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Improving HPV-related health literacy in the Austrian population – A participatory research approach

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ABSTRACT

Human papilloma virus (HPV) infections are widespread and affect a main part of the population. Long-term risks of such infections include the development of HPV-induced cancers. Although available, preventive measures are not utilized by the Austrian population to their fullest extent. Only 40% of all Austrians have completed the vaccination programme and only 46% are aware of HPV. This may be attributed to a lack of awareness or an ineffective approach in disseminating information to raise awareness about this health issue. Our aim was to determine which knowledge on HPV infections and vaccinations is present in the Austrian population and to identify the preferred mode of communication for receiving information on health-related issues, including HPV. This objective was implemented in the context of a participatory research project together with citizen scientists, whereby a target group-oriented survey was developed. Data from 889 survey participants, analyzed with descriptive statistics, demonstrated significant gender- and age-related differences in HPV knowledge and information-seeking behavior. Men and individuals under 18 were significantly less informed, especially regarding transmission routes and HPV-related diseases. Women were more aware of the vaccine's benefits and have higher vaccination rates. The use of clear, concise content and personal stories can foster engagement and address misperceptions. Customized HPV awareness campaigns and an integration of HPV education into school curricula should be implemented to facilitate early knowledge acquisition and vaccination uptake.

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Citizen science; human papilloma virus; awareness; prevention; health literacy

Introduction

The human papilloma virus (HPV) is an underestimated virus, even though infections are widespread within the European population and can lead to different diseases.[1] Infections with HPV are the cause of 60,000 new cancer cases in Europe every year.[2] The Center for Disease Control and Prevention (CDC) highlights the fact that nearly every sexually active woman and man will be infected by one or more types of HPV during their lifetime.[3] Fortunately, most HPV infections are rapidly recognized and efficiently aborted by the human immune system. In most cases even without symptoms, the latter in turn enhances the likelihood of transmission of the infections.[1,4] Nevertheless, HPV infections can, when the viral deoxyribonucleic acid (DNA) integrates into the human DNA to circumvent cytotoxic T-cell-induced cell death, result in the formation of genital warts or cancers. These include penile, vaginal, vulvar, oropharyngeal, anal and cervical cancer.[1,4]

Cervical cancer screening, as performed in many countries, acts as an early detection of cellular alterations caused by viral infections. Ongoing cellular changes reflect an enhanced risk for tumor or genital wart development.[1] Thus, screening activities provide women with a potential diagnostic marker to recognize and remove tumors or warts at an early point of time.[1] For all other types of HPV-induced cancers and warts, there are currently no screening methods in place to detect early cellular aberrations. The only currently available preventive measure is the HPV vaccination.[1]

In 2006, the first vaccines against HPV were developed. In the beginning, only the strongest tumor-inducing HPV-types were included: HPV16 and HPV18, which account for 70% of cervical cancers, as well as HPV6 and HPV11, being the main cause of genital warts and laryngeal papilloma.[5–7] In 2015, an effective vaccine against the 9 most harmful and widespread HPV-types (6, 11, 16, 18, 31, 33, 45, 52, and 58) was approved in Europe (Gardasil 9®, MSD VACCINS, Lyon, France).[8] Three HPV vaccines are currently licensed in the European Union: (i) the bivalent vaccine against HPV16 and HPV18 (Cervarix®, GlaxoSmithKline Biologicals, Rixensart, Belgium), (ii) the 4-valent recombinant vaccine against HPV 4, 11, 16, and 18 (Gardasil®, MSD VACCINS, Lyon, France), and (iii) the 9-valent recombinant vaccine Gardasil 9®.[9] Most European countries offer vaccination schedules where people receive 2 to 3 doses within a specific time frame. Ideally, this vaccine should be administered in children aged 9 to 12.[10] HPV vaccinations are most effective for those who are HPV naive at the time of immunization, meaning that they have not yet been infected with HPV. Children of all gender should be immunized before their first sexual encounter.[10] Nevertheless, vaccination at an older age still results in the development of high levels of protective HPV-specific antibodies. After vaccination, a lifelong persistence of the immune response against all targeted HPV-types exists.[11]

Although the HPV vaccination has been offered since 2006, there are still many countries, including Austria, with low

