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## HPV vaccine hesitancy among parents in Italy: a cross-sectional study

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### ABSTRACT

This cross-sectional survey determined the vaccine hesitancy related to Human papillomavirus (HPV) and the determinants among parents of adolescents aged 12 and 13 years in Italy. Data was collected through a self-administered questionnaire. Two-thirds of the parents (66.7%) had heard of HPV infection and knew that the vaccination was a preventive measure. Parents who had vaccinated their child against the HPV were more likely to have this knowledge. The vast majority (88%) considered the immunization useful for the prevention of HPV-related cancers with an average value of 8.4. This positive attitude was higher among parents who had heard of HPV infection and knew that vaccination was a preventive measure, who had received information from physicians, who had vaccinated their child against the HPV, who were concerned that their child could contract the HPV infection, and who needed information on HPV vaccination. More than half (57.9%) self-reported that they had vaccinated their child against HPV and only 6.2% had delayed the administration of a dose. One-third (33.3%) were hesitant toward anti-HPV vaccination with a total Parent Attitudes about Childhood Vaccines Survey (PACV) score  $\geq 50$ . Unmarried respondents, those who had not heard of HPV infection and did not know that the vaccination was a preventive measure, who did not believe that the vaccination was useful for the prevention of HPV-related cancers, and who needed information on HPV vaccination were more likely to be hesitant. Communication and education strategies must be undertaken to ensure that parents are fully informed and health-care professionals should provide materials with details regarding the risk of acquiring a HPV infection and vaccine usefulness.

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### KEYWORDS

Adolescents; human papillomavirus; Italy; parents; vaccine hesitancy

## Introduction

Prophylactic Human papillomavirus (HPV) vaccines have been demonstrated to be remarkably effective and safe mainly to prevent the development of high-grade cervical cancer.<sup>1</sup> In Italy, this vaccination is routinely recommended and actively offered free of charge to girls aged 11 or 12 years since 2008, and in 2017 it has been expanded to boys at ages 11–12.<sup>2</sup> Despite this recommendation, limited success has been reported since the full HPV immunization rates continue to be far below the National Immunization Plan target of 95%. Currently, only 49.9% of females and 15.5% of males for the 2005 birth cohort have completed the 3-dose series and in the Campania region, the values were 43.3% and 0.04%, respectively.<sup>3</sup>

Under-immunization rates have been related to a variety of factors. The most frequently reported reasons for incomplete or not vaccination were family social context, lack of parental knowledge or attitude they have toward vaccines, concern about safety, lack of recommendation by physicians, difficult access to preventive health services, and vaccine hesitancy.<sup>4–7</sup> At the same time, parents may have a positive influence on child's vaccination and the hesitancy, meaning a delay in acceptance or refusal to vaccinate despite the availability of vaccination services, negatively affect the coverage. Therefore, to further improve vaccination rates it is important to have an understanding of parents' knowledge and attitudes toward

HPV vaccine and why they choose to refuse or to delay this vaccination for their children are important for implementing educational interventions.

However, although previous investigations involving the knowledge, attitudes, and behaviors about HPV vaccine in different countries and populations have been carried out recently,<sup>8–12</sup> to this end there are limited reports with regard to the prevalence of HPV vaccine hesitancy for a child among parents.<sup>13–15</sup> This survey, therefore, was initiated with the intention of generating new insights that may lead to interventions to improve HPV vaccination rates of adolescents aged 12 and 13 years in Italy. This cross-sectional survey was designed to establish the current status of vaccine hesitancy related to HPV and to identify the determinants of the hesitancy among parents of adolescents aged 12 and 13 years in Italy.

## Material and methods

### Setting and sampling

The study was undertaken from April to October 2019 amongst a random sample of parents with at least one child aged 12 and 13 years attending six randomly selected middle public schools in the geographic areas of Naples and Salerno, Italy. Participation was limited to one parent per child. We estimated that we needed a minimum sample size of 410

participants, based on the sample size calculation. We assumed that the prevalence of parents who were hesitant regarding the HPV vaccine is 25%, with a margin of error of 5%, a confidence interval of 95%, and a non-response rate of 30%.

