | 13 (28) |
| **What is the HPV vaccine for?** | *(n = 461)* | *(n = 176)* | *(n = 285)* | *(n = 359)* | *(n = 102)* |
| Only female, n (%) | 185 (40) | 35 (20) | 150 (53) | 160 (45) | 25 (25) |
| All other answers, n (%) | 276 (60) | 141 (80) | 135 (47) | 199 (55) | 77 (75) |
| **Combination of all questions** | *(n = 710)* | *(n = 361)* | *(n = 349)* | *(n = 611)* | *(n = 99)* |
| Only female, n (%) | 554 (78) | 290 (80) | 264 (76) | 496 (81) | 58 (59) |
| All other answers, n (%) | 156 (22) | 71 (20) | 85 (24) | 115 (19) | 41 (41) |

**Supplementary Figure 1. Awareness and HPV Vaccine**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

**Supplementary Figure 2. Knowledge and HPV Vaccine**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

# Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

## Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

| | | Reporting Item | Page Number |
|---|---|---|---|
| **Title and abstract** | | | |
| Title | #1a | Indicate the study's design with a commonly used term in the title or the abstract | 1 |

| | | | |
|---|---|---|---|
| Abstract | #1b | Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background / rationale | #2 | Explain the scientific background and rationale for the investigation being reported | 5 |
| Objectives | #3 | State specific objectives, including any prespecified hypotheses | 5,6 |
| **Methods** | | | |
| Study design | #4 | Present key elements of study design early in the paper | 7 |
| Setting | #5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7,8 |
| Eligibility criteria | #6a | Give the eligibility criteria, and the sources and methods of selection of participants. | 7-10 |
| | #7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | n/a |
| 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. Give information separately for for exposed and unexposed groups if applicable. | 8-10 |

| | | | |
|---|---|---|---|
| Bias | #9 | Describe any efforts to address potential sources of bias | n/a |
| Study size | #10 | Explain how the study size was arrived at | 7-11 |
| Quantitative variables | #11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why | 7-9 |
| Statistical methods | #12a | Describe all statistical methods, including those used to control for confounding | 8-10 |
| Statistical methods | #12b | Describe any methods used to examine subgroups and interactions | 7-10 |
| Statistical methods | #12c | Explain how missing data were addressed | n/a |
| Statistical methods | #12d | If applicable, describe analytical methods taking account of sampling strategy | n/a |
| Statistical methods | #12e | Describe any sensitivity analyses | n/a |
| **Results** | | | |
| Participants | #13a | 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. Give information separately for for exposed and unexposed groups if applicable. | 11 |
| Participants | #13b | Give reasons for non-participation at each stage | 11 |

| | | | |
|---|---|---|---|
| Participants | #13c | Consider use of a flow diagram | n/a |
| Descriptive data | #14a | Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable. | 11,27,28 |
| Descriptive data | #14b | Indicate number of participants with missing data for each variable of interest | 11,12,16 |
| Outcome data | #15 | Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable. | 11-17 |
| Main results | #16a | 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 |
| Main results | #16b | Report category boundaries when continuous variables were categorized | 11-17 |
| Main results | #16c | If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | n/a |
| Other analyses | #17 | Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses | n/a |
| **Discussion** | | | |
| Key results | #18 | Summarise key results with reference to study objectives | 18,19 |

| | | | |
|---|---|---|---|
| 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. | 19,20 |
| Interpretation | #20 | Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence. | 18-20 |
| Generalisability | #21 | Discuss the generalisability (external validity) of the study results | 18-20 |
| **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 | 21 |

BMJ Open

# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2021-054419.R2 |
| Article Type: | Original research |
| Date Submitted by the Author: | 17-Nov-2021 |
| Complete List of Authors: | Schwendener, Corina L.; University of Basel, University Department of Medicine<br>Kiener, Laura M.; University of Basel, University Department of Medicine<br>Jafflin, Kristen; Swiss Tropical and Public Health Institute; University of Basel<br>Rouached, Sarah; University of Basel, University Department of Medicine<br>Juillerat, Anna; University of Basel, University Department of Medicine<br>Meier, Vincent; University of Basel, University Department of Medicine<br>Schärli Maurer, Susanna; Swiss Armed Forces, Rekrutierungszentrum Aarau<br>Muggli, Franco; Swiss Armed Forces, Rekrutierungszentrum Monte Ceneri<br>Gültekin, Nejla; Swiss Armed Forces, Eidgenössisches Departement für Verteidigung, Bevölkerungsschutz und Sport VBS Schweizer Armee<br>Baumann, Aron; Swiss Tropical and Public Health Institute<br>Debergh, Marlyse; University of Geneva, Institute of Sociological Research<br>Gruillot, Catherine; PROFA Consultation de santé sexuelle - planning familial<br>Huber, Benedikt; HFR Fribourg Cantonal Hospital, Department of Pediatrics<br>Merten, Sonja; Swiss Tropical and Public Health Institute; University of Basel<br>Buhl, Andrea; Swiss Tropical and Public Health Institute; University of Basel<br>Deml, Michael; University of Geneva, Institute of Sociological Research; University of Cape Town Faculty of Health Sciences, Division of Social and Behavioural Sciences, School of Public Health & Family Medicine<br>Tarr, Philip ; University of Basel, University Department of Medicine, Kantonsspital Baselland; University of Basel, University Department of Medicine |
| Primary Subject Heading: | Public health |
| Secondary Subject Heading: | Sexual health, Immunology (including allergy) |
| Keywords: | IMMUNOLOGY, Public health < INFECTIOUS DISEASES, PREVENTIVE MEDICINE, PUBLIC HEALTH, SEXUAL MEDICINE |

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# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

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**Word count:**

4422 (exclusive title page, authors' contribution statements, abstract, keywords, strengths and limitations of this study, acknowledgments, ethics approval)

**Key Words:**

HPV vaccine, HPV vaccine awareness, HPV vaccine knowledge, HPV vaccine information sources, HPV vaccine uptake, youth

## ABSTRACT:

**Objectives:** We aimed to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process of youth, both male and female, in Switzerland.

**Design:** With a mixed-methods study design, we conducted quantitative questionnaires and qualitative interviews, which lasted 20-45 minutes.

**Setting and participants:** We recruited participants, 15-26 years of age, in physicians' offices, in a local sexual health clinic, and during military enlistment. We administered quantitative questionnaires to 997 youth participants (585 male, 412 female) and conducted qualitative interviews with 31 youth (17 male, 14 female).

**Primary and secondary outcome measures:** We assessed HPV vaccine awareness, knowledge, information sources and vaccination status.

**Results:** In the study's quantitative component, 108 (20%) male and 262 (65%) female participants had received ≥1 dose of HPV vaccine. 697 (70%) participants were knowledgeable about the HPV vaccine. Females were more likely to be knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01). Younger participants in the sample compared to older participants were more likely to be aware of HPV vaccine (135/148 [91%] vs. 695/849 [82%]; p<0.01). The three most mentioned information sources were school health programs (442 [53%]), health care providers (190 [23%]), and participants' social networks (163 [20%]). Overall, 554/710 (78%) participants had a female-gendered perception of HPV vaccine, a finding which was further supported and explained by qualitative data.

**Conclusions:** Despite a male HPV vaccine recommendation being made >4 years prior to the data collection, HPV vaccine knowledge was higher among females than males, and a female-

gendered perception of HPV vaccine remains prevalent. Internet and social media were minor HPV vaccine information sources. Study findings demonstrate that HPV knowledge matters for HPV vaccine uptake and suggest that we should improve HPV information quality and access for youth, particularly by tailoring knowledge campaigns to young men.

## Strengths and limitations of this study:

- One major strength of the study is that it uses a mixed methods approach, allowing for the qualitative data to offer potential explanations to quantitative findings.
- The study included a large number of female and male youth, allowing us to gain gendered differences regarding HPV vaccination information sources.
- One limitation of this study is that we might overestimate HPV vaccination knowledge based on the way we classified answers for the quantitative component.
- Our sampling strategy led to a non-representative sample.

## 1. Introduction

Surprisingly little research has directly examined youth knowledge, awareness, and information sources as determinants of *human papillomavirus (HPV)* vaccine uptake. Furthermore, the research that has been done on youth perspectives has primarily focused on females [1-6], although the vaccine has been recommended for male youth for several years in many countries. Literature on the determinants of HPV vaccine attitudes and uptake among male youth remains limited [7-12]. Furthermore, the false perception that the HPV vaccination concerns only women continues to persist in popular discourse since it has been long known as the "cervical cancer vaccine"[3, 13].

In addition to issues related to access barriers [2, 14], previous reports in male and female youth suggest that low HPV vaccine uptake is also related to limited HPV vaccine awareness and knowledge [11, 15-17], and to the behavioral expectations youth perceive from their parents, family members, and peers [18, 19]. The most consistent predictor of HPV vaccination is having received a recommendation from a health care provider [12, 14, 20].

Previous research has focused on parents' attitudes and information sources towards HPV vaccine since the primary target group are 11-14-year-old adolescents [21-26]. A key component of the Swiss National Vaccination Strategy (NVS), in order to increase HPV vaccination rates, however, is to address insufficient levels of youth vaccination knowledge, e.g. by emphasizing the importance of school vaccination programs. Also, the NVS aims to address insufficient vaccination access, e.g., by removing financial barriers, especially for young adults with limited financial resources. Accordingly, HPV vaccine is now covered by the state when given until the age of 26 to men and women in the setting of a state vaccination program, thereby addressing such financial barriers to HPV vaccination in youth [27]. The effective implementation of each of these NVS approaches would benefit from additional research on HPV vaccine awareness,

knowledge, and information sources in youth. We have recently documented the validity of measuring vaccine hesitancy (VH) in youth using the Youth Attitudes about Vaccines (YAV) questionnaire, which shows that VH is an independent predictor of HPV non-immunization in Switzerland in female youth [28]**(Kiener L., Schwendener C., et al, manuscript submitted)**. The aims of the present study were to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process among youth, both male and female, in Switzerland. We additionally aimed to gain a more current understanding of gendered aspects youth may have around the HPV vaccine. Finally, we examined how these factors contribute to HPV vaccine uptake in both sexes and in younger and older adolescents.

## 2. Methods

### *2.1 The Swiss Context*

The Swiss Federal Office of Public Health (FOPH) and the Federal Vaccination Commission have recommended HPV vaccine since 2007 for female youth [29], and since 2015 for male youth [30]. HPV vaccine uptake has increased in the last decade [31], but lies still below the 80% immunization target [32]. In 2017-2019, the most recent evaluation period, only 20% of 16-year old males and 64% of females, had received ≥1 dose of HPV vaccine on average throughout Switzerland [33]. Regional differences in uptake have been associated with specifics of vaccination policies of local health authorities, limited information access, and the availability and quality of school vaccination programs [34, 35].

### *2.2 Study design*

We applied a convergent mixed-methods design [36], meaning we collected qualitative and quantitative data in parallel. We conducted the study in the context of our Swiss national research program (NRP74) on the determinants of VH in Switzerland regarding childhood and HPV vaccination. The local institutional review board (Ethikkommission Nordwest- und Zentralschweiz) approved the study. All participants provided written informed consent. Full details on our recruitment methods, power calculation, and the questionnaire have been previously published [37].

### *2.3 Study population and recruitment*

Participants were 15-26 years of age, male and female. Of note, youth in Switzerland are legally able to make vaccine decisions starting at age 14 [38], which supports vaccination promotion efforts which focus on youth perspectives on HPV vaccination. Even though the primary target

group is 11-14-year-olds, the vaccine is also recommended as a catch-up vaccine until 26 years in many countries, including Switzerland.

Since HPV vaccination programs in Switzerland are tailored for an age group (11-26 years) with limited contact with the health system because young people who are otherwise healthy do not tend to consult with physicians we used diverse recruitment strategies to increase study participation. We recruited participating youth in the offices of physicians providing biomedicine and sometimes additionally complementary and alternative medicine (CAM), and in a local sexual health clinic. Recruitment was done in urban and rural areas, and in 3 of 4 Swiss language regions, i.e., German, French, Italian. In order to gain more male participants, we also recruited during military enlistment (military service is compulsory for Swiss males, with enlistment being at age 18-24). Since July 1st, 2016 the cost of HPV vaccine has been covered by mandatory health insurance for male adolescents 11-14 years of age and as a catch-up vaccination until age 26 in Switzerland. We therefore divided male participants in an older and a younger age group. We refer to male participants born before vs. on/after July 1st, 2002 as the "older" and "younger" participants, respectively, meaning that younger male participants were part of the HPV vaccine target age group when 11-14 years of age. For comparison purposes, we applied the same age cut-offs to female participants.

### *2.4 Patient and public involvement*

We did not include patient or public involvement in designing the study, commenting the outcomes, interpreting the results of this study or reviewing the manuscript.

*2.5 Quantitative methods*

As previously reported [37], we developed German, French, Italian, and English versions of the questionnaire. We interviewed military participants on site (face-to-face), and the other participants on the phone, after the physician/clinic visit. Apart from age at time of interview below 15 or above 26 there were no further exclusion criteria. Quantitative interviews lasted 25-35 minutes and were conducted by medical students with previous training in participant recruitment, informed consent procedures and interview techniques. Interviews were conducted from January 2019 to April 2020. All data was entered to open data kit (ODK) using tablets [37]. The questionnaire included socio-demographics including language, place of residence, living situation (with parents, with roommates, with partner), age, nationality, and school HPV vaccination program availability (**Supplementary Material 1**).

HPV vaccination status (has received ≥1 dose of HPV vaccination) was assessed based on review of the vaccination booklet of the participant, and, if unavailable, on personal report of being vaccinated.

In order to measure youth *awareness* about the HPV vaccine, we asked all participants if they had heard of the HPV vaccine. To accommodate for a gendered perception, for those who said "no" to the previous question, we asked if they had heard of the "cervical cancer vaccine." To measure youth *knowledge* about the HPV vaccine, we asked participants what the HPV vaccine is intended for. Those who responded correctly were considered to be knowledgeable. We considered an answer to be correct if they mentioned at least one correct aspect about the HPV vaccine, i.e., it protects against "cancer", "cervical cancer", "papilloma virus", or a "sexually transmitted disease". We sought to establish where youth obtained information about the HPV vaccination by asking two questions, each with free text answer options in order to document the most precise responses: (1) "Where have you heard about HPV vaccination?" and (2) "Who

did you consult with when deciding whether or not to get the HPV vaccine?". Answers to the second question included consulting people as well as traditional media, the internet, and other forms of information supply.

### *2.6 Qualitative methods*

After completion of the quantitative interviews, participants were invited to participate in an additional qualitative interview. We subsequently contacted interested youth who indicated willingness in the German- and French-speaking regions of Switzerland. Additional participants were recruited through researcher and participant social networks and by snowball sampling. Our research team collaboratively developed a semi-structured interview guide, which we piloted and revised iteratively for clarity and coherence. The interviews allowed us to gather background information about the youth, their health status and lifestyle, the HPV vaccine decision-making process, including knowledge, awareness, information sources, and the people with whom they discussed the vaccination. Qualitative interviews were conducted (March 2019-September 2020), either face-to-face or online (Skype or Zoom), they lasted 20-45 minutes, and were audio-recorded and transcribed verbatim. Qualitative data were analyzed by social scientists Andrea Buhl and Michael J. Deml. Analysis of the qualitative interviews was guided by the Framework Method [39] with support of MAXQDA software. All quotes from interviews have been translated from German or French into English and anonymized.

## 3. Results

For the study's quantitative component, we completed telephone (n=622) or face-to-face (n=375) interviews with 1010 youth. Of these, we excluded eight participants because they did not meet the age criteria, one participant because of missing gender information, and four additional interviews due to missing answers on awareness and knowledge. Quantitative analyses are therefore based on 997 participants (585 male, 412 female). Their characteristics are shown in **Table 1**. For the study's qualitative component, we conducted 14 qualitative interviews with female youth and 17 interviews with male youth. Qualitative participants ranged in age from 15 to 26 years in age (average ~21 years). Characteristics of the participants of the qualitative interview are shown in **Table 2**.

In the following sections, we present results regarding: (1) awareness and knowledge about the HPV vaccination, (2) youth HPV vaccination information sources and people with whom they had discussed the vaccination, and (3) youth's gendered perceptions of the HPV vaccine.

### *3.1 Awareness about HPV Vaccination*

For the purpose of this study, we defined *awareness* as having heard of the HPV or "cervical cancer" vaccine. Significantly more female youth were aware of the HPV vaccine than male youth. Of the 997 participants, 461 (46%) had heard of the HPV vaccine; 176/585 (30%) males and 285/412 (69%) females ($p<0.01$). Among the 536 participants who had not heard of HPV vaccine, 369 (69%) had heard of the "cervical cancer vaccine", 255/409 (62%) males and 114/127 (90%) females ($p<0.01$).

Of the 997 participants, 830 (83%) had heard of the HPV or "cervical cancer vaccine", 431/585 (74%) of males and 399/412 (97%) of females ($p<0.01$). In both awareness of HPV vaccine and

awareness of "cervical cancer vaccine", females had more awareness than males. 695/849 (82%) of the older participants and 135/148 (91%) of the younger participants had heard of the HPV or "cervical cancer vaccine" (p<0.01). Details are shown in **Figure 1.** Subgroup analysis showed a significant difference in awareness between participants who were recruited in the military and all other participants (biomedical vs. military p<0.01; CAM vs. military p<0.01; adolescent clinic vs. military p<0.01). However, this effect was not due to the different subgroups but is rather derived from the unequal distribution of gender (more males) within the military subgroup **(Supplementary Table 1-3)**.