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numbers of people protected against HPV by vaccination. In 2023, the estimated global vaccination program coverage was of 27% for the first dose of vaccine and 20% for the full vaccination schedule for females, and 7% for the first dose and 6% for the full vaccination schedule for males, respectively.[12] Global HPV immunization coverage gradually increased from 2010 – the first year for which data were available – to 2023, with a fall in 2020–2021 on account of the COVID-19 pandemic (WHO Immunization Data portal).[13] According to an analysis of HPV vaccine coverage in Austria in 2022, 28% of children aged 9 to 11 received the first partial vaccination, with 13% getting the second partial vaccination. In total 49% of 12- and 13-year-olds received both recommended vaccines, while 53% of 14-year-olds did. Among 15- to 20-year-olds, almost 40% have completed the full vaccination programme.[14] Moreover, according to the IPSOS European HPV awareness study from 2019, only 46% of Austrians were aware of HPV and only 34% associated it with cancer.[15]

To achieve the World Health Organisations' (WHO) target of a 90% vaccination rate of girls aged 15 by 2030, the willingness to be vaccinated must be significantly increased.[16] The availability of HPV vaccination is only one factor influencing the acceptance of such preventive vaccinations. In Austria, the HPV vaccine is currently free-of-cost until age 30 and is part of the school-based-vaccination-program.[14] Therefore, there must be other factors that avoid people from accepting a vaccination that can prevent the development of a tumor or genital wart.

Studies have shown, that amongst parents the reasons against vaccination are for example fear of side effects and the children's age, them being too young for the vaccine.[17] Further motives are a lack of health literacy in the population, problems in understanding HPV information and thus a lack of awareness and knowledge about HPV, and a wrong conception of risk.[18,19] Cervical cancer is relatively well known and, by a part of the population, associated with HPV. All other types of tumors mentioned above as well as the formation of genital warts are normally not regarded by the public as being HPV induced. It is also known that women are often somewhat better informed compared to men, which might be associated to the knowledge on the diseases that are involved.[20]

To improve the health literacy on HPV in Austria, the diseases this virus can cause and the potential preventive measures, we performed a citizen science project in the county of Salzburg (Austria). Through a novel participatory research approach, including parents, teachers, pupils, and students as co-researchers, we aimed to develop an easily accessible and appealing survey to obtain information on the health literacy regarding HPV and to find out which channels are favored for the consumption of health-related information. Based on the answers from the survey, an HPV awareness campaign in the county of Salzburg was performed. This is the first study for Central Europe, with a focus on a German-speaking country, to identify and address information and communication behavior in the population regarding preventable viral infections.

In this paper, we inform about: (i) the knowledge on HPV infections and vaccinations in the Austrian population, (ii) which sources of information are preferred to receive information on health-related issues, including HPV and vaccination, and (iii) how health-related information campaigns can be improved in the future. We hypothesize that there is still a major lack of knowledge in the Austrian population regarding this health-related subject.

Materials and methods

Study setting

The project "Human PapilloWHAT?" was a participatory research project conducted in collaboration between medical scientists, students, teachers, and parents. The students, teachers, and parents were aged 11–69 years, and acted as citizen scientists. During several half-day workshops, together with these peer groups (30 people in total), their knowledge about HPV was evaluated, knowledge gaps were identified, and their need for information, including preferred channels for consuming it, was assessed. Based on this information, a survey was developed in collaboration with a smaller peer group comprising six individuals (see Figure 1). Design (title, length, layout, appearance) and content of the survey were discussed to ensure that it was as target-group oriented as possible (young people aged between 15 and 21 years and parents aged between 25 and 35 years). These target groups were selected because the 15–21 age group in Austria has the greatest potential to catch up on HPV vaccinations and the parents of younger children make the decision about their vaccination status.

Survey design and development

A structured survey, in German language, was developed in collaboration with the citizen scientists to assess the current level of knowledge in the population and preferred information channels for sensitive health topics such as HPV. In a collaborative process, participants suggested and voted on relevant questions. The possibilities of disseminating the survey to the public were also discussed. The survey was created using the online survey software unipark.com by Tivian. After completing a draft of the survey by the lead researchers, it was tested and validated by the 30 citizen scientists in a pilot run before public release (see Figure 1 for complete process). The

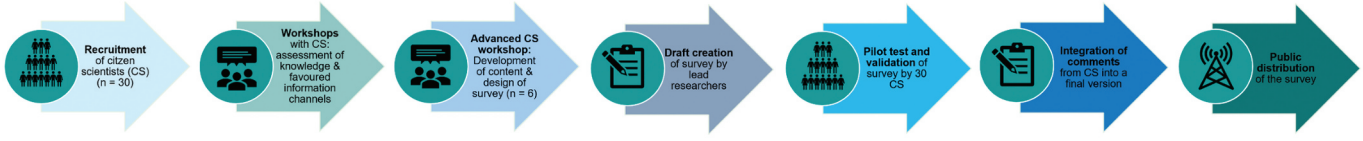

Figure 1. Schematic diagram of study setting and survey development. CS = citizen scientists; *n* = number of participating citizen scientists.