### Data collection procedure

After obtaining approval by the Ethics Committee of the Teaching Hospital of the University of Campania “Luigi Vanvitelli”, the heads of each school received a letter by the research team to request their collaboration, explaining the purposes and the procedure of the study. After the approval, students received a sealed envelope addressed to the parents with an invitation letter regarding the study objectives and procedures, an informed consent form, a two-page questionnaire to be completed by only one parent, and two envelopes to return separately the questionnaire and the signed consent to the research team. In the invitation letter and at the start of the questionnaire, participants were assured that all information collected will be kept confidential and analyzed anonymously, the study did not include any identifiers or personal information, and that their participation was on a voluntary basis. To improve the response rate, every 4 days the research team had been coming back to the schools to give a replacement questionnaire to the non-respondents. No incentives were offered to participants.

### Data collection instrument

The research team constructed a self-administered questionnaire based on its past experience in other populations.<sup>16-18</sup> To ensure comprehensibility and feasibility, the questionnaire was pretested with a random sample of 25 parents. After the pretest, few modifications were made to assure that the questions were comprehensible and interpreted as intended. The results of pretests were not included in the study.

The research team approved a final version of the questionnaire following pilot testing. The instrument consisted of four major sections: 1) socio-demographic characteristics of the respondent and of the child (gender, age, marital status, occupation and educational level of the respondent, number, gender, and ages of the children in the household); 2) knowledge regarding the HPV infection (whether the participant had heard of HPV, HPV virus transmission route, preventive strategies). The questions included “yes”, “no”, or “do not know” and multiple responses; 3) attitudes toward the HPV infection and vaccination (concern that their child could acquire the HPV infection, the importance of the HPV vaccine, willingness to vaccinate their child against HPV) and self-reported HPV immunization status of their child. Five and ten-point Likert scales were used, with the end-points labeled as 1 = strongly agree and 5 = strongly disagree and from 1 to 10, with higher values corresponding to stronger attitudes. Parents were asked whether they had refused or delayed a shot of the HPV vaccine for their child and the reasons for having delayed or refused. Vaccine hesitancy was measured using the Parent Attitudes about Childhood Vaccines Survey (PACV) that has been translated into

Italian and has been modified in order to investigate the HPV vaccine hesitancy.<sup>19</sup> The PACV contained 15 items under 3 domains: behavior, safety and efficacy, and general attitudes. The score ranged from 0 to 100 and parents with a PACV score of  $\geq 50$  were considered vaccine-hesitant and those with a PACV score of  $< 50$  were not considered vaccine-hesitant; and 4) which information sources about HPV vaccination they had used, and whether they had further need.

### Statistical analysis

Data analysis was conducted using the software Stata version 15.<sup>20</sup> Analysis was performed in two steps. First, descriptive analysis was used to summarize the socio-demographic characteristics of the study population. Second, univariate analysis was performed using chi-square test and Student’s t-test, respectively, for the categorical and the continuous variables, and those that were found with a  $p$ -value  $\leq 0.25$  were used as predictor variables into multivariate logistic and linear regression models. Third, multivariate analysis was conducted to identify the association between independent characteristics and the following outcomes of interest: having heard of HPV infection and knew that vaccination was a preventive measure (no = 0; yes = 1) (Model 1); attitude toward the utility of HPV vaccine (continuous) (Model 2); and parents’ HPV vaccine hesitancy (PACV score  $< 50$  = 0; PACV score  $\geq 50$  = 1) (Model 3). The following independent variables were included in all Models: parent (father = 0; mother = 1), age, in years (continuous), marital status (unmarried = 0; married = 1), baccalaureate/graduate degree (no = 0; yes = 1), occupation in the health sector (no = 0; yes = 1), age in years of the children in the household (12 = 1;  $> 12$  = 2;  $< 12$  = 3), child’s gender (male = 0; female = 1), having received information on HPV vaccination from physicians (no = 0; yes = 1), and need of information on HPV vaccination (no = 0; yes = 1). The variable child immunized against HPV (no = 0; yes = 1) was included in Models 1 and 2. Moreover, having heard of HPV infection and knew that vaccination was a preventive measure (no = 0; yes = 1), and concern that their child could contract the HPV infection (continuous) were included in Models 2 and 3. The variable parents who believed that the vaccination was useful for the prevention of HPV-related cancers was included in Model 3.