Of the 997 participants, 370 (39%) had received ≥1 dose of HPV vaccine. As shown in **Figure 2**, participants with greater awareness had also more often received ≥1 dose of HPV vaccine compared to participants with limited awareness (362/830 [44%] vs. 8/110 [7%]; p<0.01). This effect was manifest in males (102/431 [24%] of aware males vs. 6/106 [6%] of males with limited awareness had received ≥1 HPV vaccine dose; p<0.01), but not in females (260/399 of aware females [65%] vs. 2/4 [50%] of females with limited awareness had received ≥1 HPV vaccine dose; p=0.53), however, only few (4/413) females were unaware of the vaccine.

When we defined HPV vaccine uptake according to availability of a vaccination record, results regarding the associations of awareness and uptake and of knowledge and uptake remained essentially unchanged (**Supplementary Fig. 1 and 2**).

### *3.2 Knowledge about HPV Vaccination and Implications for Uptake*

We defined *knowledge* as being able to give a correct answer to what the HPV vaccine is for or for the association of HPV with cervical cancer. 697/997 (70%) participants had knowledge of

HPV vaccine or the "cervical cancer vaccine", while 300/997 (30%) participants did not. Females were more knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01) which is also shown in **Figure 1**. We did not find a significant difference regarding knowledge between younger and older participants (94/148 [64%] vs. 603/849 [71%]; p=0.07). Subgroup analysis showed a significant difference in knowledge between participants who were recruited in the military and all other participants (biomedical vs. military p<0.01; CAM vs. military p<0.01; adolescent clinic vs. military p<0.01). However, this effect was not due to the different subgroups but is rather derived from the unequal distribution of gender (more males) within the military subgroup **(Supplementary Table 1-3)**.

As shown in **Figure 3**, more knowledgeable participants had received ≥1 dose of HPV vaccine compared to participants with limited knowledge (298/697 [43%] vs. 72/243 [30%]; p<0.01), and there was no evidence that this difference was limited to either sex (77/355 [22%] knowledgeable males vs. 31/182 [17%] males with limited knowledge had received ≥1 HPV vaccine dose; p=0.20), and 221/342 knowledgeable females [65%] vs. 41/61 [67%] females with limited knowledge had received ≥1 HPV vaccine dose; p=0.70).

For the study's qualitative component, although the youth had agreed to participate in qualitative interviews explicitly about their HPV vaccination decisions, many participants were not able to tell us what specifically the HPV vaccine was intended to protect against. When asked about recommendations for improvements to HPV vaccination campaigns in Switzerland, almost all youth mentioned desiring more and better information. The following dialogue demonstrates how knowledge and awareness served as barriers for a 22-year-old male who had not received the vaccine:

Researcher: So, I see [from your vaccination certificate] that you didn't get the HPV vaccine.

Participant: No.

Researcher: Was it a choice?

Participant: No, it was an issue of information. I don't know what [HPV] is.

### *3.3 Youth Information Sources about HPV Vaccination*

We assessed if and where adolescents had heard about HPV vaccination and who they may have turned to when deciding whether to get vaccinated against HPV. As shown in **Figure 4**, the three most commonly mentioned information sources by youth in the quantitative questionnaire were school health programs (53%), health care providers (23%), and participants' social networks (20%). The most mentioned information sources were similar for males and females. Internet and social media were mentioned infrequently as information sources (1% of all participants; 2% of males, 1% of females). Concerning the information sources used for deciding whether or not to vaccinate, most participants consulted their social networks (42%) and/or their healthcare provider (27%), as shown in **Figure 5**. Many participants (38%) did not talk to anyone about the HPV vaccine. We found this result predominantly with male participants (61%) and less with female participants (12%). Internet and social media were also infrequently mentioned for vaccine decision-making (0.4% of participants; 0.5% of males, 0.3% of females).

Qualitative interviews with youth showed that very few had actively sought out information about the HPV vaccination during the initial recommended age for the first dose (11-14 years). Primary explanations for this from the youths' perspectives included that they were too young when the HPV vaccine was offered via school programs or by their pediatricians, and that their

parents had made the decision without being involved in the decision-making process. The few youth who reported having had discussions about the HPV vaccination described having talked to family members, primarily mothers or older siblings, or doctors (pediatricians if the vaccine was offered during the initial recommended age, gynecologists for older female participants who had not been vaccinated, and sexual health doctors for young men who have sex with men (MSM)). Apart from the MSM in the qualitative study sample, young men reported not having discussed the HPV vaccine with anybody. Several of the young women we interviewed recalled their parents' skepticism when the HPV vaccine was first introduced. A 26-year-old female who had not received the HPV vaccine explained, "It was one of the first years when it came out. 2009 or something like that. I was still a minor and still in high school. We needed our parents' permission. My mother, who is a nurse, simply decided [against it because] it was a new vaccine, and we didn't yet know the side effects."

When asked about where information about the HPV vaccine should come from, many youth suggested better information campaigns via schools. This was particularly clear among youth whose parents chose against the vaccine when they were in the initial recommended target age. Despite not being vaccinated against HPV, an 18-year-old female described her views on the added value of having HPV vaccination information campaigns and programs in schools, particularly once youth are able to make their own health decisions:

> "I think it helped me a lot that that there was information at school and that the vaccine was offered there. We were at an age when we started to make our own decisions and that's why I liked the fact that we talked about it in school. That helped me a lot. […] because our parents had decided on everything before. And this is, I think, the first time that we decide or shared decisions about our health."

A 19-year-old female participant who had received the vaccine described the roles schools played in explaining the rationale behind the HPV vaccine, "I think I find it very important that there is an education and not just 'get vaccinated' and 'it's good for you or it helps you', but rather also a 'why' and 'what is it about' and 'what would it look like if you weren't vaccinated', what would be the consequence'? I think such a relatively educated attitude is also extremely useful."

### *3.4 Youth's female-gendered perception of the HPV Vaccine*

Given the HPV vaccination's association with cervical cancer in popular discourse, we analyzed if and to what extent participants had a gendered perception of HPV vaccine. From the quantitative sample, after excluding 287 of 997 participants without knowledge of HPV or the "cervical cancer vaccine," 554 of 710 (78%) participants perceived the HPV vaccine as being only targeted towards women and not men (female-gendered answer) (**Supplementary Table 4**). For example, many participants only mentioned cervical cancer when asked what the HPV vaccine is for and only few youth mentioned that the HPV vaccine protects also males from diseases. 290/361 (80%) males and 264/349 (75%) females (p=0.13) gave a female-gendered answer. While both older and younger participants had a female-gendered perception on the purpose of the HPV vaccination, significantly more older youth had female-gendered perceptions (496/611 (81%) older vs. 58/99 (59%) younger participants (p<0.01)). In addition, 277/331 (84%) older males vs. 13/30 (43%) younger males gave a female-gendered answer (p<0.01); 219/280 (78%) older females vs. 45/69 (65%) younger females gave a female-gendered answer (p=0.02).

During qualitative interviews, we asked youth if they saw any differences for HPV vaccination between men and women. These questions elicited two types of responses: (1) youth noting the

vaccination as being beneficial for females only, and (2) discourses about females bearing the brunt of responsibility for sexual health. For the first type of response, some youth were not aware that males could get vaccinated against HPV. A 20-year-old female who had received the vaccine discussed her memories of getting the vaccine in school, “If I remember correctly, boys didn’t get vaccinated [when I was in school].” An 18-year-old male who had not received the vaccine, when asked who the HPV vaccine was for, responded, “Women. Could that be? To be honest, that’s all I know right now.” Others complained that they now realize how limited their information about the vaccination and its benefits for young males was. A 19-year-old man explained:

> “Well, I really haven't heard about [the HPV vaccination for boys] from anyone until now. And I don't think this is my personal fault that I don't know anything about it. Until now, it was only a topic for women, and now it's suddenly not anymore.”

Other youth talked about female responsibility for sexual health. A 26-year-old female who had not been vaccinated against HPV explained how she saw the HPV vaccine for males as providing protection to the females with whom young men had sexual encounters, “Girls are going to take it more seriously. For boys, it doesn’t concern them directly. It’s protection for [girls].” A 20-year-old female who had not been vaccinated against HPV echoed this sentiment:

> “I mean, for [girls], we know that (…), if we’re going to be in a relationship where we have sexual intercourse with somebody, we know that we have to protect ourselves. First of all, to not get pregnant. Second of all, we know that having any types of STDs and viruses would make our lives miserable. (…) But for boys, it’s like, “Ok, I’ll have to wear protection. But what’s the worst that can happen?”

## 4. Discussion

Our study on HPV vaccine awareness, knowledge, information sources, and gendered perception among young males and females in Switzerland has four main findings. First, young females had more HPV vaccine awareness and knowledge than young males. This confirms previous reports, consistent with HPV vaccine having been introduced initially and worldwide as a vaccine designed only for females [15, 40, 41]. Even though awareness of HPV vaccine was higher in our study in females than in males, a recent Swiss national study found limited HPV awareness among 24–26-year-old women, suggesting opportunities for intervention also in women, including those that are older than the primary target age group [42]. We might hypothesize that lower awareness of the older females in our sample is related to the amount of time that has passed since they received HPV vaccination during their early adolescence. In other words, lower awareness in the group of older females might be due to memory recall bias and perhaps less developed vaccination implementation programs at the time they would have been exposed to them.

Second, increased knowledge was associated with higher HPV vaccine uptake, in both females and males, suggesting that knowledge matters. This confirms results from previous reports [11, 15-17]. In our study we only saw a trend towards a small difference in HPV vaccine knowledge between the younger and older age groups. Other studies however, found a higher knowledge score in older compared to younger participants [15, 41]. Encouragingly, younger participants were more aware of HPV vaccine compared to older participants, in contrast to other studies [15, 43].

Third, the internet and social media played a surprisingly minor role as HPV vaccine information

sources for youth in our study. This stands in contrast to other studies that found social media to increasingly become a source of health information worldwide [44-47]. Another US study described the internet as being one of the most frequently mentioned sources of vaccine information among adolescents [48]. Currently, the potential of internet/ social media information for HPV prevention/ vaccination uptake seems not to be used in Switzerland.

Fourth, despite the male HPV vaccine recommendation was introduced more than four years prior to our interviews, both female and male youth in our study associated HPV vaccine predominantly with cervical cancer, consistent with the gendered views of HPV vaccine documented in previous reports [3, 13]. That said, it is encouraging to see a slight shift in the younger age group from a female gendered perspective to a gender-neutral perspective on HPV vaccine.

### 4.1 Strengths and limitations

One of the major strengths of our study is that it is a mixed-methods study. Our qualitative work adds some description and explanation to our quantitative findings. Furthermore, we have a large number of male participants in our study. The Swiss context in particular lacks data on HPV vaccine awareness, knowledge, and information sources from male youth. Our study addresses this research gap. Previous studies have predominantly focused on parents and their knowledge on HPV vaccine [21-26]. Our study included youth, and this allowed us to gain important insights on who youth turn to when deciding on HPV vaccination. Since the vaccine is recommended as a catch-up vaccine until 26 years in many countries, including Switzerland, we have to ensure that youth are aware of the HPV vaccine and that they have the necessary knowledge to make an informed HPV vaccination decision.

One limitation of this study is that we might overestimate knowledge based on the way we classified answers for the quantitative component. For example, if participants had heard of the HPV vaccine, we simply asked them if they know what it is for but added no further questions. In addition, for participants who have only heard of the "cervical cancer vaccine," we did not ask any follow-up questions on HPV knowledge. Other studies have assessed knowledge in more depth, asking participants more knowledge specific questions [3, 18, 19]. Since our questionnaire already lasted 25-35 minutes with questions on VH **(Jafflin K., manuscript in preparation),** CAM use **(Jafflin K., manuscript in preparation, Kiener L., Schwendener C., et al, manuscript submitted)** and moral foundations **(Jafflin K., manuscript in preparation)** we opted to not include more questions to further assess participants' knowledge. Another limitation to this study was that our sampling strategy led to a non-representative sample. Additionally, potential sources of bias arise from us not being able to get in contact with participants who do not visit a physicians' office. Our sampling strategy however allowed us to recruit a more diverse sample regarding biomedical and CAM providers.

## 5. Conclusion

This study underlines the importance of HPV awareness and knowledge given the association between HPV awareness and knowledge and HPV vaccine uptake. However, males still have limited awareness and knowledge about HPV vaccine. Future strategies to increase HPV vaccine uptake, especially among males, should focus on better and more information supply to youth explaining them the benefit of the HPV vaccine. School vaccination programs have proven to be effective and should be further expanded [31]. Parents play an important role in youth' decision making process when it comes to HPV vaccine and they should be equally informed about the benefits and importance of the HPV vaccine. Efforts should be made to underline the

effectiveness of the HPV vaccine for males and females to reach a gender-neutral perception of the HPV vaccine. Targeted public health efforts should consider exploring internet and social media as potential information distribution platforms. HPV vaccine uptake has improved over the years, but there is substantial room for improvement, particularly in terms of increasing knowledge and awareness among young men and women alike.

**Acknowledgements**

We would like to express our gratitude to all participating youth, young adults and providers for their time and effort as well as the Swiss National Science Foundation for their financial support.

**Disclosure of Potential Conflict of Interest**

All authors: no conflicts.

**Funding**

This work was supported by the Swiss National Science Foundation (National research program NRP74, grant 407440_167398, recipient: PET). The study received supplementary postdoctoral fellowship funding (to M.J.D.) from the Nora van Meeuwen-Haefliger-Foundation. We did not receive funding from vaccine manufacturers or the Swiss Federal Office of Public Health.

**Ethics approval**

The study was approved by the local ethics committee (Ethikkommission Nordwest- und Zentralschweiz, EKNZ; project ID number 2017-00725). The ethics approval covers all study participants, which includes adolescent and adult patients as well as biomedical and CAM providers. Informed consent was provided by all participants after the nature and possible

consequences of the study had been fully explained.

## Data sharing statement

Data is available upon reasonable request to the corresponding author.

**Contributors' Statement Page**

Ms. Kiener and Ms. Schwendener recruited participating youth, conducted interviews, carried out the analysis, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Jafflin conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

Ms. Rouached, Ms. Juillerat and Mr. Meier recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Schärli, Dr. Muggli, Dr. Gültekin and Dr. Gruillot recruited participating youth, and reviewed and revised the manuscript.

Mr. Baumann and Ms. Debergh recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Huber conceptualized and designed the study, recruited participating providers, and reviewed and revised the manuscript.

Dr. Merten conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, and reviewed and revised the manuscript.

Dr. Buhl designed the data collection instruments, recruited participating youth, conducted interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Deml conceptualized and designed the study, designed the data collection instruments, recruited participating providers and youth, conducted qualitative interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Tarr conceptualized and designed the study, designed the data collection instruments, recruited participating providers, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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**Figures:**

1. Awareness and Knowledge of HPV Vaccine

2. Awareness and HPV Vaccine Uptake

3. Knowledge and HPV Vaccine Uptake

4. Information Sources

5. HPV Vaccine Consulting Behavior

**Table 1. Participant Characteristics (quantitative questionnaire)**

| | All Participants (n = 997) | Male (n = 585) | Female (n = 412) |
|---|---|---|---|
| **Age** | | | |
| Age (years), median (IQR) | 19 (18-21) | 19 (19-20) | 20 (17-23) |
| Born before July 1st, 2002, n (%) | 849 (85) | 525 (90) | 324 (79) |
| Born on/ after July 1st, 2002, n (%) | 148 (15) | 60 (10) | 88 (21) |
| **Nationality** | | | |
| Swiss, n (%) | 913 (92) | 547 (94) | 366 (89) |
| **Language** | | | |
| German, n (%) | 667 (67) | 448 (77) | 229 (53) |
| French, n (%) | 168 (17) | 47 (8) | 121 (29) |
| Italian, n (%) | 156 (16) | 86 (15) | 70 (17) |
| English, n (%) | 6 (1) | 4 (1) | 2 (0.5) |
| **Recruitment setting** | | | |
| Biomedical provider, n (%) | 405 (41) | 146 (25) | 259 (63) |
| Military service, n (%) | 375 (38) | 371 (63) | 4 (1) |
| CAM provider, n (%) | 148 (15) | 55 (9) | 93 (23) |
| Adolescent clinic, n (%) | 69 (7) | 13 (2) | 56 (14) |
| **Living situation** | | | |
| With parents, n (%) | 817 (82) | 497 (85) | 320 (78) |
| **School vaccination program** | | | |
| School program available, n (%) | 448 (45) | 180 (31) | 268 (65) |
| **Vaccination status** | *n = 940* | *n = 537* | *n = 403* |
| Has received ≥1 does of HPV vaccine, n (%) | 370 (39) | 108 (20) | 262 (65) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated. Due to rounding, total numbers may not add up to 100%.