survey consisted of three parts: a warm-up phase with general questions on HPV (12 items) assessing the people's awareness on HPV, including infection, symptoms, HPV related cancers, prevention and vaccination. Correct answers were shown after each question to promote learning. The second part focused on preferred information channels on HPV (9 items), assessing communication preferences for health topics, and trusted sources regarding HPV and vaccinations. The last part was a cool-down phase collecting demographic data (5 items). Age groups in the survey were defined as ≤18 years, 19–30 years, 31–40 years, 41–55 years and ≥55 years, in the text for simplicity referred to as ≤18, 19–30, 31–40, 41–55, ≥55. The survey consisted of 26 questions with an average completing duration of 8–10 minutes. The questionnaire is available upon request by contacting the corresponding author.

Data collection and survey participants

The online survey was conducted in Austria in the province of Salzburg and surrounding areas from September 6 to November 30, 2023, through various channels, including Salzburg University of Applied Sciences, the Chamber of Labour, STEM networks (science, technology, engineering, mathematics), AVOS (society for preventive medicine Salzburg), the Salzburg state health department, parents' and students' associations, school networks, flyers with QR codes, young science network, school doctors, and media platforms. The target groups were 15- to 21-year-olds and parents. Data collection was anonymized, and no ethics approval was required as no sensitive patient data was involved. Demographic questions were kept simple in consultation with the peer group of citizen scientists to encourage participation, focusing on vaccination and parenthood status. Participants could not restart the survey or change previously answered questions, ensuring responses were completed in one session.

Statistical analysis

The online survey was performed using the software unipark.com by Tivian from which a codebook corresponding to the questions and the data from the survey were retrieved in excel format. The data was imported into the software IBM SPSS Statistics version 29.0.2.0 which was used for statistical analysis. First, descriptive analyses were performed to provide an overview of the demographic characteristics of the respondents shown as percentages. Statistical analysis was performed using Pearson's chi-square test of independence to determine the association between categorical variables. For multiple response questions, multiple response sets were defined. Test results are shown by stating the chi-square value with the degrees of freedom in brackets (χ^2 (df)), the significance value (*Asymp. Sig.*) (p-value) and the effect size measure Cramer-V (φ). Posthoc analysis was performed in Microsoft® Excel® Version 2410 by calculating the p-value of Bonferroni corrected standardized residuals of the crosstabulation of the expected frequency against the actual (observed) frequency for each categorial data. In addition, comparisons of column proportions (z-test) were performed, and Bonferroni adjustments were used to adjust the significance values to allow pairwise comparison of column proportions. We considered $p < .05$ to indicate statistical significance.

Results

General data and demographics

A total of 889 individuals participated in the survey (see Table 1). The survey was mostly completed on a smartphone (68%), with 32% completed on a desktop PC. Most participants were between the ages of 19 and 30 (41%) or under 18 (28%). Women were more likely to complete the survey (71%), compared to men (26%) or other people (3%). A total of 32% of participants indicated that they had received the HPV vaccination, 57% stated that they had not been vaccinated, and 11% did not know their vaccination status. Of the participants, 22% reported that they had children of their own.

HPV related knowledge

HPV awareness by gender and age

The survey revealed that 83% of participants were aware of HPV, while 10% indicated a lack of knowledge about the virus and 7% expressed uncertainty. A greater proportion of men (23%) reported that they had not heard of HPV than women (5%). 71% of women and 46% of men reported an interest in the subject of HPV infections. A total of 26% of men and 9.6% of women stated that they were completely uninterested in HPV. A total of 25% of respondents indicated that they or someone close to them had been affected by HPV. Additionally, 6% of the total sample expressed a negative attitude toward HPV and a preference for avoiding detailed discussions about the topic.

A chi-square test was used to compare both gender and age in relation to HPV awareness ("*Have I heard of HPV before?*"). Results showed a significance between gender and HPV awareness (χ^2 (6) = 70.9, $p < .001$, φ = 0.2 (Cramer-V)), as well as between age and HPV awareness (χ^2 (8) = 54.0, $p < .001$, φ = 0.2 (Cramer-V)).