A stepwise procedure was used to obtain the final models according to  $p$ -values for the variable inclusion and exclusion in the models respectively of 0.2 and 0.4. To examine the contribution of each variable Odds Ratios (OR), and the 95% confidence intervals (CI) surrounding the OR, were calculated in the multivariate logistic regression analysis, and standardized regression coefficients ( $\beta$ ) in the linear regression model. All of the tests for significance were two-sided and  $p$ -values equal to or less than 0.05 were considered statistically significant.

### Results

Out of 550 parents selected and to whom the questionnaire was delivered, a total of 435 consented and were enrolled in the study giving a response rate of 79.1%. The principal

**Table 1.** Main characteristics of the study population.

	N	%
<b>Characteristics of the respondent</b>		
<i>Parent</i>		
Father	108	24.8
Mother	327	75.2
<i>Age, in years</i>	44.3 ± 5.8 (29–63)*	
<i>Marital status</i>		
Married	385	88.5
Other	50	11.5
<i>Educational level</i>		
Baccalaureate/Graduate degree	123	28.3
Other	312	71.7
<i>Occupation</i>		
Health sector	13	3.1
Other	417	96.9
<i>Number of children in the household</i>		
1	94	21.8
2	267	61.9
>2	70	16.3
<i>Age of children in the household, in years</i>		
<12	189	43.5
12	92	21.1
>12	154	35.4
<b>Characteristics of the selected child</b>		
<i>Gender</i>		
Male	189	43.4
Female	246	56.6
<i>Vaccinated against HPV</i>		
Yes	252	57.9
No	183	42.1

Number for each item may not add up to total number of study population due to missing value.

\*Mean±Standard deviation (Range).

characteristics of the responders are listed in Table 1. The mean age was 44 years, mothers predominated, only 3.1% of the children had at least one parent who was occupied in the health sector, 56.6% of the parents had children between 12 and 13 years of female gender, and 78.2% had more than one child.

## Knowledge

Overall, the sample was knowledgeable about HPV infection and its vaccination. The vast majority of the respondents (94.4%) reported that they had heard of HPV infection, and, respectively, 84.2% and 74.6% of them knew that both sexes could get the infection and through complete sexual intercourse. In addition, almost three-quarters (73.6%) knew that getting a HPV vaccine was a preventive measure. Overall two-thirds of the parents (66.7%) had heard of HPV infection and knew that the vaccination was a preventive measure. Table 2 reports the results of the multivariate linear and logistic regression models constructed to investigate the role played by the different explanatory variables on the different outcomes of interest. The first model revealed that the variable “child immunized against HPV” was the only significant determinant of the knowledge of HPV infection and that the vaccination was a preventive measure. Parents who had vaccinated their child against the HPV were 3.27 times (95% CI 2.15–4.97) more likely to have this knowledge compared with those who did not vaccinate their child (Model 1).