**Abbreviations**. CAM, complementary and alternative medicine; IQR, interquartile range

652 **Table 2. Participant Characteristics (qualitative interview)**

| | | |
|---|---|---|
| **French-Speaking Region** | | |
| Female | | N= 6 |
| | Age | 15-26 years, $\bar{x}$=19.6 years |
| | Received at least 1 dose of HPV vaccination | N=4 (66%) |
| | Informed through school vaccination program | N=6 (100%) |
| Male | | N=8 |
| | Age | 15-26 years, $\bar{x}$=22.4 years |
| | Received at least 1 dose of HPV vaccination | N=4 (50%) |
| | Informed through school vaccination program | N=1 (13%) |
| **German-Speaking Region** | | |
| Female | | N=8 |
| | Age | 15-26 years, $\bar{x}$=20.9 years |
| | Received at least 1 dose of HPV vaccination | N=4 (50%) |
| | Informed through school vaccination program | N=7 (88%) |
| Male | | N=9 |
| | Age | 15-26 years, $\bar{x}$= 20.6years |
| | Received at least 1 dose of HPV vaccination | N=1 (11%) |
| | Informed through school vaccination program | N=1 (11%) |

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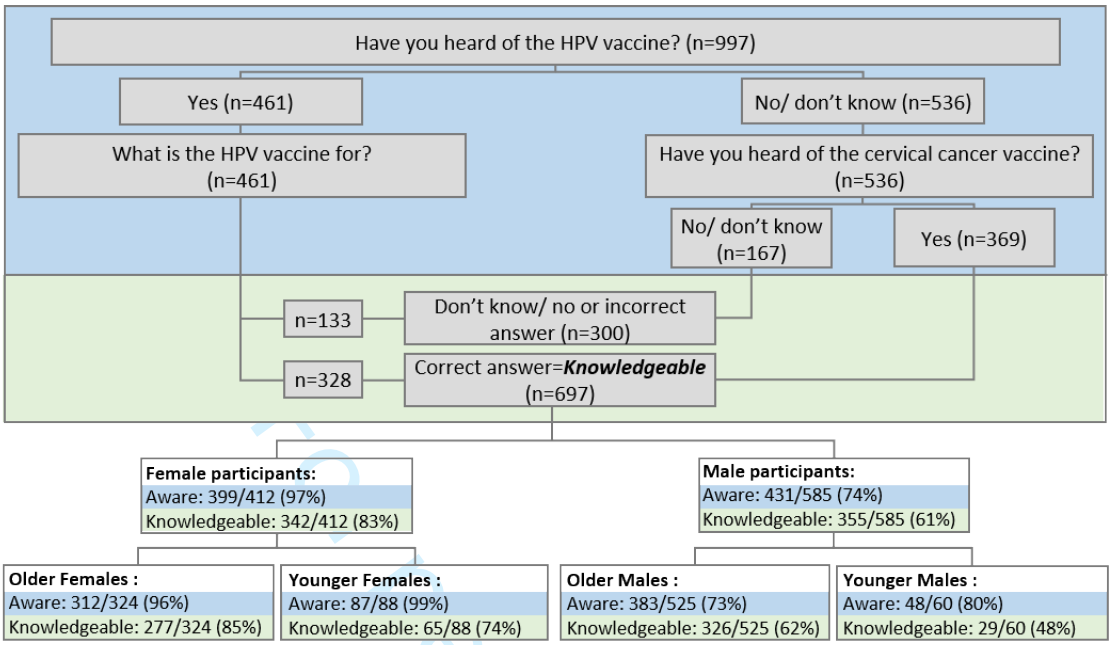
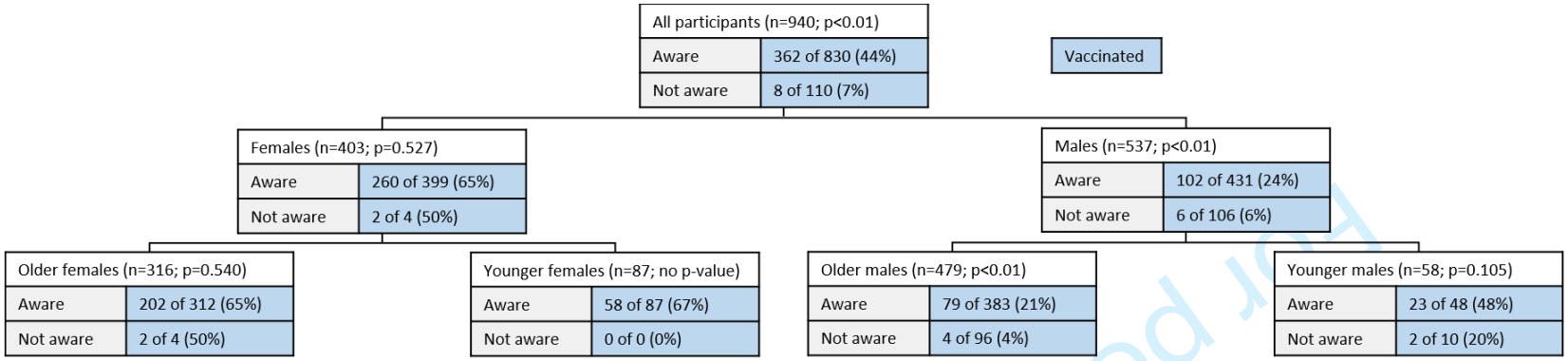
**Figure 1. Awareness and Knowledge of HPV Vaccine**



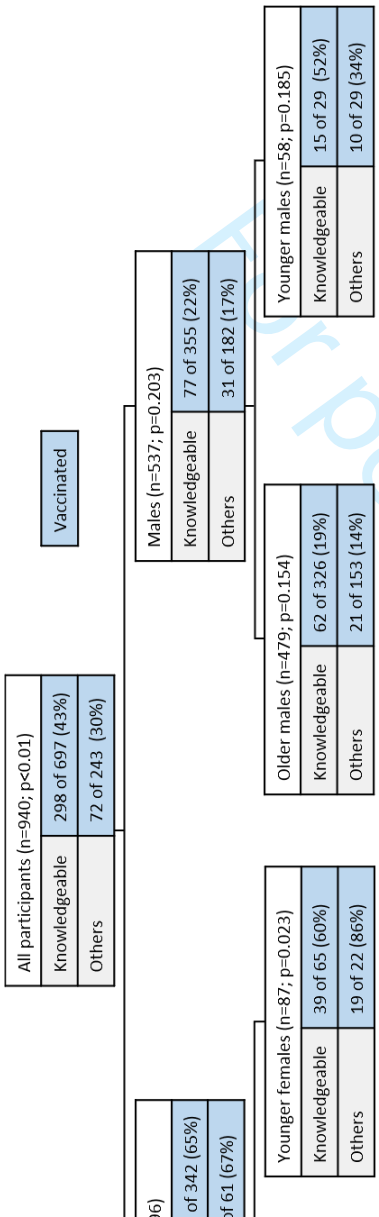

**Note.** All data in blue stands for awareness and all data in green for knowledge.

**Figure 2. Awareness and HPV Vaccine Uptake**



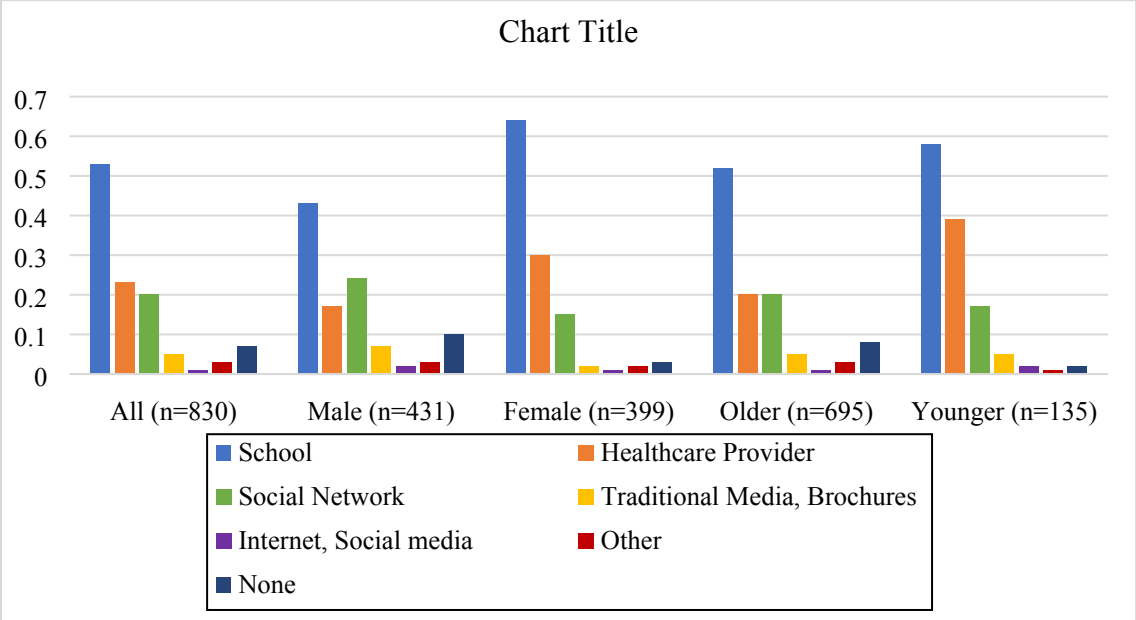

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 3. Knowledge and HPV Vaccine Uptake**



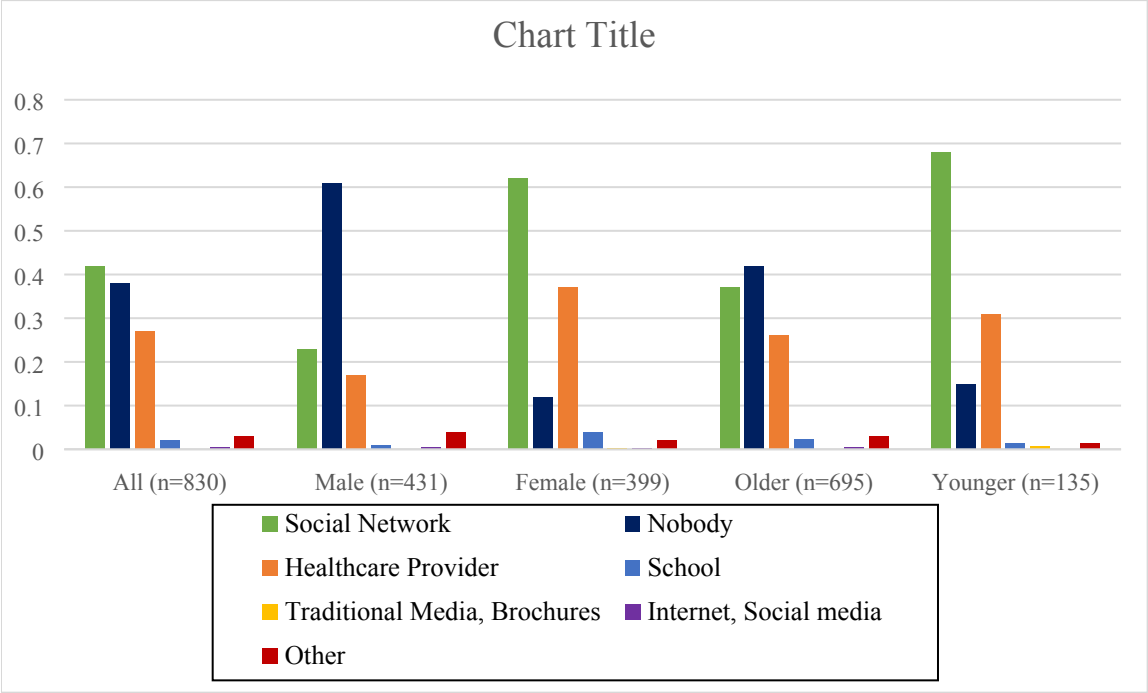

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 4. Information Sources**




**Note**. 167/997 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Figure 5. HPV Vaccine Consulting Behavior**




**Note**. 167/997 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Schwendener et al, HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study: Supplementary Material 1 – HPV Vaccination Questionnaire**

Hello, this is [interviewer name]. Could I speak with [participant name], please? As planned, I am calling to interview you as part of our study about vaccination decision-making.

I would first like to verify some details.

1. Could you please tell me your birth date?
2. What is the sex of [participant name]?
    a. Boy
    b. Girl
    c. Intersex
    d. Doesn't want to disclose
3. Is Dr. [provider name] your doctor?
4. Do you live with your parents, or somewhere else?
    a. Lives with parent(s)
    b. Doesn't live with parents
    c. Doesn't want to disclose
    d. Missing

    ➔ If a continue with question 5.

    ➔ If b continue with question 12.

    ➔ If c,d continue with question 13.
5. To start off, I would like to know how many people normally live in your parents' household, yourself included. Please include your family, but also any tenants, au pairs, students, or other people who live in your home at least 4 days a week.
6. Could you please tell me about the people who live in your home, yourself included?
7. First yourself [person 1], what is your age?
8. Sex of person 1
    a. Male
    b. Female
    c. Other/ nod disclosed
    d. Missing
9. Person 2, age
10. Person 2, sex
    a. Male
    b. Female
    c. Other/ not disclosed
    d. Missing
11. How is [second person] related to you?

    If male:
    a. Father
    b. Stepfather
    c. Father/mother's partner
    d. Stepbrother

e. Grandfather
f. Uncle, cousin
g. Other relative
h. Not a relative
i. Doesn't want to disclose
j. Doesn't know
k. Missing

If female:

a. Mother
b. Stepmother
c. Mother/ father's partner
d. Sister or half-sister
e. Grandmother
f. Aunt, cousin
g. Other relative
h. Not a relative
i. Doesn't want to disclose
j. Doesn't know
k. Missing

12. How many persons lived in your parent's household at the time before you moved out (yourself included)?

Now I would like to ask some questions about your thoughts and experiences with vaccination.

13. Have you ever delayed getting a vaccine for reasons other than illness or allergy?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
14. Have you ever skipped a vaccine for reasons other than illness or allergy?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
15. On a scale from 0 to 10, with 0 being not sure at all and 10 being completely sure, How sure are you that following the recommended vaccine schedule is a good idea for you?
    ➔ If question 15 is unclear, continue with question 16. Otherwise continue with question 17.
16. I will rephrase the question: On a scale from 0 to 10, with 0 being not sure at all and 10 being completely sure, how sure are you that it is a good idea to vaccinate you with the vaccines recommended by the Federal Office of Public Health?

Do you agree or disagree with the following statements:

17. We get more vaccines than are good for us.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
18. I believe that many of the illnesses that vaccines prevent are severe.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
19. It is better to develop immunity by getting sick than to get a vaccine.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
20. It's better to get fewer vaccines at the same time.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
21. How concerned are you that you might have a serious side effect from a vaccine?
    a. Not at all concerned
    b. Not too concerned
    c. Not sure
    d. Somewhat concerned
    e. Very concerned
    f. Doesn't want to disclose
    g. Missing
22. How concerned are you that one of the vaccines might not be safe?
    a. Not at all concerned
    b. Not too concerned

c. Not sure
d. Somewhat concerned
e. Very concerned
f. Doesn't want to disclose
g. Missing

23. How concerned are you that a vaccine might not prevent disease?
    a. Not at all concerned
    b. Not too concerned
    c. Not sure
    d. Somewhat concerned
    e. Very concerned
    f. Doesn't want to disclose
    g. Missing
24. Overall, how hesitant about vaccines would you consider yourself to be?
    a. Not at all hesitant
    b. Not too hesitant
    c. Not sure
    d. Somewhat hesitant
    e. Very hesitant
    f. Doesn't want to disclose
    g. Missing

Do you agree or disagree with the following statements:

25. I trust the information I receive about vaccines.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
26. I am able to openly discuss my concerns about vaccines with my doctor.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
27. All things considered, how much do you trust your 0 doctor, on a scale from 0 to 10, with 0 being not at all and 10 being completely?

Now I want to ask you some questions about the HPV vaccine.

28. Have you heard of the HPV vaccine?

a. Yes
b. No
c. Doesn't want to disclose
d. Doesn't know
e. Missing

➔ If a: continue with question 29.
➔ If b-e: continue with question 30.

29. What is it for?
30. Have you heard of the cervical cancer vaccine?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 31.
➔ If b-e: continue with question 37.

31. Have you received HPV vaccine?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 31.
➔ If b-e: continue with question 33.

32. Where did you receive HPV vaccine?
    a. At school
    b. At a doctor recommended by school
    c. At the family doctor's
    d. At the pediatrician's
    e. At the gynecologist's
    f. At a vaccination center
    g. Other
    h. Doesn't want to disclose
    i. Doesn't know
    j. Missing
33. Where have you heard about HPV vaccination?
34. Was the HPV vaccine recommended by your school?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
35. How do you feel about offering the HPV vaccine at school?
    a. Very supportive

b. Somewhat supportive
c. Not sure
d. Somewhat unsupportive
e. Very unsupportive
f. Doesn't want to disclose
g. Doesn't know
h. Missing

36. Who did you consult with when deciding whether or not to get the HPV vaccine?
37. What are your most trusted information sources on vaccination?
    a. No information/ no source
    b. Family
    c. My doctor
    d. Other doctor
    e. Friends and acquaintances
    f. Public health authorities
    g. TV
    h. Internet
    i. Social media (such as Facebook, Instagram and Twitter)
    j. Print media (such as books, magazines and newspapers)
    k. Other:___
    l. Doesn't want to disclose
    m. Doesn't know
    n. Missing

➔ If g: add question 38.
➔ If h: add question 39.
➔ If i: add question 40.
➔ If j: add question 41.
➔ If k: add question 42.
➔ Otherwise continue with question 43.