Results revealed notable discrepancies in knowledge levels across different groups. Men were significantly less informed

Table 1. Demographic characteristics of survey participants (n = 889).

	n	%
Age		
≤18	249	28
19–30	364	41
31–40	142	16
41–55	98	11
≥55	36	4
Gender		
Male	231	26
Female	631	71
Diverse	10	1
Not specified	17	2
HPV vaccinated		
Yes	282	32
No	508	57
Status unknown	99	11
Children		
Yes	199	22
No	690	78

about HPV, while women were better informed ($p < .001$). Diverse individuals were also less informed than women ($p = .022$). Among those under 18, a higher proportion was uninformed ($p < .001$), resulting in notably lower levels of knowledge compared to the 19–30 and 31–40 age groups ($p < .001$, $p = .035$, respectively) (Figure 2). The 19–30 age group, in contrast, showed greater knowledge with fewer participants associating with the 'No' response ($p < .005$) than statistically expected.

A link between parenthood and HPV awareness was analyzed, however no statistically significant association was observed.

Awareness on infection routes

87% of all respondents knew that men and women can be infected with HPV, 5% and 7% respectively stated that only men or women can be infected. 97% were aware that HPV can be transmitted through sexual intercourse. Transmission was cited by 9% to occur through coughing, 4% via air and 6% by shaking hands.

A chi-square test was used to compare both gender and age in relation to the awareness of ways of HPV infection ("*How can I become infected with HPV?*"). Results showed a significant difference between gender and ways of infection (χ^2 (12) = 96.4, $p < .001$) and between age and ways of infection (χ^2 (16) = 52.9, $p < .001$). The proportion of male survey participants who stated that HPV can be passed on by coughing, through the air or by shaking hands, was significantly higher than the proportion of female ($p < .001$). In line with this, significantly more women knew that HPV can be transmitted through sexual intercourse than men ($p < .001$) (Figure 3). Significantly, more participants under 18 stated that HPV can be transmitted through coughing than participants in the other age groups ($p = .009$ to $p = .034$).

Knowledge about HPV induced diseases

44% of survey participants knew that HPV is the most common sexually transmitted disease in the population (49% of women/34% of men). 20% attributed this to HIV, 8% to syphilis, and 28% to herpes.

33% of respondents assumed that only 30–40% of the population would become infected with HPV during their lives; only 18% of respondents (17% of men/18% of women) answered that there is an 80–90% infection rate in Austria. 93% of respondents knew that HPV could cause cervical cancer, 51%, 38%, 48%, and 59% knew this for anal cancer, oropharyngeal cancer, genital warts and penile cancer, respectively. 47% of respondents were aware that the incubation period of HPV can take up to 20 years before cancer develops, while 40% and 13%, respectively, exhibited incorrect assumptions regarding the period as either three months or two weeks.

A chi-square test was used to compare gender and age related to HPV-induced diseases ("*Which diseases can be caused by HPV?*"). Results showed a significance between gender and HPV-induced diseases (χ^2 (21) = 69.6, $p < .001$) and a significance between age and HPV-induced diseases (χ^2 (28) = 196.6, $p < .001$). Significantly more men than women gave the wrong answer that HPV can cause influenza, the same applies to lung cancer ($p = .01$ and $p = .013$, respectively). Significantly more women than men knew that HPV causes cervical cancer. Similarly, significantly more people under 18 stated that HPV can cause influenza compared to the other age groups ($p < .001$). All age groups were significantly more aware that HPV causes cervical cancer and genital warts than those under 18 ($p < .001$). Nevertheless, the probability of individuals under the age of 18 asserting that HPV can also cause anal and penile cancer is markedly higher than that of individuals aged 19–40 ($p < .001$ and $p = .032$, respectively) (Figure 4).

HPV protection awareness

Vaccination was known to protect against HPV infection by 91% of respondents, 86% also cited condoms as a possible protection and 7% said mouth protection. 64% of participants knew that the HPV vaccination provides lifelong protection, 30% thought that 10 years was the correct answer.

Results showed a significant association between ways of HPV protection ("*How can I protect myself from HPV?*") and age groups (χ^2 (12) = 50.5 $p < .001$). In the 19–50 age groups, significantly more people know that they can be protected against HPV with a vaccination than in the under 18 and over 55 age groups ($p < .001$ to $p = .004$, respectively).