## Attitudes

When assessing the attitudes toward HPV infection, 63.4% of the parents were concerned that their child could contract the infection. The results related to the usefulness of the vaccination, evaluated through a Likert scale ranging between 1 and 10, allowed to highlight that 88% believed that the vaccination was useful for the prevention of HPV-related cancers with an average value of 8.4. The linear regression model showed that this positive attitude was higher among parents who had heard about HPV infection and knew that the vaccination was a preventive measure, in those who had received information from physicians, in those who needed information on HPV vaccination, in those who had vaccinated their child against the HPV, and were concerned that their child could contract the HPV infection (Model 2 in Table 2).

## Behaviors

Among interviewed parents, the majority (57.9%) had vaccinated against HPV their child and only 6.2% had delayed the administration of a dose of the vaccine. The reasons for the nonvaccination varied, but the most cited included the distance from the vaccination centers, the opening hours of the vaccination centers, and that they had not received any recommendation from the physician to vaccinate their child. Moreover, 56.7% of those who had not vaccinated against HPV their child indicated that they intended to do it.

## Hesitancy

One-third of the survey respondents (33.3%) were hesitant toward anti-HPV vaccination with a total PACV score  $\geq 50$ . The median total PACV score was 41.6. The distribution of the responses for each item on the PACV is presented in Table 3. Overall, almost half were concerned that HPV-vaccine might not prevent the disease (49%) and 41.8% and 49.2%, respectively, were concerned about serious adverse effects following immunization and that childhood vaccines might not be safe. More than two-thirds of parents were either not sure or agreed that their children were getting too many vaccines and 61.1% were either not sure or agreed that they should get fewer vaccines at the same time. More than two-thirds (69.7%) agreed that they trust the information they received about the HPV vaccine, and the vast majority agreed that they could discuss their concern with the pediatrician (80.7%) although their trust in the children’s pediatrician was very low, reaching an average value of 2.9 on a scale of 0 to 10. The final multivariate logistic regression model, constructed to investigate the factors associated with the hesitancy, showed that four variables were statistically linked to the outcome. Unmarried respondents (OR = 0.44; 95% CI 0.22–0.88), those who had not heard of HPV infection and did not know that vaccination was a preventive measure (OR = 0.59; 95% CI 0.37–0.96), those who did not believe that the vaccination was useful for the prevention of HPV-related cancers (OR = 0.69; 95% CI 0.61–0.78), and those who need information on HPV vaccination (OR = 1.85; 95% CI 1.17–2.93) were more likely to be hesitant (Model 3 in Table 2).

**Table 2.** Results of multivariate logistic and linear analysis to characterize factors associated with the different outcomes of interest.

Variable				
<b>Model 1.</b> Having heard of HPV infection and knew that vaccination was a preventive measure Log likelihood = $-258.30$ , $\chi^2 = 37.16$ (3 df), $p < .0001$	<b>OR</b>	<b>SE</b>	<b>95% CI</b>	<b>p value</b>
Had vaccinated their child against the HPV	3.27	0.7	2.15–4.97	<.0001
Baccalaureate/Graduate degree	1.5	0.36	0.93–2.41	.096
Married	1.4	0.45	0.75–2.64	.289
<b>Model 2.</b> Positive attitude toward the utility of HPV vaccine $F(9.40) = 12.17$ , $R^2 = 21.5\%$ , adjusted $R^2 = 19.7\%$ , $p < .0001$	<b>Coeff.</b>	<b>SE</b>	<b>t</b>	<b>p value</b>
Had vaccinated their child against the HPV	1.19	0.2	5.94	<.0001
Concern that their child could contract the HPV infection	0.17	0.03	5.38	<.0001
Information received from physicians	0.44	0.2	2.23	.026
Had heard of HPV infection and knew that vaccination was a preventive measure	0.42	0.21	2	.046
Need of information on HPV vaccination	0.38	0.19	1.98	.049
Unmarried	−0.52	0.3	−1.74	.082
Baccalaureate/Graduate degree	−0.35	0.21	−1.68	.094
Not occupied in health sector	−0.89	0.54	−1.65	.1
Mothers	0.19	0.22	0.88	.38
<b>Model 3.</b> Parents' HPV vaccine hesitancy Log likelihood = $-225.34$ , $\chi^2 = 75.75$ (7 df), $p < .0001$	<b>OR</b>	<b>SE</b>	<b>95% CI</b>	<b>p value</b>
Did not believe that the vaccination was useful for the prevention of HPV-related cancers	0.69	0.04	0.61–0.78	<0.0001
Need of information on HPV vaccination	1.85	0.43	1.17–2.93	.008
Unmarried	0.44	0.16	0.22–0.88	.021
Had not heard of HPV infection and did not know that vaccination was a preventive measure	0.59	0.14	0.37–0.96	.033
Information received from physicians	0.65	0.15	0.41–1.03	.065
Age in years of children in the household				
12	1*	-	-	-
>12	1.44	0.51	0.72–2.87	.298
<12	1.88	0.64	0.96–3.68	.066