38. Which TV programs?
39. Which websites?
40. What social media?
41. What print media?
42. What other sources?
43. Did you apply the information you received when making decisions about vaccination?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
44. How is your health in general? Is it…
    a. Very good
    b. Good

c. OK
d. Bad
e. Very bad
f. Doesn't want to disclose
g. Doesn't know
h. Missing

45. How important is health for you? Here are three options, please tell us which one is closest to your own opinion.
    a. I live without worrying too much about consequences for my health.
    b. My lifestyle is influenced by considerations about maintaining my health.
    c. Considerations about my health have a large impact on how I live.
    d. Doesn't want to disclose
    e. Doesn't know
    f. Missing
46. In the last 12 months, that is since [month, year], which of the following treatments have you used for your own health? Please indicate yes or no for each.
    a. Acupressure
    b. Acupuncture
    c. Anthroposophical medicine
    d. Chinese medicine
    e. Chiropractics
    f. Herbal treatment
    g. Homeopathy
    h. Hypnotherapy
    i. Massage therapy
    j. Osteopathy
    k. Physiotherapy
    l. Reflexology
    m. Spiritual Healing
    n. Other:___
    o. None of these
    p. don't know

Now I would like to ask you some questions about other topics to get a sense of your core worldview and political and religious sentiments.

47. Do you consider yourself as belonging to any particular religion or denomination?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 48.
➔ If b-e: continue with question 50.

48. Which one?

a. Christian
b. Jewish
c. Islamic
d. Eastern religions
e. Other non-Christian religions
f. Doesn't want to disclose
g. Doesn't know
h. Missing

➔ If a-e: continue with question 49.
➔ If f-h: continue with question 50.

49. Please specify which exactly.
50. Apart from special occasions such as weddings and funerals, about how often do you attend religious services nowadays?
    a. Every day
    b. More than once a week
    c. Once a week
    d. At least once a month
    e. Only on special holy days
    f. Less often
    g. Never
    h. Doesn't want to disclose
    i. Doesn't know
    j. Missing
51. Regardless of whether you belong to a particular religion, how religious would you say you are?
    a. Not at all religious
    b. Somewhat religious
    c. Religious
    d. Very religious
    e. Doesn't want to disclose
    f. Doesn't know
    g. Missing
52. How important do you consider spiritual experiences to be in your everyday life?
    a. Very important
    b. Somewhat important
    c. Not very important
    d. Not important at all
    e. Not sure
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
53. How interested would you say you are in politics? Are you…
    a. Very interested
    b. Quite interested

c. Hardly interested
d. Or, not at all interested?
e. Doesn't want to disclose
f. Doesn't know
g. Missing

54. Is there a particular political party that you feel closer to than all the other political parties?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 55.
➔ If b-e: continue with question 56.

55. Which one?
56. In politics, people sometimes talk of "left" and "right". Where would you place yourself? Would you consider yourself…
    a. Left
    b. Center left
    c. Center
    d. Center right
    e. Right
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
57. How often do you participate in activities with a society, a club, a political party, a cultural association, or other groups, including religious groups?
    a. Almost every day
    b. About once a week
    c. About 1-3 times a month
    d. A few times a year
    e. More rarely
    f. Never
    g. Doesn't want to disclose
    h. Doesn't know
    i. Missing

We would now like to pose some questions regarding the values that generally guide people in their everyday life. The questions don't directly relate to vaccinations.

When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking?

58. Whether or not someone suffered emotionally. Is it not at all relevant, not very relevant, slightly relevant, somewhat relevant, very relevant or extremely relevant?
    a. Not at all relevant

b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

59. Whether or not someone was treated differently than others.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

60. Whether or not someone's actions showed love for his or her country.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

61. Whether or not someone's actions showed lack of respect for authority.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

62. Whether or not someone violated standards of purity and decency.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant

f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

63. Whether or not someone was good at math.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

64. Whether or not someone cared for someone weak and vulnerable.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

65. Whether or not someone acted unfairly.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

66. Whether or not someone did something to betray his or her group.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

67. Whether or not someone conformed to the traditions of society.
    a. Not at all relevant
    b. Not very relevant
    c. Slightly relevant
    d. Somewhat relevant
    e. Very relevant
    f. Extremely relevant
    g. Doesn't want to disclose
    h. Doesn't know
    i. Missing
68. Whether or not someone did something disgusting.
    a. Not at all relevant
    b. Not very relevant
    c. Slightly relevant
    d. Somewhat relevant
    e. Very relevant
    f. Extremely relevant
    g. Doesn't want to disclose
    h. Doesn't know
    i. Missing

Please listen to the following statements and indicate whether you strongly disagree, moderately disagree, slightly disagree, slightly agree, moderately agree or strongly agree.

69. Compassion for those who are suffering is the most crucial virtue.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
70. When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
71. I am proud of my country's history.
    a. Strongly disagree

b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

72. Respect for authority is something all children need to learn.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

73. People should not do things that are disgusting even if no one is harmed.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

74. It is better to do good than to do bad.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

75. One of the worst things a person could do is hurt a defenseless animal.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

76. Justice is the most important requirement for a society.

a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

77. People should be loyal to their family members even when they have done something wrong.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
78. Men and women should each have different roles to play in society.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
79. I would call some acts wrong on the grounds that they are unnatural.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing

I just have a few more questions to finish up.

80. Which of these descriptions applies to what you have been doing for the last seven days?
    a. In paid work or away temporarily
    b. In education (even if on vacation)
    c. Unemployed and actively looking for a job
    d. Unemployed, wished to work but didn't actively look for a job

e. Permanently sick or disabled
f. Retired
g. In community or military service
h. Doing housework, looking after children or other persons
i. Other
j. Doesn't want to disclose
k. Doesn't know
l. Missing

➔ If a: continue with question 81.
➔ If b-l: continue with question 82.

81. Regardless of your basic or contracted hours, how many hours per week do you normally work, including any paid or unpaid overtime?
82. And what about your father? Which describes his situation in the last seven days?
    a. In paid work or away temporarily
    b. In education (even if on vacation)
    c. Unemployed and actively looking for a job
    d. Unemployed, wished to work but didn't actively look for a job
    e. Permanently sick or disabled
    f. Retired
    g. In community or military service
    h. Doing housework, looking after children or other persons
    i. Other
    j. Doesn't want to disclose
    k. Doesn't know
    l. Missing

➔ If a: continue with question 83.
➔ If b-l: continue with question 85.

83. How many hours does he normally work, including any paid or unpaid overtime?
84. What is his current occupation?
85. And what about your mother? Which describes her situation in the last seven days?
    a. In paid work or away temporarily
    b. In education (even if on vacation)
    c. Unemployed and actively looking for a job
    d. Unemployed, wished to work but didn't actively look for a job
    e. Permanently sick or disabled
    f. Retired
    g. In community or military service
    h. Doing housework, looking after children or other persons
    i. Other
    j. Doesn't want to disclose
    k. Doesn't know
    l. Missing
86. How many hours does she normally work, including any paid or unpaid overtime?
87. What is her current occupation?

➔ If a: continue with question 86.
➔ If b-l: continue with question 88.

88. Are you a citizen of Switzerland?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 90.
➔ If b: continue with question 89.
➔ If c-e: continue with question 93.

89. What citizenship do you hold?
90. Were you born in Switzerland?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a, c-e: continue with question 93.
➔ If b: continue with question 91.

91. In which country were you born?
92. What year did you first come to Switzerland?
93. What is your postcode?

We have finished the interview. Thank you very much for your time.

94. Do you have comments you would like to make?
95. Thank you very much for your participation in this telephone interview. In order to better understand what young people think about HPV vaccinations we plan to also speak to some young people in person. We are able to travel to a place that is convenient and comfortable for our interview partners at a date and time that suit them. Please let me know if:
    a. you would be interested to take part in a face-to-face interview
    b. are not sure yet but we may contact you again
    c. you would not like to be contacted again

➔ If a,b: continue with question 96.
➔ If c: end of interview.

96. Would you prefer to be interviewed alone, or would you rather have one or even both of your parents being present?
    a. Alone
    b. With one or both parents
    c. Missing
97. How can we contact you?
    a. SMS
    b. Telephone

c. Email:___
d. Missing

# Schwendener et al, HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study: Supplementary Material 2

## Supplementary Table 1. Awareness and knowledge of subgroups

| | All Participants (n = 997) | Biomedical provider (n = 405) | Military Service (n = 375) | CAM provider (n = 148) | Adolescent clinic (n = 69) |
|---|---|---|---|---|---|
| **Awareness** | | | | | |
| Aware, n (%) | 830 (83) | 357 (88) | 271 (72) | 136 (92) | 66 (96) |
| **Knowledge** | | | | | |
| Knowledgeable, n (%) | 697 (70) | 293 (72) | 229 (61) | 119 (80) | 56 (81) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated.
**Abbreviations**. CAM, complementary and alternative medicine

## Supplementary Table 2. Awareness and knowledge of subgroups – male participants

| | All Participants (n = 585) | Biomedical provider (n = 146) | Military Service (n = 371) | CAM provider (n = 55) | Adolescent clinic (n = 13) |
|---|---|---|---|---|---|
| **Awareness** | | | | | |
| Aware, n (%) | 431 (74) | 108 (74) | 268 (72) | 43 (78) | 12 (92) |
| **Knowledge** | | | | | |
| Knowledgeable, n (%) | 355 (61) | 77 (53) | 227 (61) | 41 (75) | 10 (77) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated.
**Abbreviations**. CAM, complementary and alternative medicine

## Supplementary Table 3. Awareness and knowledge of subgroups – female participants

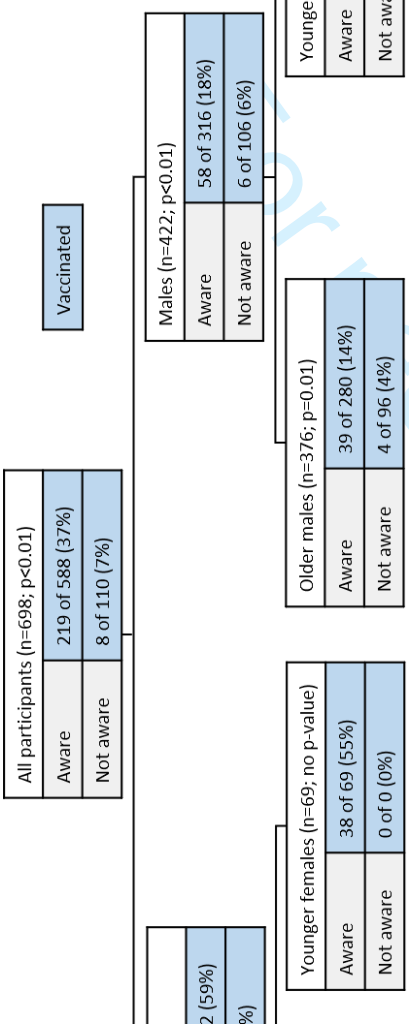
| | All Participants (n = 412) | Biomedical provider (n = 259) | Military Service (n = 4) | CAM provider (n = 93) | Adolescent clinic (n = 56) |
|---|---|---|---|---|---|
| **Awareness** | | | | | |
| Aware, n (%) | 399 (97) | 249 (96) | 3 (75) | 93 (100) | 54 (96) |
| **Knowledge** | | | | | |
| Knowledgeable, n (%) | 342 (83) | 216 (83) | 2 (50) | 78 (84) | 46 (82) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated.
**Abbreviations**. CAM, complementary and alternative medicine

**Supplementary Table 4. Survey questions concerning gendered perceptions of HPV Vaccine**

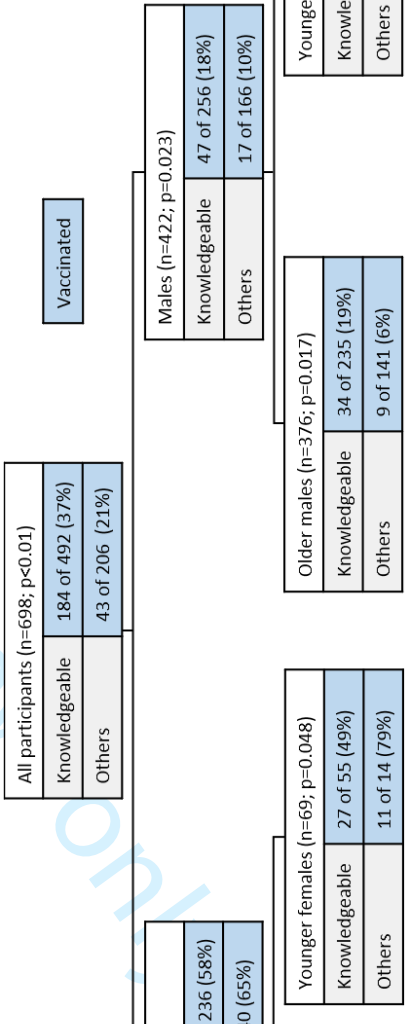
| | | By gender | | By age groups | |
|---|---|---|---|---|---|
| | **All participants** | **Male** | **Female** | **Born before 1.7.02** | **Born on/ after 1.7.02** |
| **Have you heard of the HPV vaccine?** | *(n = 997)* | *(n = 585)* | *(n = 412)* | *(n = 849)* | *(n = 148)* |
| Yes, n (%) | 461 (46) | 176 (30) | 285 (69) | 359 (42) | 102 (69) |
| No/ don't know, n (%) | 536 (54) | 409 (70) | 127 (31) | 490 (58) | 46 (31) |
| **Have you heard of the cervical cancer vaccine?** | *(n = 535)* | *(n = 409)* | *(n = 126)* | *(n = 489)* | *(n = 46)* |
| Yes, n (%) | 369 (69) | 255 (62) | 114 (90) | 336 (69) | 33 (72) |
| No/ don't know, n (%) | 166 (31) | 154 (38) | 12 (10) | 153 (31) | 13 (28) |
| **What is the HPV vaccine for?** | *(n = 461)* | *(n = 176)* | *(n = 285)* | *(n = 359)* | *(n = 102)* |
| Only female, n (%) | 185 (40) | 35 (20) | 150 (53) | 160 (45) | 25 (25) |
| All other answers, n (%) | 276 (60) | 141 (80) | 135 (47) | 199 (55) | 77 (75) |
| **Combination of all questions** | *(n = 711)* | *(n = 361)* | *(n = 350)* | *(n = 611)* | *(n = 100)* |
| Only female, n (%) | 554 (78) | 290 (80) | 264 (75) | 496 (81) | 58 (58) |
| All other answers, n (%) | 157 (22) | 71 (20) | 86 (25) | 115 (19) | 42 (42) |

**Supplementary Figure 1. Awareness and HPV**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

**Supplementary Figure 2. Knowledge and HPV**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

# Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

## Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

| | | Reporting Item | Page Number |
|---|---|---|---|
| **Title and abstract** | | | |
| Title | #1a | Indicate the study's design with a commonly used term in the title or the abstract | 1 |

| | | | |
|---|---|---|---|
| Abstract | #1b | Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background / rationale | #2 | Explain the scientific background and rationale for the investigation being reported | 5 |
| Objectives | #3 | State specific objectives, including any prespecified hypotheses | 5,6 |
| **Methods** | | | |
| Study design | #4 | Present key elements of study design early in the paper | 7 |
| Setting | #5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7,8 |
| Eligibility criteria | #6a | Give the eligibility criteria, and the sources and methods of selection of participants. | 7-10 |
| | #7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | n/a |
| 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. Give information separately for for exposed and unexposed groups if applicable. | 8-10 |

| | | | |
|---|---|---|---|
| Bias | #9 | Describe any efforts to address potential sources of bias | n/a |
| Study size | #10 | Explain how the study size was arrived at | 7-11 |
| Quantitative variables | #11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why | 7-9 |
| Statistical methods | #12a | Describe all statistical methods, including those used to control for confounding | 8-10 |
| Statistical methods | #12b | Describe any methods used to examine subgroups and interactions | 7-10 |
| Statistical methods | #12c | Explain how missing data were addressed | n/a |
| Statistical methods | #12d | If applicable, describe analytical methods taking account of sampling strategy | n/a |
| Statistical methods | #12e | Describe any sensitivity analyses | n/a |
| **Results** | | | |
| Participants | #13a | 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. Give information separately for for exposed and unexposed groups if applicable. | 11 |
| Participants | #13b | Give reasons for non-participation at each stage | 11 |

| | | | |
|---|---|---|---|
| Participants | #13c | Consider use of a flow diagram | n/a |
| Descriptive data | #14a | Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable. | 11,27,28 |
| Descriptive data | #14b | Indicate number of participants with missing data for each variable of interest | 11,12,16 |
| Outcome data | #15 | Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable. | 11-17 |
| Main results | #16a | 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 |
| Main results | #16b | Report category boundaries when continuous variables were categorized | 11-17 |
| Main results | #16c | If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | n/a |
| Other analyses | #17 | Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses | n/a |
| **Discussion** | | | |
| Key results | #18 | Summarise key results with reference to study objectives | 18,19 |

| | | | |
|---|---|---|---|
| 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. | 19,20 |
| Interpretation | #20 | Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence. | 18-20 |
| Generalisability | #21 | Discuss the generalisability (external validity) of the study results | 18-20 |
| **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 | 21 |