Significant differences were also received associating gender and HPV vaccination (χ^2 (6) = 69.7, $p = < .001$, $\varphi = 0.2$ (Cramer-V)), as well as age and HPV vaccination (χ^2 (8) = 163.3, $p < .001$, $\varphi = 0.3$ (Cramer-V)). Significantly less men were vaccinated against HPV ($p < .001$), and more women ($p < .001$). Significantly more men compared to women also stated that they did not know their HPV vaccination status ($p < .001$). A greater proportion of individuals within the 19–30 age group have received the HPV vaccination compared to those in other age groups ($p < .001$ to $p = .017$, respectively). It was observed that those under 18 were significantly

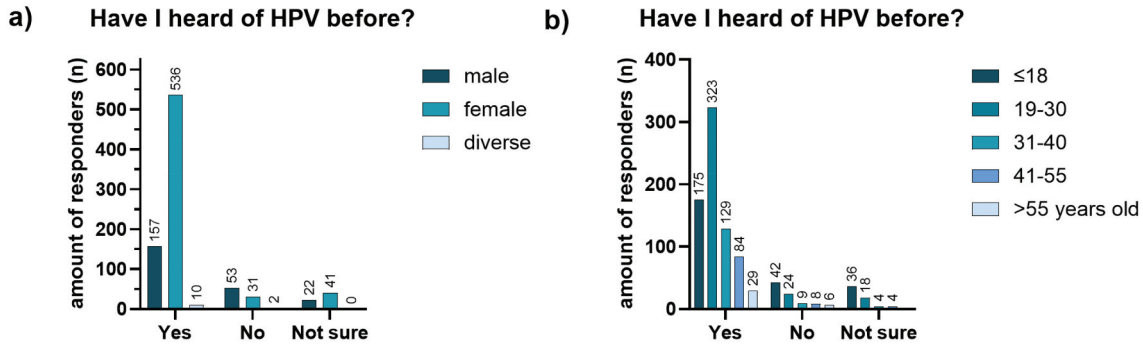

Figure 2. Number (n) of respondents who have ever heard of HPV, by gender (a) and age groups (b).

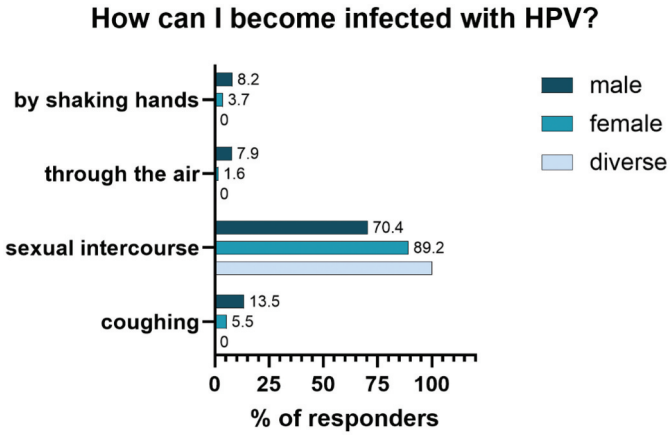

Figure 3. Gender differences in knowledge about HPV infection routes (in % of the total population).

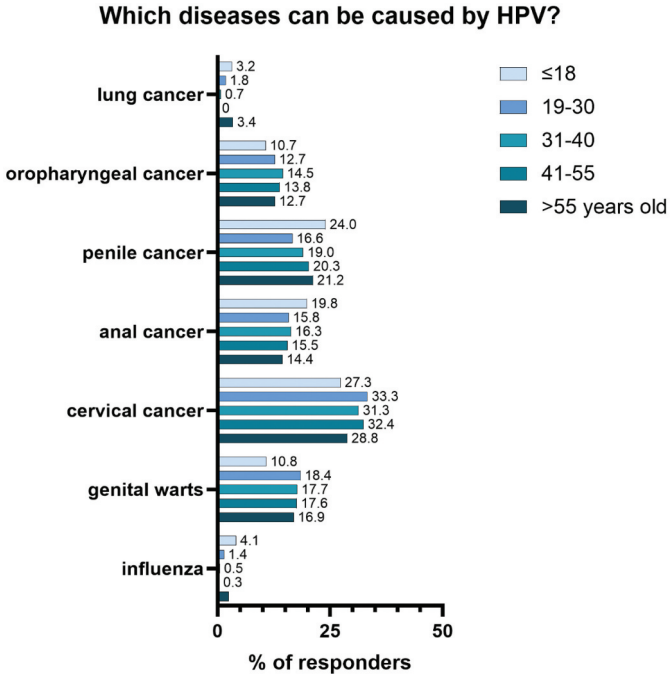

Figure 4. Knowledge about HPV-induced diseases by age groups (in % of the total population).

more likely to indicate that they were unsure of their HPV vaccination status, in comparison to the other age groups ($p < .001$) (Figure 5).

Association of HPV awareness and vaccination status

Results also showed a significant association between HPV awareness and vaccination status (χ^2 (4) = 62.7, $p = < .001$, $\varphi = 0.2$ (Cramer-V)). Significantly more people who have heard of HPV were vaccinated ($p = .009$) compared to those who have never heard of HPV or are not sure ($p < .001$) (Figure 6).

