



Public support of voluntary school-based HPV vaccination in Germany: results of repeated cross-sectional surveys

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Abstract

Aim This study is designed to assess public support for a voluntary school-based vaccination programme against human papillomavirus (HPV). This is particularly important as the effectiveness of such programmes depends on public acceptance and uptake, and strong evidence of support plays a crucial role in persuading policymakers to adopt or expand such delivery strategies.

Subjects and methods The study involved three telephone-based cross-sectional surveys to gauge public support for voluntary school-based HPV vaccination in Germany. We analysed associations between sociodemographic factors and support of school-based vaccination using a multivariable logistic regression in a pooled dataset across all three surveys.

Results Overall, 72% of respondents across all survey waves supported voluntary HPV vaccination in schools. Support was significantly higher among men, participants still in school, those with moderate or higher education levels, residents of northern Germany, individuals living in large cities and respondents with the intention to vaccinate their children against HPV infection. In contrast, support was significantly lower among respondents from western Germany, individuals living in middle-sized households and participants with children under 9 years of age.

Conclusion The study demonstrated broad public support for a voluntary school-based HPV vaccination programme in Germany. The observed differences in support based on sociodemographic factors, such as gender, education, regional differences and intention to vaccinate underscore the need for tailored communication strategies and targeted interventions to ensure equitable acceptance and participation across all demographic groups.

Keywords Human papillomavirus (HPV) · Vaccination · School-based vaccination · Cross-sectional survey · Public support

Background

In 2007, the Standing Committee on Vaccination (STIKO) issued a recommendation for the vaccination of girls in Germany against infection with the human papillomavirus (HPV). This was extended in 2018 with the introduction of a gender-neutral HPV vaccination recommendation for children and adolescents aged 9 to 14 years. Those who have

not received the vaccination at this age may obtain it free of charge up to the age of 18 years (AG HPV der Ständigen Impfkommision 2018).

To interrupt the transmission of HPV in the population and to protect people who cannot be vaccinated for various reasons (community protection), an overall vaccination coverage of at least 70% is required (Lehtinen et al. 2019). In 2018, WHO set the goal of eliminating cervical cancer worldwide. To achieve this goal, WHO formulated the objective that 90% of 15-year-old girls and a significant proportion of boys worldwide should be fully vaccinated against HPV by 2030 (World Health Organisation 2020). However, Germany is currently far from reaching those goals, with vaccination rates of 54% of 15-year-old girls and 34% of 15-year-old boys in 2023 (Rieck et al. 2024).

In Germany, general practitioners (GPs) are currently the main providers of the HPV vaccine. The low HPV

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vaccination rates indicate that new strategies are needed to increase vaccination coverage, as current strategies apparently do not adequately reach eligible children and adolescents or their parents. One potential reason could be that adolescents, unlike young children, are less likely to visit GP practices (Klein et al. 1998). This makes them harder to reach.

Experiences from countries such as Australia and England demonstrate that offering HPV vaccination in schools is an effective strategy for achieving high HPV vaccination rates among adolescents (Perman et al. 2017; Hansen et al. 2015; Skinner and Cooper Robbins 2010; Skinner et al. 2020; Tiley et al. 2020). One reason is that school-based vaccination is more accessible and convenient for adolescents and their parents. School-based HPV vaccination programmes can also reduce costs and logistical barriers by leveraging existing school infrastructure and resources. Targeting the recommended age group for HPV vaccination in schools ensures that children are vaccinated before they are likely to be exposed to the virus, which is crucial for the vaccine's effectiveness. Additionally, the influence of peers and the establishment of vaccination as a social norm within the school environment contribute significantly to the success of these programmes. Engaging parents through informational sessions and consent processes in schools has been shown to further increase acceptance and support for HPV vaccination (Drolet et al. 2019; Markowitz et al. 2014; Kessels et al. 2012; Gilkey et al. 2017; World Health Organization 2013). According to expert interviews, an organised school-based HPV vaccination programme would also have the potential to significantly increase vaccination rates in Germany (Schott et al. 2022). Given that support in the population is an important prerequisite for the success of such a programme, we conducted representative surveys to examine support for a voluntary school-based HPV vaccination programme.