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BMJ Open

# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2021-054419.R3 |
| Article Type: | Original research |
| Date Submitted by the Author: | 13-Jan-2022 |
| Complete List of Authors: | Schwendener, Corina L.; University of Basel, University Department of Medicine<br>Kiener, Laura M.; University of Basel, University Department of Medicine<br>Jafflin, Kristen; Swiss Tropical and Public Health Institute; University of Basel<br>Rouached, Sarah; University of Basel, University Department of Medicine<br>Juillerat, Anna; University of Basel, University Department of Medicine<br>Meier, Vincent; University of Basel, University Department of Medicine<br>Schärli Maurer, Susanna; Swiss Armed Forces, Rekrutierungszentrum Aarau<br>Muggli, Franco; Swiss Armed Forces, Rekrutierungszentrum Monte Ceneri<br>Gültekin, Nejla; Swiss Armed Forces, Eidgenössisches Departement für Verteidigung, Bevölkerungsschutz und Sport VBS Schweizer Armee<br>Baumann, Aron; Swiss Tropical and Public Health Institute<br>Debergh, Marlyse; University of Geneva, Institute of Sociological Research<br>Gruillot, Catherine; PROFA Consultation de santé sexuelle - planning familial<br>Huber, Benedikt; HFR Fribourg Cantonal Hospital, Department of Pediatrics<br>Merten, Sonja; Swiss Tropical and Public Health Institute; University of Basel<br>Buhl, Andrea; Swiss Tropical and Public Health Institute; University of Basel<br>Deml, Michael; University of Geneva, Institute of Sociological Research; University of Cape Town Faculty of Health Sciences, Division of Social and Behavioural Sciences, School of Public Health & Family Medicine<br>Tarr, Philip ; University of Basel, University Department of Medicine, Kantonsspital Baselland; University of Basel, University Department of Medicine |
| Primary Subject Heading: | Public health |
| Secondary Subject Heading: | Sexual health, Immunology (including allergy) |
| Keywords: | IMMUNOLOGY, Public health < INFECTIOUS DISEASES, PREVENTIVE MEDICINE, PUBLIC HEALTH, SEXUAL MEDICINE |

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# HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study

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**Word count:**

4490 (exclusive title page, authors' contribution statements, abstract, keywords, strengths and limitations of this study, acknowledgments, ethics approval)

**Key Words:**

HPV vaccine, HPV vaccine awareness, HPV vaccine knowledge, HPV vaccine information sources, HPV vaccine uptake, youth

## ABSTRACT:

**Objectives:** We aimed to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process of youth, both male and female, in Switzerland.

**Design:** With a mixed-methods study design, we conducted quantitative questionnaires and qualitative interviews, which lasted 20-45 minutes.

**Setting and participants:** We recruited participants, 15-26 years of age, in physicians' offices, in a local sexual health clinic, and during military enlistment. We administered quantitative questionnaires to 997 youth participants (585 male, 412 female) and conducted qualitative interviews with 31 youth (17 male, 14 female).

**Primary and secondary outcome measures:** We assessed HPV vaccine awareness, knowledge, information sources and vaccination status.

**Results:** In the study's quantitative component, 108 (20%) male and 262 (65%) female participants had received ≥1 dose of HPV vaccine. 697 (70%) participants were knowledgeable about the HPV vaccine. Females were more likely to be knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01). Younger participants in the sample compared to older participants were more likely to be aware of HPV vaccine (135/148 [91%] vs. 695/849 [82%]; p<0.01). The three most mentioned information sources were school health programs (442 [53%]), health care providers (190 [23%]), and participants' social networks (163 [20%]). Overall, 554/710 (78%) participants had a female-gendered perception of HPV vaccine, a finding which was further supported and explained by qualitative data.

**Conclusions:** Despite a male HPV vaccine recommendation being made >4 years prior to the data collection, HPV vaccine knowledge was higher among females than males, and a female-

gendered perception of HPV vaccine remains prevalent. Internet and social media were minor HPV vaccine information sources. Study findings demonstrate that HPV knowledge matters for HPV vaccine uptake and suggest that we should improve HPV information quality and access for youth, particularly by tailoring knowledge campaigns to young men.

## Strengths and limitations of this study:

- One major strength of the study is that it uses a mixed methods approach, allowing for the qualitative data to offer potential explanations to quantitative findings.
- The study included a large number of female and male youth, allowing us to gain gendered differences regarding HPV vaccination information sources.
- One limitation of this study is that we might overestimate HPV vaccination knowledge based on the way we classified answers for the quantitative component.
- Our sampling strategy led to a non-representative sample.

## 1. Introduction

Surprisingly little research has directly examined youth knowledge, awareness, and information sources as determinants of *human papillomavirus (HPV)* vaccine uptake. Furthermore, the research that has been done on youth perspectives has primarily focused on females [1-6], although the vaccine has been recommended for male youth for several years in many countries. Literature on the determinants of HPV vaccine attitudes and uptake among male youth remains limited [7-12]. Furthermore, the false perception that the HPV vaccination concerns only women continues to persist in popular discourse since it has been long known as the "cervical cancer vaccine"[3, 13].

In addition to issues related to access barriers [2, 14], previous reports in male and female youth suggest that low HPV vaccine uptake is also related to limited HPV vaccine awareness and knowledge [11, 15-17], and to the behavioral expectations youth perceive from their parents, family members, and peers [18, 19]. The most consistent predictor of HPV vaccination is having received a recommendation from a health care provider [12, 14, 20].

Previous research has focused on parents' attitudes and information sources towards HPV vaccine since the primary target group are 11-14-year-old adolescents [21-26]. A key component of the Swiss National Vaccination Strategy (NVS), in order to increase HPV vaccination rates, however, is to address insufficient levels of youth vaccination knowledge, e.g. by emphasizing the importance of school vaccination programs. Also, the NVS aims to address insufficient vaccination access, e.g., by removing financial barriers, especially for young adults with limited financial resources. Accordingly, HPV vaccine is now covered by the state when given until the age of 26 to men and women in the setting of a state vaccination program, thereby addressing such financial barriers to HPV vaccination in youth [27]. The effective implementation of each of these NVS approaches would benefit from additional research on HPV vaccine awareness,

knowledge, and information sources in youth. We have recently documented the validity of measuring vaccine hesitancy (VH) in youth using the Youth Attitudes about Vaccines (YAV) questionnaire, which shows that VH is an independent predictor of HPV non-immunization in Switzerland in female youth [28]**(Kiener L., Schwendener C., et al, manuscript submitted)**. The aims of the present study were to provide a detailed characterization of HPV vaccine awareness, knowledge, and information sources in the HPV vaccine decision-making process among youth, both male and female, in Switzerland. We additionally aimed to gain a more current understanding of gendered aspects youth may have around the HPV vaccine. Finally, we examined how these factors contribute to HPV vaccine uptake in both sexes and in younger and older adolescents.

## 2. Methods

### *2.1 The Swiss Context*

The Swiss Federal Office of Public Health (FOPH) and the Federal Vaccination Commission have recommended HPV vaccine since 2007 for female youth [29], and since 2015 for male youth [30]. HPV vaccine uptake has increased in the last decade [31], but lies still below the 80% immunization target [32]. In 2017-2019, the most recent evaluation period, only 20% of 16-year old males and 64% of females, had received ≥1 dose of HPV vaccine on average throughout Switzerland [33]. Regional differences in uptake have been associated with specifics of vaccination policies of local health authorities, limited information access, and the availability and quality of school vaccination programs [34, 35].

### *2.2 Study design*

We applied a convergent mixed-methods design [36], meaning we collected qualitative and quantitative data in parallel. We conducted the study in the context of our Swiss national research program (NRP74) on the determinants of VH in Switzerland regarding childhood and HPV vaccination. The local institutional review board (Ethikkommission Nordwest- und Zentralschweiz) approved the study. All participants provided written informed consent. Full details on our recruitment methods, power calculation, and the questionnaire have been previously published [37].

### *2.3 Study population and recruitment*

Participants were 15-26 years of age, male and female. Of note, youth in Switzerland are legally able to make vaccine decisions starting at age 14 [38], which supports vaccination promotion efforts which focus on youth perspectives on HPV vaccination. Even though the primary target

group is 11-14-year-olds, the vaccine is also recommended as a catch-up vaccine until 26 years in many countries, including Switzerland.

Since HPV vaccination programs in Switzerland are tailored for an age group (11-26 years) with limited contact with the health system because young people who are otherwise healthy do not tend to consult with physicians we used diverse recruitment strategies to increase study participation. We recruited participating youth in the offices of physicians providing biomedicine and sometimes additionally complementary and alternative medicine (CAM), and in a local sexual health clinic. Recruitment was done in urban and rural areas, and in 3 of 4 Swiss language regions, i.e., German, French, Italian. In order to gain more male participants, we also recruited during military enlistment (military service is compulsory for Swiss males, with enlistment being at age 18-24). Since July 1st, 2016 the cost of HPV vaccine has been covered by mandatory health insurance for male adolescents 11-14 years of age and as a catch-up vaccination until age 26 in Switzerland. We therefore divided male participants in an older and a younger age group. We refer to male participants born before vs. on/after July 1st, 2002 as the "older" and "younger" participants, respectively, meaning that younger male participants were part of the HPV vaccine target age group when 11-14 years of age. For comparison purposes, we applied the same age cut-offs to female participants.

### *2.4 Patient and public involvement*

We did not include patient or public involvement in designing the study, commenting the outcomes, interpreting the results of this study or reviewing the manuscript.

*2.5 Quantitative methods*

As previously reported [37], we developed German, French, Italian, and English versions of the questionnaire. We interviewed military participants on site (face-to-face), and the other participants on the phone, after the physician/clinic visit. Apart from age at time of interview below 15 or above 26 there were no further exclusion criteria. Quantitative interviews lasted 25-35 minutes and were conducted by medical students with previous training in participant recruitment, informed consent procedures and interview techniques. Interviews were conducted from January 2019 to April 2020. All data was entered to open data kit (ODK) using tablets [37]. The questionnaire included socio-demographics including language, place of residence, living situation (with parents, with roommates, with partner), age, nationality, and school HPV vaccination program availability (**Supplementary Material 1**). We did not collect information on participants' underlying health conditions, diagnoses, and/or reasons for clinic visits - this was not part of our national research program that focused on vaccine hesitancy, and we did not request ethics commission approval for collection of such information. In addition, detailed analysis of participant's medical conditions would have been time consuming and could have undermined participant's willingness to participate in our study.

HPV vaccination status (has received ≥1 dose of HPV vaccination) was assessed based on review of the vaccination booklet of the participant, and, if unavailable, on personal report of being vaccinated.

In order to measure youth *awareness* about the HPV vaccine, we asked all participants if they had heard of the HPV vaccine. To accommodate for a gendered perception, for those who said "no" to the previous question, we asked if they had heard of the "cervical cancer vaccine." To measure youth *knowledge* about the HPV vaccine, we asked participants what the HPV vaccine is intended for. Those who responded correctly were considered to be knowledgeable. We

considered an answer to be correct if they mentioned at least one correct aspect about the HPV vaccine, i.e., it protects against “cancer”, “cervical cancer”, “papilloma virus”, or a “sexually transmitted disease”. We sought to establish where youth obtained information about the HPV vaccination by asking two questions, each with free text answer options in order to document the most precise responses: (1) “Where have you heard about HPV vaccination?” and (2) “Who did you consult with when deciding whether or not to get the HPV vaccine?”. Answers to the second question included consulting people as well as traditional media, the internet, and other forms of information supply.

### *2.6 Qualitative methods*

After completion of the quantitative interviews, participants were invited to participate in an additional qualitative interview. We subsequently contacted interested youth who indicated willingness in the German- and French-speaking regions of Switzerland. Additional participants were recruited through researcher and participant social networks and by snowball sampling. Our research team collaboratively developed a semi-structured interview guide, which we piloted and revised iteratively for clarity and coherence. The interviews allowed us to gather background information about the youth, their health status and lifestyle, the HPV vaccine decision-making process, including knowledge, awareness, information sources, and the people with whom they discussed the vaccination. Qualitative interviews were conducted (March 2019-September 2020), either face-to-face or online (Skype or Zoom), they lasted 20-45 minutes, and were audio-recorded and transcribed verbatim. Qualitative data were analyzed by social scientists Andrea Buhl and Michael J. Deml. Analysis of the qualitative interviews was guided by the Framework Method [39] with support of MAXQDA software. All quotes from interviews have been translated from German or French into English and anonymized.

## 3. Results

For the study's quantitative component, we completed telephone (n=622) or face-to-face (n=375) interviews with 1010 youth. Of these, we excluded eight participants because they did not meet the age criteria, one participant because of missing gender information, and four additional interviews due to missing answers on awareness and knowledge. Quantitative analyses are therefore based on 997 participants (585 male, 412 female). Their characteristics are shown in **Table 1**. For the study's qualitative component, we conducted 14 qualitative interviews with female youth and 17 interviews with male youth. Qualitative participants ranged in age from 15 to 26 years in age (average ~21 years). Characteristics of the participants of the qualitative interview are shown in **Table 2**.

In the following sections, we present results regarding: (1) awareness and knowledge about the HPV vaccination, (2) youth HPV vaccination information sources and people with whom they had discussed the vaccination, and (3) youth's gendered perceptions of the HPV vaccine.

### *3.1 Awareness about HPV Vaccination*

For the purpose of this study, we defined *awareness* as having heard of the HPV or "cervical cancer" vaccine. Significantly more female youth were aware of the HPV vaccine than male youth. Of the 997 participants, 461 (46%) had heard of the HPV vaccine; 176/585 (30%) males and 285/412 (69%) females ($p<0.01$). Among the 536 participants who had not heard of HPV vaccine, 369 (69%) had heard of the "cervical cancer vaccine", 255/409 (62%) males and 114/127 (90%) females ($p<0.01$).

Of the 997 participants, 830 (83%) had heard of the HPV or "cervical cancer vaccine", 431/585 (74%) of males and 399/412 (97%) of females ($p<0.01$). In both awareness of HPV vaccine and

awareness of "cervical cancer vaccine", females had more awareness than males. 695/849 (82%) of the older participants and 135/148 (91%) of the younger participants had heard of the HPV or "cervical cancer vaccine" (p<0.01). Details are shown in **Figure 1.** Subgroup analysis showed a significant difference in awareness between participants who were recruited in the military and all other participants (biomedical vs. military p<0.01; CAM vs. military p<0.01; adolescent clinic vs. military p<0.01). However, this effect was not due to the different subgroups but is rather derived from the unequal distribution of gender (more males) within the military subgroup **(Supplementary Table 1-3)**.

Of the 997 participants, 370 (39%) had received ≥1 dose of HPV vaccine. As shown in **Figure 2**, participants with greater awareness had also more often received ≥1 dose of HPV vaccine compared to participants with limited awareness (362/830 [44%] vs. 8/110 [7%]; p<0.01). This effect was manifest in males (102/431 [24%] of aware males vs. 6/106 [6%] of males with limited awareness had received ≥1 HPV vaccine dose; p<0.01), but not in females (260/399 of aware females [65%] vs. 2/4 [50%] of females with limited awareness had received ≥1 HPV vaccine dose; p=0.53), however, only few (4/413) females were unaware of the vaccine.

When we defined HPV vaccine uptake according to availability of a vaccination record, results regarding the associations of awareness and uptake and of knowledge and uptake remained essentially unchanged (**Supplementary Fig. 1 and 2**).

### *3.2 Knowledge about HPV Vaccination and Implications for Uptake*

We defined *knowledge* as being able to give a correct answer to what the HPV vaccine is for or for the association of HPV with cervical cancer. 697/997 (70%) participants had knowledge of

HPV vaccine or the "cervical cancer vaccine", while 300/997 (30%) participants did not. Females were more knowledgeable than males (342/412 [83%] vs. 355/585 [61%]; p<0.01) which is also shown in **Figure 1**. We did not find a significant difference regarding knowledge between younger and older participants (94/148 [64%] vs. 603/849 [71%]; p=0.07). Subgroup analysis showed a significant difference in knowledge between participants who were recruited in the military and all other participants (biomedical vs. military p<0.01; CAM vs. military p<0.01; adolescent clinic vs. military p<0.01). However, this effect was not due to the different subgroups but is rather derived from the unequal distribution of gender (more males) within the military subgroup **(Supplementary Table 1-3)**.

As shown in **Figure 3**, more knowledgeable participants had received ≥1 dose of HPV vaccine compared to participants with limited knowledge (298/697 [43%] vs. 72/243 [30%]; p<0.01), and there was no evidence that this difference was limited to either sex (77/355 [22%] knowledgeable males vs. 31/182 [17%] males with limited knowledge had received ≥1 HPV vaccine dose; p=0.20), and 221/342 knowledgeable females [65%] vs. 41/61 [67%] females with limited knowledge had received ≥1 HPV vaccine dose; p=0.70).