\*Reference category

**Table 3.** Descriptive characteristics of PACV about HPV-vaccine.

Item	Parent response	N (%)
Have you vaccinated your child for HPV-vaccine?	Yes	252 (57.9)
	No	183 (42.1)
Have you ever delayed having your child get a dose of HPV-vaccine for reasons other than illness or allergy?	Yes	19 (6.2)
	No	273 (88.3)
	Don't know	17 (5.5)
How sure are you that following the recommended shot schedule is a good idea for your child?	0–10	2.5 ± 1.89*
If you had another infant today, would you want him/her to get all the recommended shots?	Yes	367 (84.4)
	No	58 (13.3)
	Don't know	10 (2.3)
Overall, how hesitant about HPV-vaccine would you consider yourself to be?	Hesitant	97 (22.3)
	Not hesitant	259 (59.5)
Adolescents get more shots than are good for them	Not sure	79 (18.2)
	Agree	203 (46.7)
	Disagree	127 (29.2)
I believe that many of the illnesses shots prevent are severe	Not sure	105 (24.1)
	Agree	263 (60.5)
	Disagree	91 (20.9)
It is better for my child to develop immunity by getting sick than to get a shot	Not sure	81 (18.6)
	Agree	269 (61.8)
	Disagree	65 (15)
It is better for adolescents to get fewer vaccines at the same time	Not sure	101 (23.2)
	Agree	134 (30.8)
	Disagree	169 (38.9)
How concerned are you that your child might have a serious side effect from HPV-vaccine?	Not sure	132 (30.3)
	Concerned	182 (41.8)
	Not concerned	190 (43.7)
How concerned are you that HPV-vaccine might not be safe?	Not sure	63 (14.5)
	Concerned	214 (49.2)
	Not concerned	80 (18.4)
How concerned are you that HPV-vaccine might not prevent the disease?	Not sure	141 (32.4)
	Concerned	213 (49)
	Not concerned	150 (34.5)
I trust the information I receive about HPV-vaccine	Not sure	72 (16.5)
	Agree	303 (69.7)
	Disagree	31 (7.1)
I am able to openly discuss my concerns about HPV-vaccine with my child's doctor	Not sure	101 (23.2)
	Agree	351 (80.7)
	Disagree	54 (12.4)
	Not sure	30 (6.9)
All things considered, how much do you trust your child's doctor?	0–10	2.9 ± 1.81*

Number for each item may not add up to total number of study population due to missing value.

\*Mean ± Standard deviation.



## Sources of information

Almost all participants (97%) had received information about HPV vaccination. Participants were also asked to indicate sources of knowledge, with the most reported source being health-care provider (63.2%), and the next most popular were Internet and social media (42.1%). When asked about the information needs, less than half (47.2%) considered that they were not sufficiently informed about HPV vaccination and were open to receive further information.

## Discussion

This was the first study designed to provide information on the prevalence of HPV vaccination hesitancy of parents in Italy using the PACV instrument and to identify the related factors. Due to the variability of methods used in reporting hesitancy in the literature, the characteristics of the samples, and the health-care setting where the studies were conducted, it may be difficult to make comparison between the present results and the studies done elsewhere.