Favoured information channels about HPV and health

37% of participants (39% of women/34% of men) would spend more than 20 minutes to find out about a specific health topic such as HPV. 31% would invest 10–20 minutes (34% of women/27% of men), 23% 5–10 minutes (26% of men/21% of women), and 8% less than 5 minutes (12% of men/6% of women). Results showed a significant association between time expenditure and gender (χ^2 (9) = 50.6 $p = < .001$, $\varphi = 0.137$ (Cramer-V)). In short, men tend to spend less time informing themselves about HPV than women.

When it comes to their health, the most favored information channel is their doctor's practice or hospital (80%), followed by websites (56%), scientific studies (53%), conversations with friends or family (49%), flyers or brochures (26%) and social media (18%) (Figure 7a). Results show a significant association between information channels and both, gender (χ^2 (33) = 82.0, $p < .001$) and age (χ^2 (44) = 215.5, $p < .001$). Women are significantly more likely than men to obtain information about health topics through flyers, brochures or conversations with friends and family ($p < .001$, $p = .029$, respectively). Diverse individuals are more likely to access health information through streaming platforms like Netflix or Amazon Prime than women or men ($p < .001$). The younger demographic (aged 18 and below) is significantly more likely to seek information on social media than the 31–40 age group ($p = .01$). In contrast, all individuals aged 18 and above demonstrate a clear preference for obtaining information about a health topic via information brochures and flyers ($p < .05$). Individuals aged 19–30 obtain information via websites at a significantly higher frequency than those under the age of 18 ($p < .001$). It can be observed that conversations with friends and family play a significantly greater role as a source of information for all individuals under the age of 40 than for those above this age bracket ($p < .05$). Individuals aged 41 and above demonstrate a significantly stronger preference for obtaining information through radio, television, and newspapers compared to those in the under 30 age group ($p < .05$).

In contrast, when it comes to sharing information about HPV, participants ranked sharing with people affected by HPV caused cancer most popular, followed by family, researchers, friends, and medical professionals (mean values 3,57/3,19/3,05/2,77/1,6). There was no association of preferred channels for sharing information in terms of age or gender.

Favourite information channels about vaccination

When it comes to vaccination, 91% of respondents trust doctors, 71% trust scientists, 26% trust adverts from the Ministry of Health, 23% trust friends or family, and 14% trust school communications. Only 4% and 3% trust public advertising and digital media respectively (Figure 7b). The free comment field often contained remarks such as 'Wikipedia,' 'No one since coronavirus,' 'nobody anymore' or 'only myself.'

Results of a chi-square test showed a significant association between preferred information channels on vaccination and age (χ^2 (32) = 128.9 $p = < .001$). Specifically, those aged under 18 placed significantly more trust in school notifications and in information from friends and family than all other age groups when it comes to vaccinations ($p < .001$ to $p = .035$). They also trust scientists significantly less than those aged between 19 and 40 ($p < .001$). The 19–30 age group exhibits a significantly higher degree of trust in doctors and friends and family than

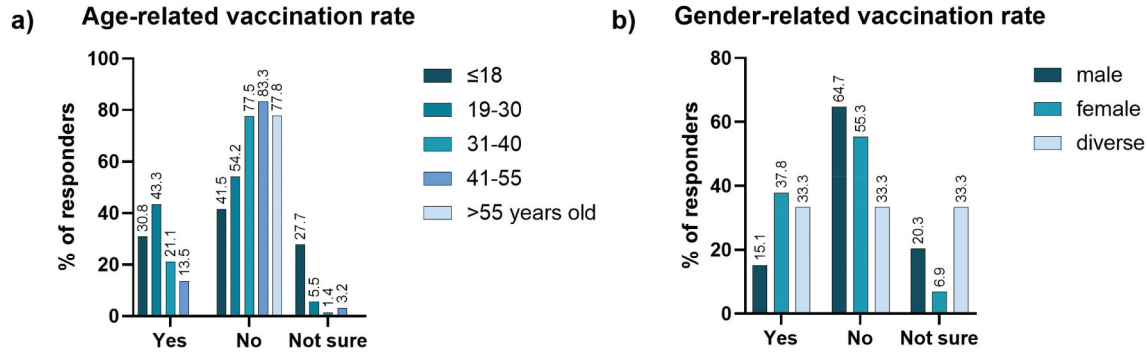

Figure 5. Differences in HPV vaccination rates by age (a) and gender (b) (in % of the total population).