For the study's qualitative component, although the youth had agreed to participate in qualitative interviews explicitly about their HPV vaccination decisions, many participants were not able to tell us what specifically the HPV vaccine was intended to protect against. When asked about recommendations for improvements to HPV vaccination campaigns in Switzerland, almost all youth mentioned desiring more and better information. The following dialogue demonstrates how knowledge and awareness served as barriers for a 22-year-old male who had not received the vaccine:

Researcher: So, I see [from your vaccination certificate] that you didn't get the HPV vaccine.

Participant: No.

Researcher: Was it a choice?

Participant: No, it was an issue of information. I don't know what [HPV] is.

### *3.3 Youth Information Sources about HPV Vaccination*

We assessed if and where adolescents had heard about HPV vaccination and who they may have turned to when deciding whether to get vaccinated against HPV. As shown in **Figure 4**, the three most commonly mentioned information sources by youth in the quantitative questionnaire were school health programs (53%), health care providers (23%), and participants' social networks (20%). The most mentioned information sources were similar for males and females. Internet and social media were mentioned infrequently as information sources (1% of all participants; 2% of males, 1% of females). Concerning the information sources used for deciding whether or not to vaccinate, most participants consulted their social networks (42%) and/or their healthcare provider (27%), as shown in **Figure 5**. Many participants (38%) did not talk to anyone about the HPV vaccine. We found this result predominantly with male participants (61%) and less with female participants (12%). Internet and social media were also infrequently mentioned for vaccine decision-making (0.4% of participants; 0.5% of males, 0.3% of females).

Qualitative interviews with youth showed that very few had actively sought out information about the HPV vaccination during the initial recommended age for the first dose (11-14 years). Primary explanations for this from the youths' perspectives included that they were too young when the HPV vaccine was offered via school programs or by their pediatricians, and that their

parents had made the decision without being involved in the decision-making process. The few youth who reported having had discussions about the HPV vaccination described having talked to family members, primarily mothers or older siblings, or doctors (pediatricians if the vaccine was offered during the initial recommended age, gynecologists for older female participants who had not been vaccinated, and sexual health doctors for young men who have sex with men (MSM)). Apart from the MSM in the qualitative study sample, young men reported not having discussed the HPV vaccine with anybody. Several of the young women we interviewed recalled their parents' skepticism when the HPV vaccine was first introduced. A 26-year-old female who had not received the HPV vaccine explained, "It was one of the first years when it came out. 2009 or something like that. I was still a minor and still in high school. We needed our parents' permission. My mother, who is a nurse, simply decided [against it because] it was a new vaccine, and we didn't yet know the side effects."

When asked about where information about the HPV vaccine should come from, many youth suggested better information campaigns via schools. This was particularly clear among youth whose parents chose against the vaccine when they were in the initial recommended target age. Despite not being vaccinated against HPV, an 18-year-old female described her views on the added value of having HPV vaccination information campaigns and programs in schools, particularly once youth are able to make their own health decisions:

> "I think it helped me a lot that that there was information at school and that the vaccine was offered there. We were at an age when we started to make our own decisions and that's why I liked the fact that we talked about it in school. That helped me a lot. […] because our parents had decided on everything before. And this is, I think, the first time that we decide or shared decisions about our health."

A 19-year-old female participant who had received the vaccine described the roles schools played in explaining the rationale behind the HPV vaccine, "I think I find it very important that there is an education and not just 'get vaccinated' and 'it's good for you or it helps you', but rather also a 'why' and 'what is it about' and 'what would it look like if you weren't vaccinated', what would be the consequence'? I think such a relatively educated attitude is also extremely useful."

### *3.4 Youth's female-gendered perception of the HPV Vaccine*

Given the HPV vaccination's association with cervical cancer in popular discourse, we analyzed if and to what extent participants had a gendered perception of HPV vaccine. From the quantitative sample, after excluding 287 of 997 participants without knowledge of HPV or the "cervical cancer vaccine," 554 of 710 (78%) participants perceived the HPV vaccine as being only targeted towards women and not men (female-gendered answer) (**Supplementary Table 4**). For example, many participants only mentioned cervical cancer when asked what the HPV vaccine is for and only few youth mentioned that the HPV vaccine protects also males from diseases. 290/361 (80%) males and 264/349 (75%) females (p=0.13) gave a female-gendered answer. While both older and younger participants had a female-gendered perception on the purpose of the HPV vaccination, significantly more older youth had female-gendered perceptions (496/611 (81%) older vs. 58/99 (59%) younger participants (p<0.01)). In addition, 277/331 (84%) older males vs. 13/30 (43%) younger males gave a female-gendered answer (p<0.01); 219/280 (78%) older females vs. 45/69 (65%) younger females gave a female-gendered answer (p=0.02).

During qualitative interviews, we asked youth if they saw any differences for HPV vaccination between men and women. These questions elicited two types of responses: (1) youth noting the

vaccination as being beneficial for females only, and (2) discourses about females bearing the brunt of responsibility for sexual health. For the first type of response, some youth were not aware that males could get vaccinated against HPV. A 20-year-old female who had received the vaccine discussed her memories of getting the vaccine in school, “If I remember correctly, boys didn’t get vaccinated [when I was in school].” An 18-year-old male who had not received the vaccine, when asked who the HPV vaccine was for, responded, “Women. Could that be? To be honest, that’s all I know right now.” Others complained that they now realize how limited their information about the vaccination and its benefits for young males was. A 19-year-old man explained:

> “Well, I really haven't heard about [the HPV vaccination for boys] from anyone until now. And I don't think this is my personal fault that I don't know anything about it. Until now, it was only a topic for women, and now it's suddenly not anymore.”

Other youth talked about female responsibility for sexual health. A 26-year-old female who had not been vaccinated against HPV explained how she saw the HPV vaccine for males as providing protection to the females with whom young men had sexual encounters, “Girls are going to take it more seriously. For boys, it doesn’t concern them directly. It’s protection for [girls].” A 20-year-old female who had not been vaccinated against HPV echoed this sentiment:

> “I mean, for [girls], we know that (…), if we’re going to be in a relationship where we have sexual intercourse with somebody, we know that we have to protect ourselves. First of all, to not get pregnant. Second of all, we know that having any types of STDs and viruses would make our lives miserable. (…) But for boys, it’s like, “Ok, I’ll have to wear protection. But what’s the worst that can happen?”

## 4. Discussion

Our study on HPV vaccine awareness, knowledge, information sources, and gendered perception among young males and females in Switzerland has four main findings. First, young females had more HPV vaccine awareness and knowledge than young males. This confirms previous reports, consistent with HPV vaccine having been introduced initially and worldwide as a vaccine designed only for females [15, 40, 41]. Even though awareness of HPV vaccine was higher in our study in females than in males, a recent Swiss national study found limited HPV awareness among 24–26-year-old women, suggesting opportunities for intervention also in women, including those that are older than the primary target age group [42]. We might hypothesize that lower awareness of the older females in our sample is related to the amount of time that has passed since they received HPV vaccination during their early adolescence. In other words, lower awareness in the group of older females might be due to memory recall bias and perhaps less developed vaccination implementation programs at the time they would have been exposed to them.

Second, increased knowledge was associated with higher HPV vaccine uptake, in both females and males, suggesting that knowledge matters. This confirms results from previous reports [11, 15-17]. In our study we only saw a trend towards a small difference in HPV vaccine knowledge between the younger and older age groups. Other studies however, found a higher knowledge score in older compared to younger participants [15, 41]. Encouragingly, younger participants were more aware of HPV vaccine compared to older participants, in contrast to other studies [15, 43].

Third, the internet and social media played a surprisingly minor role as HPV vaccine information

sources for youth in our study. This stands in contrast to other studies that found social media to increasingly become a source of health information worldwide [44-47]. Another US study described the internet as being one of the most frequently mentioned sources of vaccine information among adolescents [48]. Currently, the potential of internet/ social media information for HPV prevention/ vaccination uptake seems not to be used in Switzerland.

Fourth, despite the male HPV vaccine recommendation was introduced more than four years prior to our interviews, both female and male youth in our study associated HPV vaccine predominantly with cervical cancer, consistent with the gendered views of HPV vaccine documented in previous reports [3, 13]. That said, it is encouraging to see a slight shift in the younger age group from a female gendered perspective to a gender-neutral perspective on HPV vaccine.

## 4.1 Strengths and limitations

One of the major strengths of our study is that it is a mixed-methods study. Our qualitative work adds some description and explanation to our quantitative findings. Furthermore, we have a large number of male participants in our study. The Swiss context in particular lacks data on HPV vaccine awareness, knowledge, and information sources from male youth. Our study addresses this research gap. Previous studies have predominantly focused on parents and their knowledge on HPV vaccine [21-26]. Our study included youth, and this allowed us to gain important insights on who youth turn to when deciding on HPV vaccination. Since the vaccine is recommended as a catch-up vaccine until 26 years in many countries, including Switzerland, we have to ensure that youth are aware of the HPV vaccine and that they have the necessary knowledge to make an informed HPV vaccination decision.

One limitation of this study is that we might overestimate knowledge based on the way we classified answers for the quantitative component. For example, if participants had heard of the HPV vaccine, we simply asked them if they know what it is for but added no further questions. In addition, for participants who have only heard of the "cervical cancer vaccine," we did not ask any follow-up questions on HPV knowledge. Other studies have assessed knowledge in more depth, asking participants more knowledge specific questions [3, 18, 19]. Since our questionnaire already lasted 25-35 minutes with questions on VH **(Jafflin K., manuscript in preparation),** CAM use **(Jafflin K., manuscript in preparation, Kiener L., Schwendener C., et al, manuscript submitted)** and moral foundations **(Jafflin K., manuscript in preparation)** we opted to not include more questions to further assess participants' knowledge. Another limitation to this study was that our sampling strategy led to a non-representative sample. Additionally, potential sources of bias arise from us not being able to get in contact with participants who do not visit a physicians' office. Our sampling strategy however allowed us to recruit a more diverse sample regarding biomedical and CAM providers.

## 5. Conclusion

This study underlines the importance of HPV awareness and knowledge given the association between HPV awareness and knowledge and HPV vaccine uptake. However, males still have limited awareness and knowledge about HPV vaccine. Future strategies to increase HPV vaccine uptake, especially among males, should focus on better and more information supply to youth explaining them the benefit of the HPV vaccine. School vaccination programs have proven to be effective and should be further expanded [31]. Parents play an important role in youth' decision making process when it comes to HPV vaccine and they should be equally informed about the benefits and importance of the HPV vaccine. Efforts should be made to underline the

effectiveness of the HPV vaccine for males and females to reach a gender-neutral perception of the HPV vaccine. Targeted public health efforts should consider exploring internet and social media as potential information distribution platforms. HPV vaccine uptake has improved over the years, but there is substantial room for improvement, particularly in terms of increasing knowledge and awareness among young men and women alike.

**Acknowledgements**

We would like to express our gratitude to all participating youth, young adults and providers for their time and effort as well as the Swiss National Science Foundation for their financial support.

**Disclosure of Potential Conflict of Interest**

All authors: no conflicts.

**Funding**

This work was supported by the Swiss National Science Foundation (National research program NRP74, grant 407440_167398, recipient: PET). The study received supplementary postdoctoral fellowship funding (to M.J.D.) from the Nora van Meeuwen-Haefliger-Foundation. We did not receive funding from vaccine manufacturers or the Swiss Federal Office of Public Health.

**Ethics approval**

The study was approved by the local ethics committee (Ethikkommission Nordwest- und Zentralschweiz, EKNZ; project ID number 2017-00725). The ethics approval covers all study participants, which includes adolescent and adult patients as well as biomedical and CAM providers. Informed consent was provided by all participants after the nature and possible

consequences of the study had been fully explained.

## Data sharing statement

Data is available upon reasonable request to the corresponding author.

**Contributors' Statement Page**

Ms. Kiener and Ms. Schwendener recruited participating youth, conducted interviews, carried out the analysis, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Jafflin conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

Ms. Rouached, Ms. Juillerat and Mr. Meier recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Schärli, Dr. Muggli, Dr. Gültekin and Dr. Gruillot recruited participating youth, and reviewed and revised the manuscript.

Mr. Baumann and Ms. Debergh recruited participating youth, conducted interviews, and reviewed and revised the manuscript.

Dr. Huber conceptualized and designed the study, recruited participating providers, and reviewed and revised the manuscript.

Dr. Merten conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, and reviewed and revised the manuscript.

Dr. Buhl designed the data collection instruments, recruited participating youth, conducted interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Deml conceptualized and designed the study, designed the data collection instruments, recruited participating providers and youth, conducted qualitative interviews, analyzed qualitative data, and reviewed and revised the manuscript.

Dr. Tarr conceptualized and designed the study, designed the data collection instruments, recruited participating providers, coordinated and supervised data collection, carried out the analyses, and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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**Figures:**

1. Awareness and Knowledge of HPV Vaccine

2. Awareness and HPV Vaccine Uptake

3. Knowledge and HPV Vaccine Uptake

4. Information Sources

5. HPV Vaccine Consulting Behavior

**Table 1. Participant Characteristics (quantitative questionnaire)**

| | All Participants (n = 997) | Male (n = 585) | Female (n = 412) |
|---|---|---|---|
| **Age** | | | |
| Age (years), median (IQR) | 19 (18-21) | 19 (19-20) | 20 (17-23) |
| Born before July 1st, 2002, n (%) | 849 (85) | 525 (90) | 324 (79) |
| Born on/ after July 1st, 2002, n (%) | 148 (15) | 60 (10) | 88 (21) |
| **Nationality** | | | |
| Swiss, n (%) | 913 (92) | 547 (94) | 366 (89) |
| **Language** | | | |
| German, n (%) | 667 (67) | 448 (77) | 229 (53) |
| French, n (%) | 168 (17) | 47 (8) | 121 (29) |
| Italian, n (%) | 156 (16) | 86 (15) | 70 (17) |
| English, n (%) | 6 (1) | 4 (1) | 2 (0.5) |
| **Recruitment setting** | | | |
| Biomedical provider, n (%) | 405 (41) | 146 (25) | 259 (63) |
| Military service, n (%) | 375 (38) | 371 (63) | 4 (1) |
| CAM provider, n (%) | 148 (15) | 55 (9) | 93 (23) |
| Adolescent clinic, n (%) | 69 (7) | 13 (2) | 56 (14) |
| **Living situation** | | | |
| With parents, n (%) | 817 (82) | 497 (85) | 320 (78) |
| **School vaccination program** | | | |
| School program available, n (%) | 448 (45) | 180 (31) | 268 (65) |
| **Vaccination status** | *n = 940* | *n = 537* | *n = 403* |
| Has received ≥1 does of HPV vaccine, n (%) | 370 (39) | 108 (20) | 262 (65) |

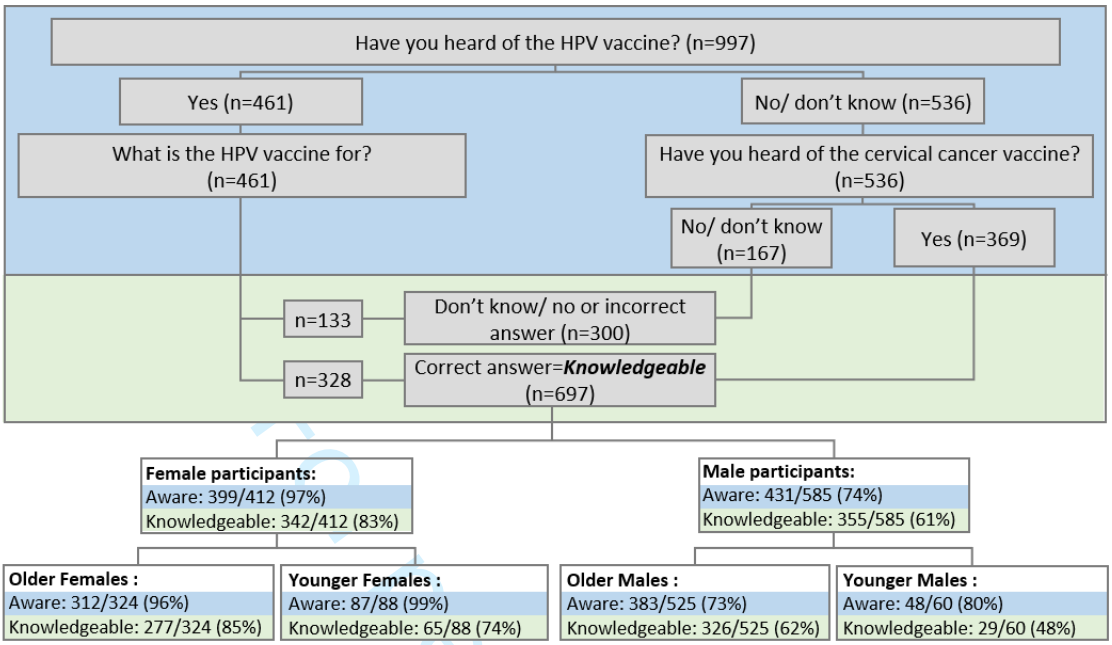
**Note.** All data shown are number (%) of participants, unless otherwise indicated. Due to rounding, total numbers may not add up to 100%.