Methods

In three consecutive years we conducted cross-sectional surveys to provide representative snapshots of the opinions of the population on voluntary school-based HPV vaccination in Germany.

We developed a short questionnaire (Supplement 1) and commissioned a renowned market research company (Kantar) in Germany for the sampling and data collection. The surveys were conducted via telephone interview in July 2022, July 2023 and July 2024. Survey respondents were randomly selected from private households in Germany with at least one fixed telephone and people with at least one mobile phone. The "Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute e. V." (ADM) master sample,

which was developed with the objective to ensure a representative sample of the German population was used as the sampling frame for the selection. The telephone numbers were generated using the "Random Last Two Digits [RL (2) DJ]" technique based on the established Gabler/Häder procedure for sampling in telephone (fixed or mobile) surveys in Germany (Gabler and Häder 1997). The select sample of respondents comprises 65% with a fixed telephone and 35% with a mobile phone.

Support of school-based vaccination was assessed with the following question: "Human papillomaviruses, also known as HPV, cause several types of cancer. The HPV vaccine, which is recommended by the Standing Committee on Immunisation for adolescents aged 9–14 years, protects against cancers caused by HPV. Would you personally support regular, voluntary HPV vaccination in schools?", with response options (1)—"Yes, I support this", (2)—"No, I don't support this", (3)—"Don't know".

The covariates included socio-demographic characteristics, which were coded as follows: gender (male, female), age (14–17, 18–29, 30–39, 40–49, 50–59, 60–69, 70 and above), education level (low = still in school, moderate = elementary or secondary school, further education without a university qualification, high = university qualification or completed university education), place of residence categorised into four regions (North = Hamburg, Bremen, Schleswig–Holstein, Lower Saxony; South = Bavaria, Baden–Württemberg; West = North Rhine–Westphalia, Saarland, Rhineland–Palatinate, Hesse; East = Mecklenburg–Western Pomerania, Saxony–Anhalt, Berlin, Brandenburg, Saxony, Thuringia), place of residence according to city size (small = city population of less than 20,000, medium = city population between 20,000 and 100,000), large = city population of 100,000 or more), household size (small = 1–2 persons; medium = 3–4 persons; large = ≥ 5 persons). The third survey also included an additional question regarding the parental status of survey participants (children below the age of 18) (coded as yes or no), which was posed to participants aged 20 to 65. Those who indicated that they had children below the age of 18 were also asked about their intention (coded as yes or no) to vaccinate their children against HPV infection. The question was phrased as follows: "Would you vaccinate this child?"—with following response options: (1) The child has already been vaccinated against HPV, (2) The child has not yet been vaccinated against HPV, but I would have the child vaccinated against HPV, (3) The child has not been vaccinated against HPV, and I cannot imagine having the child vaccinated against HPV, (4) Don't know.

The analysis was conducted using the statistical software package SAS 9.4. The study population was characterised, and support rates for school-based HPV vaccination were quantified overall, by survey wave and across sociodemographic strata. Factorial weighting was applied to align the

sample with the sociodemographic characteristics of the population, including age, gender, education, and region. Missing values for factors related to place of residence (region, city size) (< 1% missing values) were imputed using the mode value to ensure data completeness and consistency in the analyses. To study the associations of support of school-based vaccination with sociodemographic factors, binary logistic regression was run using the pooled dataset including all three survey waves. The models were adjusted for the key variables gender, age group, education and survey wave.

Results

Demographic characteristics of participants

A total of 3021 people aged 14 years and older participated in the three surveys, comprising 1013 participants in 2022 and 1004 each in 2023 and 2024. The distribution of survey participants across the range of socio-demographic characteristics (gender, age groups, educational level, place of residence, parental status and intention to vaccinate) is provided in Table 1.

Support for voluntary school-based HPV-vaccination

Overall, more than two-thirds (72%) of respondents supported voluntary HPV vaccination in schools, with the highest support expressed by survey participants in 2024 (76%) and the lowest support expressed by participants in 2023 (68%) (Table 2). The results of the surveys indicate that approximately 22% of respondents are opposed to voluntary HPV vaccination in schools, irrespective of the survey year. A total of less than one-tenth (7%) of respondents indicated that they were unsure or did not provide an opinion.