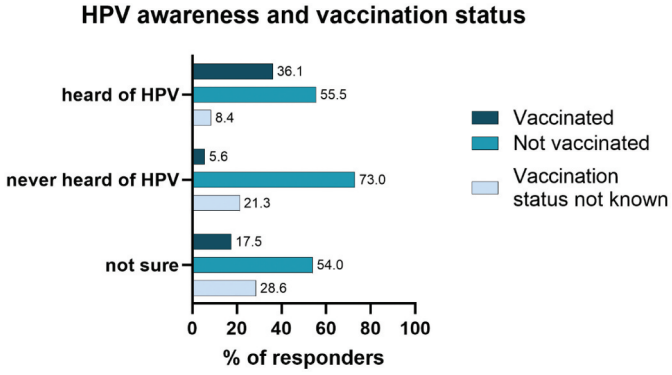

Figure 6. Correlation between HPV awareness and vaccination status (groups "heard of HPV," "never heard of HPV," "not sure" were set to 100%).

the 31–40 age group ($p < .05$). Moreover, the influence of advertisements from the Ministry of Health is more pronounced among the 19–30 age group than among those below the age of 18 ($p = .009$).

Slogans and brochures

Participants were asked to rank their favorite slogans concerning information gain and vaccination. The following slogans would encourage respondents to get more information about HPV: (i) 'Almost everyone is HPV-positive,' followed by (ii) 'HPV: sexually transmitted and a cause of cancer.' Subsequent slogans would motivate participants to get an HPV vaccination: (i) 'HPV – there is a vaccination against cancer.' or (ii) 'Love is

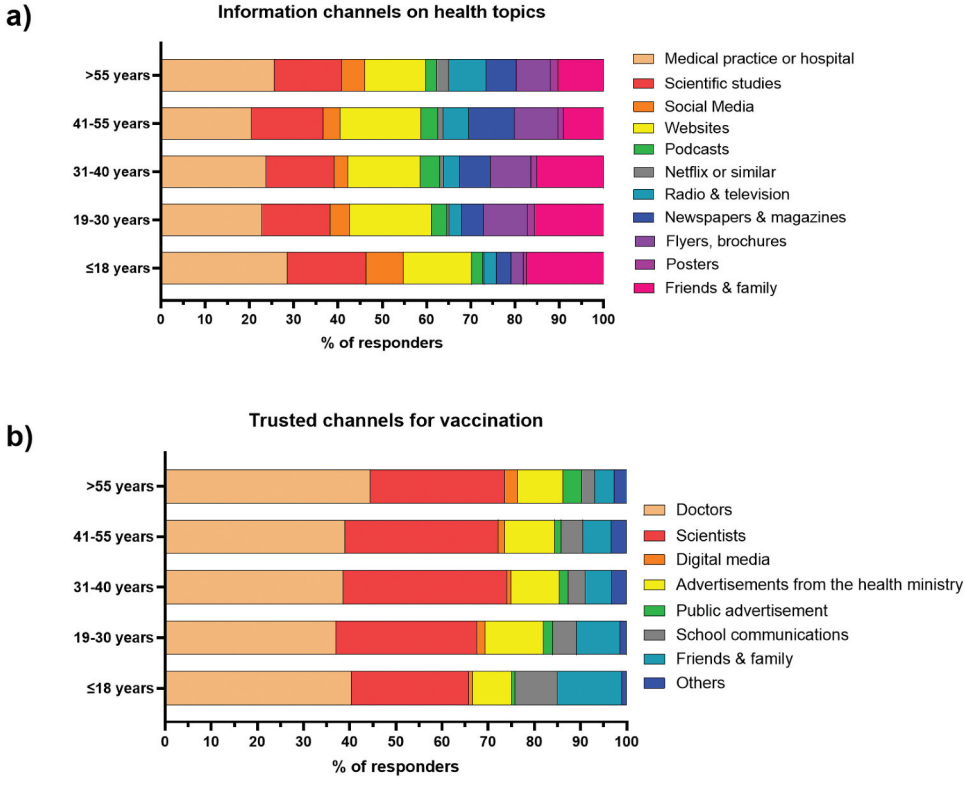

Figure 7. Favoured information channels on health topics in general (a) and about vaccination specifically (b) (in %).

possible without HPV – vaccinate now!' and (iii) 'Don't let genital warts ruin your date and get vaccinated now!'

In the case of information brochures, 45% of respondents indicated that they would be most likely to select a straightforward fact-check format accompanied by the logo of the Ministry of Health.