**Abbreviations**. CAM, complementary and alternative medicine; IQR, interquartile range

**Table 2. Participant Characteristics (qualitative interview)**

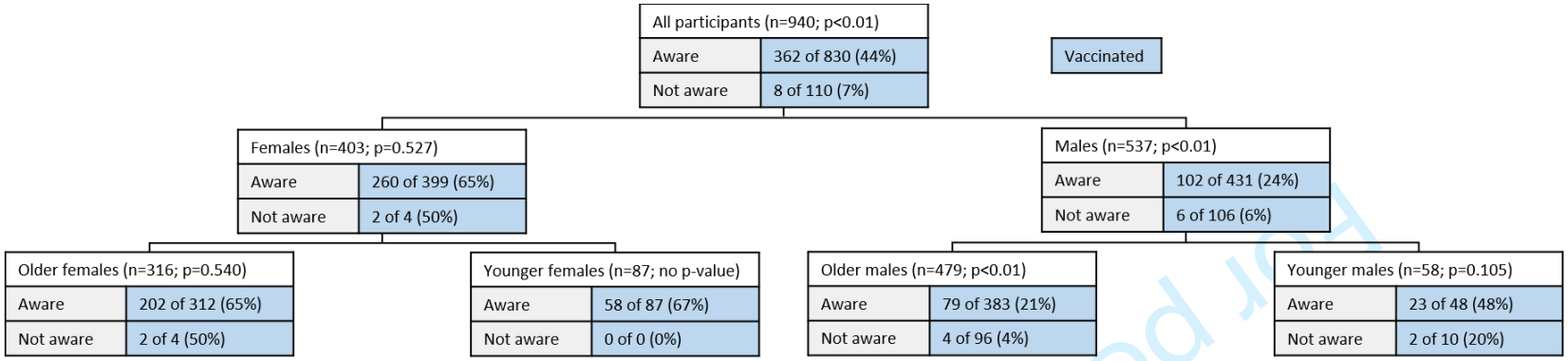
| | | |
|---|---|---|
| **French-Speaking Region** | | |
| Female | | N= 6 |
| | Age | 15-26 years, $\bar{x}$=19.6 years |
| | Received at least 1 dose of HPV vaccination | N=4 (66%) |
| | Informed through school vaccination program | N=6 (100%) |
| Male | | N=8 |
| | Age | 15-26 years, $\bar{x}$=22.4 years |
| | Received at least 1 dose of HPV vaccination | N=4 (50%) |
| | Informed through school vaccination program | N=1 (13%) |
| **German-Speaking Region** | | |
| Female | | N=8 |
| | Age | 15-26 years, $\bar{x}$=20.9 years |
| | Received at least 1 dose of HPV vaccination | N=4 (50%) |
| | Informed through school vaccination program | N=7 (88%) |
| Male | | N=9 |
| | Age | 15-26 years, $\bar{x}$= 20.6years |
| | Received at least 1 dose of HPV vaccination | N=1 (11%) |
| | Informed through school vaccination program | N=1 (11%) |

**Figure 1. Awareness and Knowledge of HPV Vaccine**



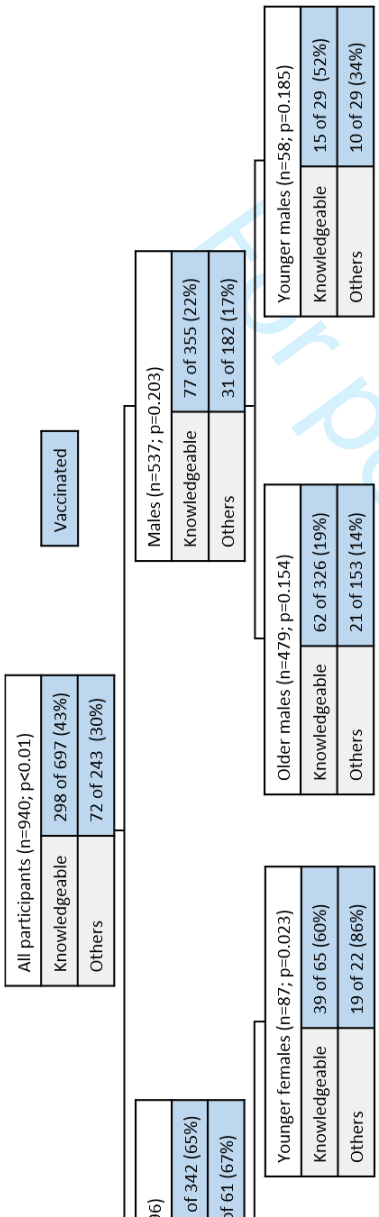

**Note.** All data in blue stands for awareness and all data in green for knowledge.

**Figure 2. Awareness and HPV Vaccine Uptake**



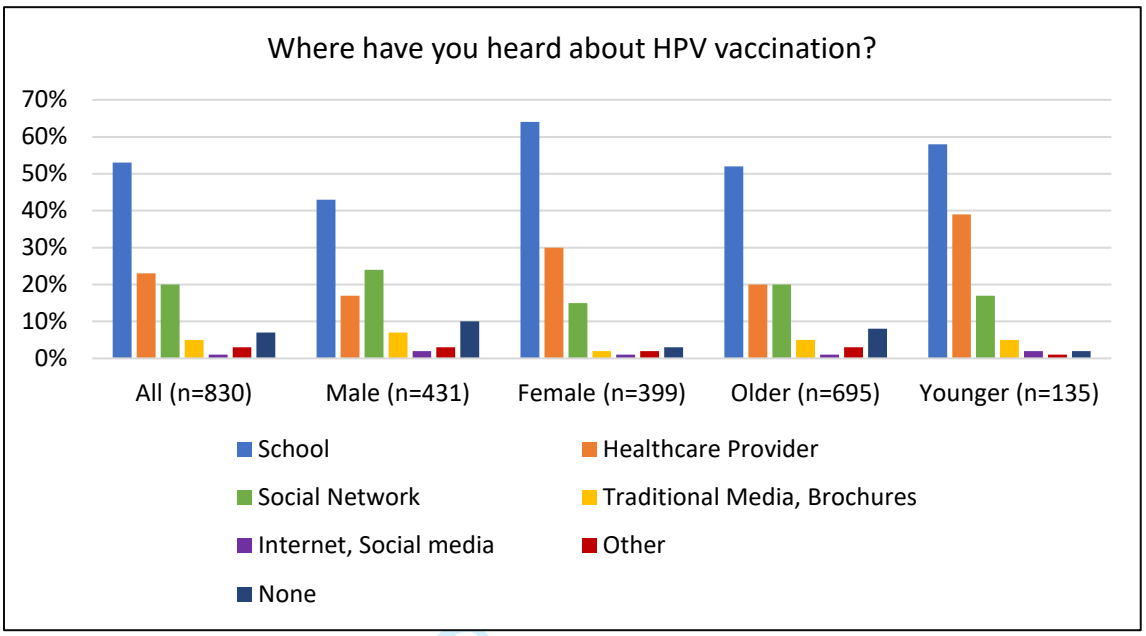

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 3. Knowledge and HPV Vaccine Uptake**



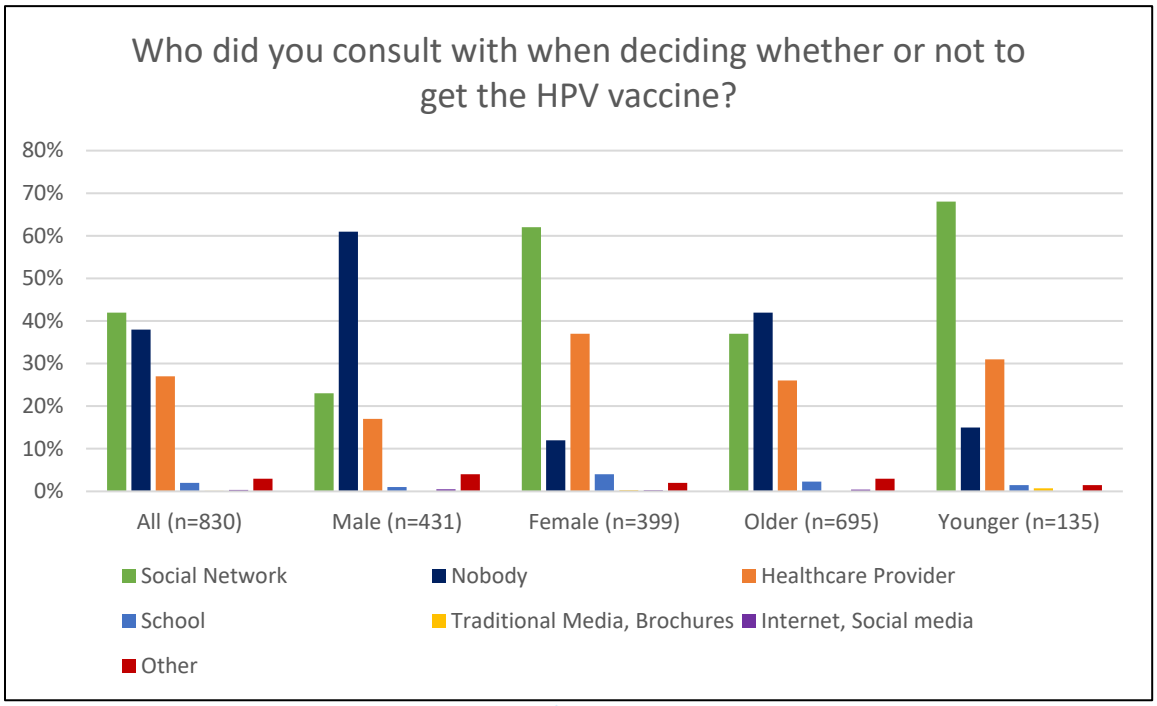

**Note.** 53/997 participants were excluded due to missing information on HPV immunization status and 4/997 due to missing answers.

**Figure 4. Information Sources**




**Note**. 167/997 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Figure 5. HPV Vaccine Consulting Behavior**




**Note**. 167/997 participants were excluded due to lack of HPV vaccine knowledge. Multiple answers were possible.

**Schwendener et al, HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study: Supplementary Material 1 – HPV Vaccination Questionnaire**

Hello, this is [interviewer name]. Could I speak with [participant name], please? As planned, I am calling to interview you as part of our study about vaccination decision-making.

I would first like to verify some details.

1. Could you please tell me your birth date?
2. What is the sex of [participant name]?
    a. Boy
    b. Girl
    c. Intersex
    d. Doesn't want to disclose
3. Is Dr. [provider name] your doctor?
4. Do you live with your parents, or somewhere else?
    a. Lives with parent(s)
    b. Doesn't live with parents
    c. Doesn't want to disclose
    d. Missing

    ➔ If a continue with question 5.

    ➔ If b continue with question 12.

    ➔ If c,d continue with question 13.
5. To start off, I would like to know how many people normally live in your parents' household, yourself included. Please include your family, but also any tenants, au pairs, students, or other people who live in your home at least 4 days a week.
6. Could you please tell me about the people who live in your home, yourself included?
7. First yourself [person 1], what is your age?
8. Sex of person 1
    a. Male
    b. Female
    c. Other/ nod disclosed
    d. Missing
9. Person 2, age
10. Person 2, sex
    a. Male
    b. Female
    c. Other/ not disclosed
    d. Missing
11. How is [second person] related to you?

    If male:
    a. Father
    b. Stepfather
    c. Father/mother's partner
    d. Stepbrother

e. Grandfather
f. Uncle, cousin
g. Other relative
h. Not a relative
i. Doesn't want to disclose
j. Doesn't know
k. Missing

If female:

a. Mother
b. Stepmother
c. Mother/ father's partner
d. Sister or half-sister
e. Grandmother
f. Aunt, cousin
g. Other relative
h. Not a relative
i. Doesn't want to disclose
j. Doesn't know
k. Missing

12. How many persons lived in your parent's household at the time before you moved out (yourself included)?

Now I would like to ask some questions about your thoughts and experiences with vaccination.

13. Have you ever delayed getting a vaccine for reasons other than illness or allergy?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
14. Have you ever skipped a vaccine for reasons other than illness or allergy?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
15. On a scale from 0 to 10, with 0 being not sure at all and 10 being completely sure, How sure are you that following the recommended vaccine schedule is a good idea for you?
    ➔ If question 15 is unclear, continue with question 16. Otherwise continue with question 17.
16. I will rephrase the question: On a scale from 0 to 10, with 0 being not sure at all and 10 being completely sure, how sure are you that it is a good idea to vaccinate you with the vaccines recommended by the Federal Office of Public Health?

Do you agree or disagree with the following statements:

17. We get more vaccines than are good for us.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
18. I believe that many of the illnesses that vaccines prevent are severe.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
19. It is better to develop immunity by getting sick than to get a vaccine.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
20. It's better to get fewer vaccines at the same time.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
21. How concerned are you that you might have a serious side effect from a vaccine?
    a. Not at all concerned
    b. Not too concerned
    c. Not sure
    d. Somewhat concerned
    e. Very concerned
    f. Doesn't want to disclose
    g. Missing
22. How concerned are you that one of the vaccines might not be safe?
    a. Not at all concerned
    b. Not too concerned

c. Not sure
d. Somewhat concerned
e. Very concerned
f. Doesn't want to disclose
g. Missing

23. How concerned are you that a vaccine might not prevent disease?
    a. Not at all concerned
    b. Not too concerned
    c. Not sure
    d. Somewhat concerned
    e. Very concerned
    f. Doesn't want to disclose
    g. Missing
24. Overall, how hesitant about vaccines would you consider yourself to be?
    a. Not at all hesitant
    b. Not too hesitant
    c. Not sure
    d. Somewhat hesitant
    e. Very hesitant
    f. Doesn't want to disclose
    g. Missing

Do you agree or disagree with the following statements:

25. I trust the information I receive about vaccines.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
26. I am able to openly discuss my concerns about vaccines with my doctor.
    a. Strongly agree
    b. Agree
    c. Not sure
    d. Disagree
    e. Strongly disagree
    f. Doesn't want to disclose
    g. Missing
27. All things considered, how much do you trust your 0 doctor, on a scale from 0 to 10, with 0 being not at all and 10 being completely?

Now I want to ask you some questions about the HPV vaccine.

28. Have you heard of the HPV vaccine?

a. Yes
b. No
c. Doesn't want to disclose
d. Doesn't know
e. Missing

➔ If a: continue with question 29.
➔ If b-e: continue with question 30.

29. What is it for?
30. Have you heard of the cervical cancer vaccine?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 31.
➔ If b-e: continue with question 37.

31. Have you received HPV vaccine?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 31.
➔ If b-e: continue with question 33.

32. Where did you receive HPV vaccine?
    a. At school
    b. At a doctor recommended by school
    c. At the family doctor's
    d. At the pediatrician's
    e. At the gynecologist's
    f. At a vaccination center
    g. Other
    h. Doesn't want to disclose
    i. Doesn't know
    j. Missing
33. Where have you heard about HPV vaccination?
34. Was the HPV vaccine recommended by your school?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
35. How do you feel about offering the HPV vaccine at school?
    a. Very supportive

b. Somewhat supportive
c. Not sure
d. Somewhat unsupportive
e. Very unsupportive
f. Doesn't want to disclose
g. Doesn't know
h. Missing

36. Who did you consult with when deciding whether or not to get the HPV vaccine?
37. What are your most trusted information sources on vaccination?
    a. No information/ no source
    b. Family
    c. My doctor
    d. Other doctor
    e. Friends and acquaintances
    f. Public health authorities
    g. TV
    h. Internet
    i. Social media (such as Facebook, Instagram and Twitter)
    j. Print media (such as books, magazines and newspapers)
    k. Other:___
    l. Doesn't want to disclose
    m. Doesn't know
    n. Missing

➔ If g: add question 38.
➔ If h: add question 39.
➔ If i: add question 40.
➔ If j: add question 41.
➔ If k: add question 42.
➔ Otherwise continue with question 43.

38. Which TV programs?
39. Which websites?
40. What social media?
41. What print media?
42. What other sources?
43. Did you apply the information you received when making decisions about vaccination?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing
44. How is your health in general? Is it…
    a. Very good
    b. Good

c. OK
d. Bad
e. Very bad
f. Doesn't want to disclose
g. Doesn't know
h. Missing

45. How important is health for you? Here are three options, please tell us which one is closest to your own opinion.
    a. I live without worrying too much about consequences for my health.
    b. My lifestyle is influenced by considerations about maintaining my health.
    c. Considerations about my health have a large impact on how I live.
    d. Doesn't want to disclose
    e. Doesn't know
    f. Missing
46. In the last 12 months, that is since [month, year], which of the following treatments have you used for your own health? Please indicate yes or no for each.
    a. Acupressure
    b. Acupuncture
    c. Anthroposophical medicine
    d. Chinese medicine
    e. Chiropractics
    f. Herbal treatment
    g. Homeopathy
    h. Hypnotherapy
    i. Massage therapy
    j. Osteopathy
    k. Physiotherapy
    l. Reflexology
    m. Spiritual Healing
    n. Other:___
    o. None of these
    p. don't know

Now I would like to ask you some questions about other topics to get a sense of your core worldview and political and religious sentiments.