Gender and age group Support for voluntary HPV vaccination in schools was statistically significantly higher among men (73%) than among women (70%). With regard to age group, support was higher (82%) among participants aged under 17 years, although this age group showed a notable decline in support over the three surveys: 96% in 2022 versus 76% in 2024. Overall, the level of support of voluntary HPV vaccination is high among adults, with a notable difference between adults aged 18–29 (74%) versus adults aged 70 years and above (63%). However, the difference in support across age group was not statistically significant (Table 2).

Education level Support of voluntary HPV vaccination in schools is particularly high among respondents who are still

in school, a key target group for vaccination, with an overall support rate of 84% [range 76% in the 2023 survey to 96% in the 2022 survey]. Support also significantly varied with the level of education, ranging from 63% among respondents with low education to 77% among those with high education [range for high education 77% in the 2022 survey to 78% in the 2024 survey]. Notably, there is a significant difference in support of voluntary HPV school-based vaccination across education levels.

Place of residence At the federal level, the highest support of voluntary HPV vaccination was observed in the federal state of Schleswig–Holstein (88%) [range 86% in the 2023 and 2024 surveys to 94% in the 2022 survey], while the lowest support was recorded in Saxony (62%) [range 56% in the 2022 survey to 69% in the 2024 survey] (Fig. 1, Supplement 2).

Regionally, support for voluntary HPV vaccination in schools was highest in northern Germany (79%) and lowest in western Germany (70%). A statistically significant difference was observed between northern and eastern Germany, with participants from northern Germany being about two times more likely to support voluntary school-based HPV vaccination compared to those from eastern Germany ($p = 0.001$). In contrast, participants from western Germany were 0.9 times less likely to support compared to their eastern counterparts ($p = 0.463$).

When considering city size, respondents from large cities showed higher support (74%) [range 73% in the 2024 survey to 76% in the 2022 survey] for voluntary school-based HPV vaccination. In contrast, respondents from small cities were the least supportive, with an overall support rate of 67% [range 62% in the 2022 survey to 73% in the 2024 survey]. These differences in support based were statistically significant.

Household size Survey participants from large-sized households were significantly less likely to support a voluntary HPV school-based vaccination compared to those from small households.

Parental status and intention to vaccinate In 2024, respondents without children under the age of majority and those with children aged 9 to 17 expressed higher support for a voluntary school-based HPV vaccination programme (73%) compared to respondents with children under the age of 9 (65%). However, this difference was not statistically significant.

Regarding parental intention to vaccinate, parents who indicated that they do not intend to vaccinate their children against HPV were very unlikely to support voluntary HPV school-based vaccination compared to those who intend to vaccinate, with a highly significant statistical difference.

Table 1 Sociodemographic characteristics of survey respondents

	Survey 2022 <i>n</i> (%)	Survey 2023 <i>n</i> (%)	Survey 2024 <i>n</i> (%)	Total <i>N</i> (%)
Gender				
Male	497 (49)	492 (49)	492 (49)	1,482 (49)
Female	516 (51)	512 (51)	512 (51)	1,539 (51)
Age groups				
14–17	49 (5)	45 (4)	57 (6)	151 (5)
18–29	152 (15)	154 (15)	141 (14)	447 (15)
30–39	150 (15)	149 (15)	149 (15)	448 (15)
40–49	142 (14)	141 (14)	142 (14)	425 (14)
50–59	188 (19)	186 (19)	186 (18)	560 (19)
60–69	147 (15)	146 (15)	146 (15)	439 (14)
70 and older	185 (18)	183 (18)	183 (18)	551 (18)
Education level				
Still in school	46 (4)	46 (4)	46 (4)	138 (4)
Low	330 (33)	327 (33)	326 (33)	983 (33)
Moderate	301 (30)	298 (30)	298 (30)	898 (30)
High	336 (33)	333 (33)	334 (33)	1,002 (33)
Place of residence (city size class)				
Small	411 (40)	412 (42)	412 (41)	1,235 (41)
Medium	250 (25)	270 (26)	261 (26)	780 (26)
Large	352 (35)	322 (32)	331 (33)	1,005 (33)
Place of residence (region)				
West	357 (35)	354 (35)	355 (35)	1,066 (35)
East	198 (19)	196 (19)	196 (20)	590 (20)
North	163 (16)	162 (16)	162 (16)	487 (16)
South	295 (29)	292 (29)	291 (29)	878 (29)
Household size				
Small	622 (61)	617 (61)	618 (61)	1,857 (61)
Medium	315 (31)	300 (30)	322 (32)	936 (31)
Large	76 (8)	88 (9)	65 (6)	229 (8)
Parental status (children under 18 years)*				
Yes (aged < 9 years)	–	–	123 (18)	123 (18)
Yes (aged 9–17 years)	–	–	85 (13)	85 (13)
No	–	–	463 (69)	463 (69)
Parental intention to vaccinate the child**				
Yes	–	–	154 (74)	154 (74)
No	–	–	54 (26)	54 (26)
Total	1,013 (100)	1,004 (100)	1,004 (100)	3,021 (100)