A first key finding was that one-third of the surveyed parents were HPV vaccine hesitant and this is consistent with a similar study among parents of children of the same age.<sup>14</sup> A higher result of 48% has been observed in France in a sample of parents of girls aged 11–15 years<sup>21</sup> whereas a lower value of 24.1% was found among parents and/or guardians in Romania.<sup>22</sup> The hesitancy was significantly more common among unmarried parents', less knowledgeable, those who did not believe that the vaccination was useful for the prevention of HPV-related cancers, and who wished to receive more information about this vaccination. The finding that those hesitant were less knowledgeable about HPV is not surprising because one would expect that those non-hesitant would have received at least basic information about the virus and the vaccine. Therefore, educational interventions are imperative in order to improve the parents' knowledge about the HPV infection and the vaccination, considering also that the majority of the sample expressed the need of additional information.

A second key finding was that 57.9% of the parents self-reported that they had vaccinated their children against HPV and 6.2% that they had delayed the administration of a dose of the vaccine. These rates are worrying because the coverage among adolescents remains well below the Italian immunization goals.<sup>2</sup> The coverage was similar to that found in the United States with 54.4% of African American parents of children aged 10–12 years consented this vaccination<sup>23</sup> and 8% of parents of 11- to 17-year-old child reported they had “delayed or put off getting” HPV vaccine<sup>24</sup> and in the UK 11% of parents of girls aged 13–17 years delayed.<sup>25</sup> Whereas higher values have been reported in Brazil, where parental acceptance of HPV vaccine was 92% for daughters and 86% for sons<sup>26</sup> and lower values were reported in Serbian population (2%).<sup>27</sup> It is clear that it is very important to understand the reasons why parents delayed or refused to vaccinate their children in order to implement adequate and effective educational program for the successful HPV vaccine coverage. In this investigation, the lack of recommendation by the physicians,

concerns about side effects, and unavailable of the vaccine were the main justifications indicated by participants who have delayed or refused the vaccine. This observation is in agreement with data reported from previous studies.<sup>16,24,28,29</sup> The results demonstrate that health-care professionals, and specifically primary health-care providers, responsible for delivery of childhood vaccination and for providing adequate information to parents, are encouraged to inform parents more effectively about the importance and the safety of the vaccination to reduce the burden of HPV infection-related cancers. Moreover, these findings may be useful for policy makers and health-care managers to better target the vaccination programs, since it is well established that the success of these programs depends on the provision of health-care services.

A third key finding was the evaluation of participants' level of knowledge and attitudes. A concerning result from the present study was the lack of knowledge with only two-thirds knew the HPV infection and the vaccination and almost three-quarters knew that getting a HPV vaccine was a preventive measure. Knowledge gaps regarding the vaccine have been reported in most investigations. For instance, in the United States, 77.3% were aware that the vaccine can prevent HPV-related cancers<sup>30</sup> and in the already mentioned experience in Serbia 71% knew the vaccine.<sup>27</sup> Whereas, lower values were found among parents in the United States with slightly less than 50% correctly answered knowledge items<sup>31</sup> and even less among Chinese parents (38.3%)<sup>32</sup> and Korean American (31.4%)<sup>33</sup>. This finding highlights the need of implementing public educational campaigns on vaccination. Regarding the attitudes, 88% of parents considered the vaccination useful in order to prevent the HPV diseases. Similar results have been observed in the United States (80.4%)<sup>30</sup> and in Italy (71.2%).<sup>34</sup> It should be underlined that the positive beliefs regarding the perception of HPV vaccine usefulness are a relevant finding because it emphasizes that parents understand the importance of preventive measures for the neoplastic diseases that rarely affect the adolescent population.