Discussion

Understanding how different demographic groups perceive and seek information about HPV is crucial in shaping effective health communication strategies. The present study uncovers key insights into the gender- and age-related disparities in HPV knowledge, offering a perspective on how these factors influence the way individuals engage with health information. The objective was to primarily engage with young people and parents, a goal that was largely achieved. Our results have shown that, while most participants were aware of HPV, there were significant gaps in awareness based on gender and age. Based on our results, men and younger individuals under 18 appear to be significantly less informed about HPV. Knowledge about transmission routes and HPV related diseases also seems to be partly incomplete among men and younger age groups. A higher proportion of men expressed complete disinterest in HPV compared to women. These findings are in line with other studies.[6,21] Furthermore, a strong association was observed between HPV awareness and vaccination status, as has been also shown in other studies.[21–23] Women were clearly more likely to be vaccinated against HPV than men and more aware of the HPV vaccine and its protective effects. Younger adults (aged 19–30) showed higher vaccination rates than other age groups, while those under 18 were more likely to be unsure of their vaccination status. This was also confirmed by other studies in the EU.[15,22]

The discrepancy in knowledge levels between the sexes may suggest that HPV is still perceived as a "women's health issue," as previous studies have demonstrated.[20,22] Insufficient information in schools or a lack of educational programmes could be reasons for the lack of knowledge among young people, which was also mentioned in earlier researchs.[23–25] Young people´s attitudes in Austria are also closely linked to those of their parents, who appear to be skeptical toward HPV vaccination when poorly informed.[24,26,27] The gaps in knowledge regarding infection routes and HPV related diseases could be due to the lack of political support,[28] inaccurate information in the media or misunderstandings in communication. Incorrect assumptions about the duration of vaccination effectiveness (e.g. only 10 years) also highlight the need for clearer public health messaging. Our study is limited by the absence of data on the socioeconomic factors that may contribute to the observed differences in knowledge. Further limitations are the reliance on survey-based data, which are prone to specific bias, such as that we probably only reached certain population groups, i.e. those with a good understanding of the German language and general interest in health topics. We tried to address this in keeping the language as simple as possible and disseminating the survey through many different channels.

Additionally, the findings indicate that information behavior is influenced by gender and age. Women spend more time on health topics, likely due to social and cultural norms emphasizing women´s role as healthcare providers for their families. For men, the shorter time commitment may indicate the need for concise, visually engaging materials. Younger individuals' reliance on social media highlights the potential for leveraging digital platforms like TikTok or Instagram for targeted HPV awareness campaigns. The preference for traditional media among older adults suggests that a mixed-media approach could maximize outreach effectiveness across age groups. Participants' preference for sharing information with those directly affected by HPV reflects the emotional resonance of personal stories in motivating public health action. Campaigns could utilize testimonials to foster empathy and engagement. When it comes to vaccination information, low trust in public advertising and digital media, likely influenced by COVID-19 misinformation, highlights the need for rebuilding trust in public health messaging through transparent, evidence-based messaging endorsed by trusted figures like doctors and scientists. They occupy an important position in the trust hierarchy of all respondents, especially in Austria.[24] High trust in school notifications among younger participants supports integrating HPV education into school curricula to promote early awareness and vaccination. Slogans combining fear appeals with solutions, emphasizing HPV's severity and vaccination benefits, were particularly effective, as shown in previous studies.[24,29]

Key implications of our study are:

- Education and awareness building must be target group-orientated: Men and adolescents under 18, require focused initiatives (e.g. specific campaigns or school programmes) to improve HPV awareness and correct misconceptions about its transmission.
- Vaccination education must be improved: Misinformation about the duration of protection and the need for vaccination could be better communicated by doctors and scientists, particularly to underrepresented groups like men and younger populations. Since the vaccination rate associates with knowledge about HPV, campaigns should combine informative content with motivational strategies, such as catchy slogans, to encourage vaccination.

These findings confirm our hypothesis that there is a significant lack of knowledge within the population and highlight the gaps in public awareness. In addition, they emphasize the necessity of adapting HPV awareness and vaccination campaigns to align with demographic preferences. An example of an age group focussed campaign was developed in this project together with citizen scientists.[30] Citizen science initiatives may be effective in co-creating tools to engage young people on health issues. Future studies should analyze the underlying causes of knowledge discrepancies and investigate the long-term efficacy of the proposed communication strategies and their impact on vaccination rates in real-world-settings.

Disclosure statement

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Notes on contributors

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The free version of DeepL (deepl.com) was used for language improvement in this article.

Ethical statement

Ethical approval was not required for this study as no health-related personal data was collected. All citizen scientists were voluntarily involved and signed a declaration of consent at the beginning of the project.

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