*Only participants aged 20 to 65 years in survey 2024 were asked about their parental status

**Only parents having children

Discussion

The present study provides a comprehensive analysis of public opinion on voluntary HPV school-based vaccination in Germany, drawing on data collected with surveys conducted in 2022, 2023 and 2024. The findings offer valuable insights into the demographic factors linked to the support of such a public health strategy.

Despite notable fluctuations in support of voluntary school-based HPV vaccination across the three survey waves, peaking at 76% in 2024, our findings reveal consistent and substantial public support for such a vaccination programme. On average, approximately 72% of respondents across all three surveys expressed support for voluntary HPV vaccination in schools. Compared with the results of similar studies assessing public support for school-based HPV

Table 2 Support for voluntary school-based HPV vaccination by sociodemographic characteristics of respondents in Germany

	Support		Adjusted* OR [95% CI]	P value
	<i>n</i>	%		
Gender				
Men	1.079	73	1.00 (ref.)	ref
Women	1.072	70	0.74 [0.59–0.86]	<.001
Age groups				
14–17	124	82	1.00 (ref.)	ref
18–29	330	74	0.65 [0.32–1.31]	0.234
30–39	322	72	0.55 [0.27–1.14]	0.107
40–49	306	72	0.70 [0.34–1.45]	0.335
50–59	403	72	0.71 [0.35–1.45]	0.348
60–69	317	72	0.78 [0.38–1.60]	0.506
70 and older	349	63	0.60 [0.29–1.23]	0.161
Education level				
Low	621	63	1.00 (ref.)	ref
Still in school	116	84	2.21 [1.72–4.52]	0.03
Moderate	635	71	1.53 [1.22–1.93]	<.001
High	779	77	2.19 [1.72–2.79]	<.001
Place of residence (City size class)				
Small	842	67	1.00 (ref.)	ref
Medium	399	73	1.30 [1.03–1.65]	0.030
Large	746	74	1.33 [1.05–1.67]	0.016
Place of residence (Region)				
East	411	71	1.00 (ref.)	ref
West	732	70	0.92 [0.70–1.17]	0.463
South	627	72	1.05 [0.80–1.38]	0.708
North	381	79	1.71 [1.23–2.38]	0.001
Household size				
Small	1.326	73	1.00 (ref.)	ref
Medium	683	74	1.01 [0.80–1.27]	0.960
Large	143	64	0.50 [0.34–0.69]	<.001
Parental status (children under 18 years)**				
No	369	81	1.00 (ref.)	ref
Yes (aged < 9 years)	78	65	0.54 [0.33–0.88]	0.036
Yes (aged 9–17 years)	62	73	0.95 [0.54–1.67]	0.415
Parental willingness to vaccinate the child***				
Yes	127	87	1.00 (ref.)	ref
No	6	13	0.02 [0.00–0.06]	<.001
Year of survey				
2022	720	71	1.00 (ref.)	ref
2023	680	68	0.91 [0.74–1.13]	0.416
2024	751	75	1.30 [1.01–1.65]	0.037