A fourth key finding was the evaluation of the results from the multivariate regression analysis. Parents who self-reported that they had vaccinated their child against HPV were more likely to know the infection and its vaccination. This characteristic has been already underlined in the previous research among parents in Thailand, where participants with greater knowledge had higher acceptance of the HPV vaccination.<sup>35</sup> Moreover, several studies among different groups showed that the knowledge of HPV infection was associated with the willingness to vaccinate their children.<sup>8,36,37</sup> It should be noted that among the socio-demographic characteristics, only marital status resulted significantly associated with the vaccine hesitancy, since those unmarried were more likely to be hesitant. This observation may be explained by the fact that the mothers, without the support of the husbands, might have difficulty in vaccinations' choice and, therefore, be more hesitant. Furthermore, those who had not heard of HPV infection and its vaccination and those who did not consider the vaccination useful for the prevention of HPV-related cancers were more likely to be hesitant. The important role of the level of knowledge has been already reported.<sup>29,38</sup> In addition, it was found that parents who needed information

were more likely to be hesitant. These results support the existing literature, regarding a relationship between needing more information and being hesitant.<sup>24</sup> Having correct and complete information is necessary to understand the importance of HPV vaccination, mainly for those with a difficult access to evidence-based information.

A fifth key finding was that almost all parents received information about HPV vaccination from a myriad of sources but overwhelmingly through health-care providers. Health-care professionals have an important role since they must reassure vaccine hesitant parents regarding the safety of the HPV vaccine, and offered to discuss with them further if they had any concerns. Such important role is underlined by the result that parents who had received information from a physician were more likely to consider this vaccination useful for the prevention of neoplastic HPV diseases. Interestingly, information from physicians, despite the association was not significant, has an impact on vaccination hesitancy, since parents informed by them showed lower hesitancy. Therefore, this finding suggests that physicians are considered influential as an advice source and provides further evidence on the importance and utility of their recommendation as a key determinant of HPV vaccination compliance. This is in accordance with previous research that has demonstrated the important role that health-care providers play in patients' health-care decisions.<sup>17,39</sup> However, it should be noted that respondents identified as one of the main reasons for having not vaccinated their child the fact that a physician had not previously recommended the vaccination. Reducing this perceived barrier may be important for ensuring that parents who desire to vaccinate their children actually receive the vaccine. Furthermore, almost half of the parents interviewed reported that they would have liked to receive comprehensive information about vaccination. Efforts are necessary to increase provider-patient communication and educational initiatives about HPV infection and its vaccine in parents with children in order to achieve a high rate of vaccination coverage.

## Limitations

The results of this study should be interpreted in the context of the following methodological limitations that may impact the interpretation of these findings. First, this was a cross-sectional study and, therefore, it was possible only capture the associations between several variables and temporality and causal inference cannot be established, which prevents drawing definitive conclusions about the direction of relations between the different outcomes related to HPV and its determinants. Second, the sample was selected in a geographic area. Thus, the specific context of place could limit the generalizability of the findings and, therefore, these results might not reflect knowledge, attitudes, and behaviors of parents of the entire country. Third, the data came from the participants themselves and confirmatory of vaccination status was not obtained from medical records, thus the information may not accurately reflect what the parent experienced and may be subject to recall bias. However,

since the children in this study were vaccinated no later than 1 year prior to the baseline questionnaire, the probability that their parents do not remember or were unsure whether or not the HPV vaccination has been performed is less likely to occur. Fourth, social desirability bias may have affected parents' responses and it is likely that not all provided an accurate response, though it was attempted to limit this bias to the extent possible by keeping surveys anonymous. Despite these limitations, this survey provides important insight for providers who rely on parental reports of child's vaccination status.

In conclusion, communication and education strategies must be undertaken as part of a targeted vaccination program to ensure that parents are fully informed and it is essential that health-care professionals provide materials with details regarding the risk of acquiring a HPV infection and vaccine efficacy.

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