47. Do you consider yourself as belonging to any particular religion or denomination?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 48.
➔ If b-e: continue with question 50.

48. Which one?

a. Christian
b. Jewish
c. Islamic
d. Eastern religions
e. Other non-Christian religions
f. Doesn't want to disclose
g. Doesn't know
h. Missing

➔ If a-e: continue with question 49.
➔ If f-h: continue with question 50.

49. Please specify which exactly.
50. Apart from special occasions such as weddings and funerals, about how often do you attend religious services nowadays?
    a. Every day
    b. More than once a week
    c. Once a week
    d. At least once a month
    e. Only on special holy days
    f. Less often
    g. Never
    h. Doesn't want to disclose
    i. Doesn't know
    j. Missing
51. Regardless of whether you belong to a particular religion, how religious would you say you are?
    a. Not at all religious
    b. Somewhat religious
    c. Religious
    d. Very religious
    e. Doesn't want to disclose
    f. Doesn't know
    g. Missing
52. How important do you consider spiritual experiences to be in your everyday life?
    a. Very important
    b. Somewhat important
    c. Not very important
    d. Not important at all
    e. Not sure
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
53. How interested would you say you are in politics? Are you…
    a. Very interested
    b. Quite interested

c. Hardly interested
d. Or, not at all interested?
e. Doesn't want to disclose
f. Doesn't know
g. Missing

54. Is there a particular political party that you feel closer to than all the other political parties?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 55.
➔ If b-e: continue with question 56.

55. Which one?
56. In politics, people sometimes talk of "left" and "right". Where would you place yourself? Would you consider yourself…
    a. Left
    b. Center left
    c. Center
    d. Center right
    e. Right
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
57. How often do you participate in activities with a society, a club, a political party, a cultural association, or other groups, including religious groups?
    a. Almost every day
    b. About once a week
    c. About 1-3 times a month
    d. A few times a year
    e. More rarely
    f. Never
    g. Doesn't want to disclose
    h. Doesn't know
    i. Missing

We would now like to pose some questions regarding the values that generally guide people in their everyday life. The questions don't directly relate to vaccinations.

When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking?

58. Whether or not someone suffered emotionally. Is it not at all relevant, not very relevant, slightly relevant, somewhat relevant, very relevant or extremely relevant?
    a. Not at all relevant

b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

59. Whether or not someone was treated differently than others.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

60. Whether or not someone's actions showed love for his or her country.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

61. Whether or not someone's actions showed lack of respect for authority.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

62. Whether or not someone violated standards of purity and decency.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant

f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

63. Whether or not someone was good at math.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

64. Whether or not someone cared for someone weak and vulnerable.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

65. Whether or not someone acted unfairly.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

66. Whether or not someone did something to betray his or her group.
a. Not at all relevant
b. Not very relevant
c. Slightly relevant
d. Somewhat relevant
e. Very relevant
f. Extremely relevant
g. Doesn't want to disclose
h. Doesn't know
i. Missing

67. Whether or not someone conformed to the traditions of society.
    a. Not at all relevant
    b. Not very relevant
    c. Slightly relevant
    d. Somewhat relevant
    e. Very relevant
    f. Extremely relevant
    g. Doesn't want to disclose
    h. Doesn't know
    i. Missing
68. Whether or not someone did something disgusting.
    a. Not at all relevant
    b. Not very relevant
    c. Slightly relevant
    d. Somewhat relevant
    e. Very relevant
    f. Extremely relevant
    g. Doesn't want to disclose
    h. Doesn't know
    i. Missing

Please listen to the following statements and indicate whether you strongly disagree, moderately disagree, slightly disagree, slightly agree, moderately agree or strongly agree.

69. Compassion for those who are suffering is the most crucial virtue.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
70. When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
71. I am proud of my country's history.
    a. Strongly disagree

b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

72. Respect for authority is something all children need to learn.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

73. People should not do things that are disgusting even if no one is harmed.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

74. It is better to do good than to do bad.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

75. One of the worst things a person could do is hurt a defenseless animal.
a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

76. Justice is the most important requirement for a society.

a. Strongly disagree
b. Moderately disagree
c. Slightly disagree
d. Moderately agree
e. Strongly agree
f. Doesn't want to disclose
g. Doesn't know
h. Missing

77. People should be loyal to their family members even when they have done something wrong.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
78. Men and women should each have different roles to play in society.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing
79. I would call some acts wrong on the grounds that they are unnatural.
    a. Strongly disagree
    b. Moderately disagree
    c. Slightly disagree
    d. Moderately agree
    e. Strongly agree
    f. Doesn't want to disclose
    g. Doesn't know
    h. Missing

I just have a few more questions to finish up.

80. Which of these descriptions applies to what you have been doing for the last seven days?
    a. In paid work or away temporarily
    b. In education (even if on vacation)
    c. Unemployed and actively looking for a job
    d. Unemployed, wished to work but didn't actively look for a job

e. Permanently sick or disabled
f. Retired
g. In community or military service
h. Doing housework, looking after children or other persons
i. Other
j. Doesn't want to disclose
k. Doesn't know
l. Missing

➔ If a: continue with question 81.
➔ If b-l: continue with question 82.

81. Regardless of your basic or contracted hours, how many hours per week do you normally work, including any paid or unpaid overtime?
82. And what about your father? Which describes his situation in the last seven days?
    a. In paid work or away temporarily
    b. In education (even if on vacation)
    c. Unemployed and actively looking for a job
    d. Unemployed, wished to work but didn't actively look for a job
    e. Permanently sick or disabled
    f. Retired
    g. In community or military service
    h. Doing housework, looking after children or other persons
    i. Other
    j. Doesn't want to disclose
    k. Doesn't know
    l. Missing

➔ If a: continue with question 83.
➔ If b-l: continue with question 85.

83. How many hours does he normally work, including any paid or unpaid overtime?
84. What is his current occupation?
85. And what about your mother? Which describes her situation in the last seven days?
    a. In paid work or away temporarily
    b. In education (even if on vacation)
    c. Unemployed and actively looking for a job
    d. Unemployed, wished to work but didn't actively look for a job
    e. Permanently sick or disabled
    f. Retired
    g. In community or military service
    h. Doing housework, looking after children or other persons
    i. Other
    j. Doesn't want to disclose
    k. Doesn't know
    l. Missing
86. How many hours does she normally work, including any paid or unpaid overtime?
87. What is her current occupation?

➔ If a: continue with question 86.
➔ If b-l: continue with question 88.

88. Are you a citizen of Switzerland?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a: continue with question 90.
➔ If b: continue with question 89.
➔ If c-e: continue with question 93.

89. What citizenship do you hold?
90. Were you born in Switzerland?
    a. Yes
    b. No
    c. Doesn't want to disclose
    d. Doesn't know
    e. Missing

➔ If a, c-e: continue with question 93.
➔ If b: continue with question 91.

91. In which country were you born?
92. What year did you first come to Switzerland?
93. What is your postcode?

We have finished the interview. Thank you very much for your time.

94. Do you have comments you would like to make?
95. Thank you very much for your participation in this telephone interview. In order to better understand what young people think about HPV vaccinations we plan to also speak to some young people in person. We are able to travel to a place that is convenient and comfortable for our interview partners at a date and time that suit them. Please let me know if:
    a. you would be interested to take part in a face-to-face interview
    b. are not sure yet but we may contact you again
    c. you would not like to be contacted again

➔ If a,b: continue with question 96.
➔ If c: end of interview.

96. Would you prefer to be interviewed alone, or would you rather have one or even both of your parents being present?
    a. Alone
    b. With one or both parents
    c. Missing
97. How can we contact you?
    a. SMS
    b. Telephone

c. Email:___
d. Missing

# Schwendener et al, HPV Vaccine Awareness, Knowledge, and Information Sources among Youth in Switzerland: A Mixed Methods Study: Supplementary Material 2

## Supplementary Table 1. Awareness and knowledge of subgroups

| | All Participants (n = 997) | Biomedical provider (n = 405) | Military Service (n = 375) | CAM provider (n = 148) | Adolescent clinic (n = 69) |
|---|---|---|---|---|---|
| **Awareness** | | | | | |
| Aware, n (%) | 830 (83) | 357 (88) | 271 (72) | 136 (92) | 66 (96) |
| **Knowledge** | | | | | |
| Knowledgeable, n (%) | 697 (70) | 293 (72) | 229 (61) | 119 (80) | 56 (81) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated.
**Abbreviations**. CAM, complementary and alternative medicine

## Supplementary Table 2. Awareness and knowledge of subgroups – male participants

| | All Participants (n = 585) | Biomedical provider (n = 146) | Military Service (n = 371) | CAM provider (n = 55) | Adolescent clinic (n = 13) |
|---|---|---|---|---|---|
| **Awareness** | | | | | |
| Aware, n (%) | 431 (74) | 108 (74) | 268 (72) | 43 (78) | 12 (92) |
| **Knowledge** | | | | | |
| Knowledgeable, n (%) | 355 (61) | 77 (53) | 227 (61) | 41 (75) | 10 (77) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated.
**Abbreviations**. CAM, complementary and alternative medicine

## Supplementary Table 3. Awareness and knowledge of subgroups – female participants

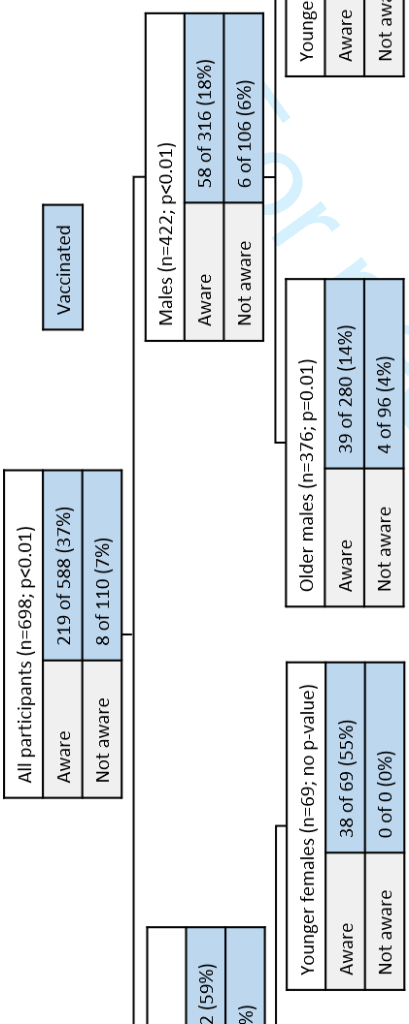
| | All Participants (n = 412) | Biomedical provider (n = 259) | Military Service (n = 4) | CAM provider (n = 93) | Adolescent clinic (n = 56) |
|---|---|---|---|---|---|
| **Awareness** | | | | | |
| Aware, n (%) | 399 (97) | 249 (96) | 3 (75) | 93 (100) | 54 (96) |
| **Knowledge** | | | | | |
| Knowledgeable, n (%) | 342 (83) | 216 (83) | 2 (50) | 78 (84) | 46 (82) |

**Note.** All data shown are number (%) of participants, unless otherwise indicated.
**Abbreviations**. CAM, complementary and alternative medicine

**Supplementary Table 4. Survey questions concerning gendered perceptions of HPV Vaccine**

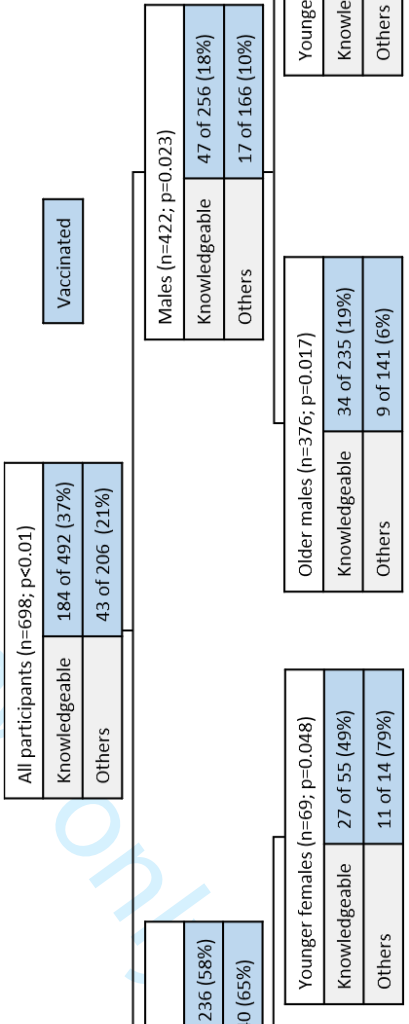
| | | By gender | | By age groups | |
|---|---|---|---|---|---|
| | **All participants** | **Male** | **Female** | **Born before 1.7.02** | **Born on/ after 1.7.02** |
| **Have you heard of the HPV vaccine?** | *(n = 997)* | *(n = 585)* | *(n = 412)* | *(n = 849)* | *(n = 148)* |
| Yes, n (%) | 461 (46) | 176 (30) | 285 (69) | 359 (42) | 102 (69) |
| No/ don't know, n (%) | 536 (54) | 409 (70) | 127 (31) | 490 (58) | 46 (31) |
| **Have you heard of the cervical cancer vaccine?** | *(n = 535)* | *(n = 409)* | *(n = 126)* | *(n = 489)* | *(n = 46)* |
| Yes, n (%) | 369 (69) | 255 (62) | 114 (90) | 336 (69) | 33 (72) |
| No/ don't know, n (%) | 166 (31) | 154 (38) | 12 (10) | 153 (31) | 13 (28) |
| **What is the HPV vaccine for?** | *(n = 461)* | *(n = 176)* | *(n = 285)* | *(n = 359)* | *(n = 102)* |
| Only female, n (%) | 185 (40) | 35 (20) | 150 (53) | 160 (45) | 25 (25) |
| All other answers, n (%) | 276 (60) | 141 (80) | 135 (47) | 199 (55) | 77 (75) |
| **Combination of all questions** | *(n = 711)* | *(n = 361)* | *(n = 350)* | *(n = 611)* | *(n = 100)* |
| Only female, n (%) | 554 (78) | 290 (80) | 264 (75) | 496 (81) | 58 (58) |
| All other answers, n (%) | 157 (22) | 71 (20) | 86 (25) | 115 (19) | 42 (42) |

**Supplementary Figure 1. Awareness and HPV**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

**Supplementary Figure 2. Knowledge and HPV**




**Note.** 302/1001 participants were excluded due to no vaccination booklet and 1/1001 due to missing answers.

# Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

## Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

| | | Reporting Item | Page Number |
|---|---|---|---|
| **Title and abstract** | | | |
| Title | #1a | Indicate the study's design with a commonly used term in the title or the abstract | 1 |

| | | | |
|---|---|---|---|
| Abstract | #1b | Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background / rationale | #2 | Explain the scientific background and rationale for the investigation being reported | 5 |
| Objectives | #3 | State specific objectives, including any prespecified hypotheses | 5,6 |
| **Methods** | | | |
| Study design | #4 | Present key elements of study design early in the paper | 7 |
| Setting | #5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7,8 |
| Eligibility criteria | #6a | Give the eligibility criteria, and the sources and methods of selection of participants. | 7-10 |
| | #7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | n/a |
| 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. Give information separately for for exposed and unexposed groups if applicable. | 8-10 |

| | | | |
|---|---|---|---|
| Bias | #9 | Describe any efforts to address potential sources of bias | n/a |
| Study size | #10 | Explain how the study size was arrived at | 7-11 |
| Quantitative variables | #11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why | 7-9 |
| Statistical methods | #12a | Describe all statistical methods, including those used to control for confounding | 8-10 |
| Statistical methods | #12b | Describe any methods used to examine subgroups and interactions | 7-10 |
| Statistical methods | #12c | Explain how missing data were addressed | n/a |
| Statistical methods | #12d | If applicable, describe analytical methods taking account of sampling strategy | n/a |
| Statistical methods | #12e | Describe any sensitivity analyses | n/a |
| **Results** | | | |
| Participants | #13a | 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. Give information separately for for exposed and unexposed groups if applicable. | 11 |
| Participants | #13b | Give reasons for non-participation at each stage | 11 |

| | | | |
|---|---|---|---|
| Participants | #13c | Consider use of a flow diagram | n/a |
| Descriptive data | #14a | Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable. | 11,27,28 |
| Descriptive data | #14b | Indicate number of participants with missing data for each variable of interest | 11,12,16 |
| Outcome data | #15 | Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable. | 11-17 |
| Main results | #16a | 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 |
| Main results | #16b | Report category boundaries when continuous variables were categorized | 11-17 |
| Main results | #16c | If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | n/a |
| Other analyses | #17 | Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses | n/a |
| **Discussion** | | | |
| Key results | #18 | Summarise key results with reference to study objectives | 18,19 |

| | | | |
|---|---|---|---|
| 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. | 19,20 |
| Interpretation | #20 | Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence. | 18-20 |
| Generalisability | #21 | Discuss the generalisability (external validity) of the study results | 18-20 |
| **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 | 21 |

 This checklist was completed on 10. June 2021 using https://www.goodreports.org/, a tool made by the EQUATOR Network in collaboration with Penelope.ai