*Adjusted for gender, age group, education and survey year

**Only participants aged 20 to 65 years in survey 2024 were asked about their parental status

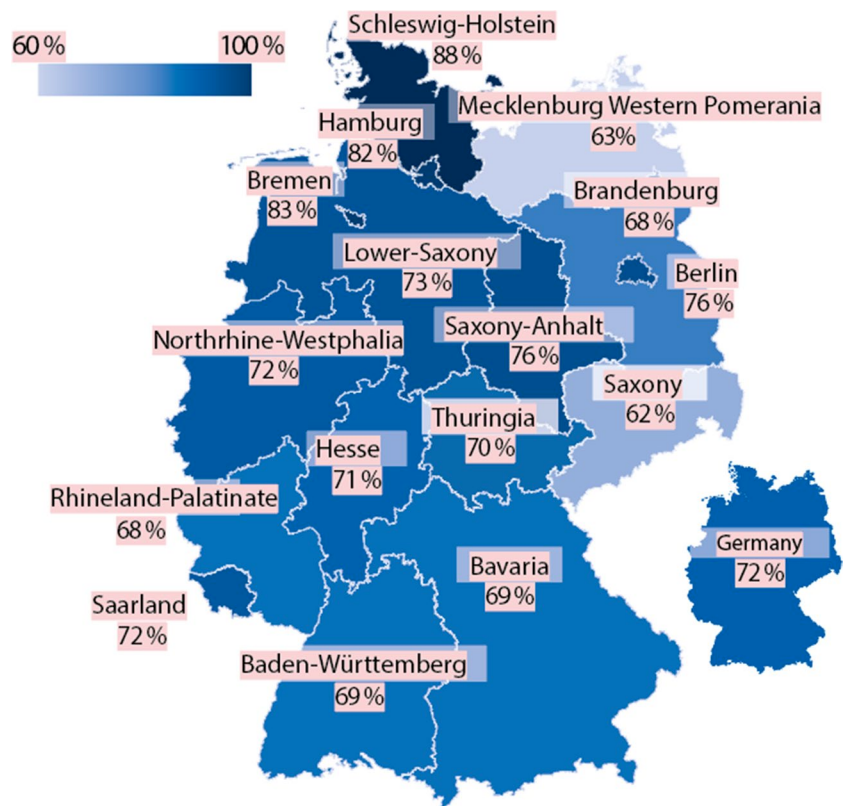
***Only parents having children

vaccination programmes in other countries (Colón-López et al. 2021; Vercruysse et al. 2016; Wilson et al. 2012), our results are in the upper range as these studies showed levels of support ranging from low (11%) to high support (92%) for HPV vaccination in schools (Perkins et al. 2010; Robitz et al. 2011). Given the effectiveness of school-based HPV vaccination programmes in achieving high vaccination coverage and reducing the burden of HPV-related diseases (Thilly et al. 2024, Paul and Fabio 2014; Falcaro et al. 2021), the level of support in Germany is encouraging as it suggests a solid population-wide support for implementing such an HPV vaccination strategy. Additionally, since support for policies often correlates with their stage of implementation—typically increasing after they have been introduced (Diepeveen et al. 2013)—it can be anticipated that support for school-based HPV vaccination in Germany might grow further once the programme is implemented. As demonstrated in previous studies in Germany, offering HPV vaccination in schools is both feasible and effective. School-based HPV programmes facilitate earlier vaccination, whether administered in schools or at GP clinics, while also reaching unvaccinated children and adolescents who may have missed vaccination at GP clinics. Additionally, school-based vaccination helps address socioeconomic and regional disparities in HPV vaccine uptake (Takla et al. 2022; Singer et al. 2025). Therefore, a voluntary school-based HPV vaccination program could serve as a valuable complement to Germany's existing GP-based system, ultimately enhancing overall HPV vaccine coverage. This approach has already been implemented in France, a country with similar healthcare structures to Germany, which introduced a nationwide school-based HPV vaccination program at the beginning of the 2023/2024 school year, while maintaining its existing private practice-based HPV vaccination system (Thilly et al. 2024).

We found gender, higher education level, the region Northern Germany and parental intention to vaccinate against HPV-infection as significant factors associated with support of a voluntary school-based HPV vaccination programme in Germany. Men demonstrated a small but statistically significantly higher support level (73%) compared to women (70%). While other studies have also found differences in perceived benefits, awareness or attitudes towards vaccination between genders (Heimbecker et al. 2024; Heyde et al. 2024), the majority of studies have found women to be more likely to be supportive in contrast to our results due to higher perceived benefits of HPV vaccination, higher awareness and risk perception among women compared to men (Heimbecker et al. 2024; Reimer et al. 2014).

Our study also reveals significant differences in support with regard to the education level. Survey participants with higher education levels were significantly more supportive of school-based HPV vaccination. Our results are in line with findings of other studies demonstrating a strong link

Fig. 1 Support for voluntary school-based HPV vaccination by federal state in Germany (Cumulative data 2022, 2023 and 2024)



between higher education levels and higher support for health policies due to better health literacy, trust in science, and awareness of public health benefits (Diepeveen et al. 2013). This suggests that tailoring public health messages on the benefits of voluntary school-based vaccination to different education levels is necessary to improve knowledge about the benefits of HPV vaccination in lower educated groups.

Regional disparities in support of voluntary school-based HPV vaccination were also statistically significant. Northern Germany showed the highest level of support (79%). These results could be explained by regional differences in public health attitudes, hesitancy linked to cultural conservatism, trust in scientists, institutions and in governmental interventions, historical, political and social factors in Germany (Bade et al. 2024; Eitze et al. 2024; Sterl et al. 2023). The regional disparities in support of voluntary school-based HPV vaccination highlight the importance of culturally sensitive and trust-building approaches for a successful implementation of such a delivery strategy in the country. Thus, the implementation concept for voluntary school-based vaccination in Germany must be responsive to the historical, cultural, political and structural contexts of the different regions.

Finally, our study found that parents willing to vaccinate their children against HPV showed markedly higher support (87%) indicating the importance of parental intention

as a significant correlate of support of an HPV school-based vaccination programme (Newman et al. 2018; Adjei Boakye et al. 2023; Oyediji et al. 2024). Thus, active engagement strategies that educate, address concerns and build trust among parents will be vital in translating the high support observed in our surveys into widespread programme participation.

Limitations

This study has several limitations that should be considered when interpreting the results. First, as a repeat cross-sectional survey, it provides only snapshots of public opinion at specific points in time. Longitudinal studies would be needed to assess how attitudes towards school-based HPV vaccination change over time and in response to public health interventions at the individual level. Second, the reliance on self-reported data introduces the possibility of response bias, particularly in sensitive topics such as vaccination, where social desirability may influence respondents' answers. Third, the survey excluded individuals without access to a telephone, which may have limited the representativeness of the sample, particularly among lower-income populations who may have less access to telecommunication services. Finally, the cross-sectional design of our surveys precludes any causal interpretation.

Conclusions

The demographic variations in support observed in this study highlight the importance of targeted educational campaigns and community engagement efforts to ensure widespread acceptance and participation in a potential voluntary school-based HPV vaccination programme in Germany. Future research should investigate the specific barriers faced by less supportive groups, such as individuals with lower education levels or those without an intention to vaccinate, and develop tailored strategies to address these challenges.

Furthermore, given the regional disparities in support, pilot programmes in areas with lower vaccination coverage could provide valuable insights into effective local strategies for increasing acceptance of a voluntary HPV school-based vaccination programme. These pilots could serve as scalable models for broader implementation across the country.

By addressing demographic and regional disparities and incorporating strategies such as a recall system, a voluntary school-based HPV vaccination programme has the potential to substantially increase HPV vaccination rates and significantly reduce HPV-related diseases in Germany. The strong general support of voluntary school-based HPV vaccination provides a solid foundation for policymakers to consider implementing such a programme in Germany.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10389-025-02641-8>.

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Data availability The data presented in this study are available to the public upon reasonable request.

Declarations

Ethical approval This research was conducted in accordance with the Declaration of Helsinki. Ethical approval was not required according to state regulations (§ 15 Abs. 1 of the Professional Code of Conduct for Physicians (BOÄ) in Baden-Württemberg) as the surveys were fully anonymous.

Consent to participate All participants in the study provided verbal informed consent to participate in the surveys. Parental consent was not required for participants younger than 16 years old in anonymous opinion research, as, according to the German Civil Code (Bürgerliches Gesetzbuch), individuals in Germany aged 14 or older are considered to have (limited) legal capacity. It can therefore be assumed that they

have the ability to understand the nature of their participation in a fully anonymous survey.

Conflict of interest The authors declare no financial conflicts of interest. However, they are deeply committed to cancer prevention in their professional activities, including efforts to promote HPV vaccination.

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