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Original article

Getting Human Papillomavirus Vaccination Back on Track: A National Survey

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A B S T R A C T

Purpose: Adolescent human papillomavirus (HPV) vaccine uptake in the United States dropped during the COVID-19 pandemic due to a decrease in well visits. This study sought to identify opportunities for primary care professionals (PCPs) to get adolescent vaccination back on track.
Methods: In early 2021, we recruited 1,047 PCPs (71% physicians) who provided adolescent vaccines in the United States from an existing panel. Participants completed an online survey about changes in adolescent HPV vaccine uptake and actions taken to promote vaccination during the pandemic, as well as intentions to engage in activities to increase adolescent vaccination in the next 3 months.
Results: A substantial proportion of PCPs (43%) reported that HPV vaccine uptake decreased in the first year of the pandemic; few (7%) PCPs reported an increase in uptake. PCPs reporting increased uptake were more likely to have used nurse-only vaccination visits, held drop-in and drive-through vaccination clinics, and used telehealth visits to recommend vaccination (all $p < .05$). Nearly two-thirds (62%) of all PCPs planned to promote adolescent vaccine uptake in the next 3 months. Planning was more common among PCPs who believed HPV vaccine uptake at their clinics increased during the pandemic, who saw more than 10 adolescent patients per week, who had ever reviewed their clinic's vaccination rates, and were nurses (all $p < .05$).
Discussion: Many PCPs saw HPV vaccination drop during the pandemic. Several interventions could help clinics get HPV vaccination back on track, including increasing the availability of nurse-only vaccination visits and vaccination-only clinics.

IMPLICATIONS AND CONTRIBUTION

Adolescent human papillomavirus (HPV) vaccination dropped during the COVID-19 pandemic. In this survey, reporting increased HPV vaccine uptake among patient panels of primary care professionals was associated with quality improvement activities. Future intent to promote vaccines was associated with routine immunization practices. Concerted national efforts are needed to ensure HPV vaccination is back on track.

Persistent infection with human papillomavirus (HPV) causes six types of cancer (anal, cervical, oropharyngeal, penile, vaginal, and vulvar) and genital warts [1–3]. Numerous studies have demonstrated that HPV vaccines are effective and safe. A recent cohort study of 1.6 million girls and women found that HPV vaccination was associated with an 88% lower risk of invasive cervical cancer [4], and several other studies have demonstrated

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the vaccine's association with lower cancer incidence and mortality [5,6]. Since the introduction of HPV vaccines in the United States, coverage has slowly but steadily risen [7], though it remains well below the Healthy People 2030 target goal of 80% for adolescents aged 13–15 years [8].

The COVID-19 pandemic has hindered patient access to primary care, placing new burdens on providers [9], and disrupting routine adolescent vaccination [10]. As of June 2022, the US Centers for Disease Control and Prevention reported that HPV vaccine orders were down between 9% and 24% in each of the last three years, and state vaccination registry data also show drops for ages 11–12 years [11]. Furthermore, HPV vaccine orders have yet to return to prepandemic levels, meaning that the number of undervaccinated children likely continues to grow. Even once vaccination gets back to prepandemic levels, it will take seven or more years to work through the shortfall, leading to thousands of cases of HPV cancer that would have otherwise been avoided [12].

Primary care holds the greatest promise of getting HPV vaccination back on track. Providers' recommendations remain one of the strongest motivators of HPV vaccine uptake [13]. The current study sought to understand how primary care professionals (PCPs)—including providers, advanced practitioners, and nurses—perceived challenges related to routine adolescent vaccine uptake during the COVID-19 pandemic using a national survey of PCPs. To identify opportunities to get adolescent vaccination back on track, we sought to characterize PCPs' perceptions of routine adolescent vaccine uptake during the pandemic, their efforts to promote vaccination during the pandemic, and their intention to engage in promotional activities for adolescent vaccination in the future.

Methods

Participants

Study participants were PCPs who were members of a standing panel developed by Sermo using digital ads, marketing emails, and referrals. Participants were eligible for inclusion in our study if they (1) were US physicians, physician assistants, nurse practitioners, or nurses, (2) provided primary care to adolescents between the ages of 11 and 17 years, and (3) were not from the state of Vermont due to local policies prohibiting inclusion. The response rate was 61% among physicians and 41% among physician assistants, nurse practitioners, and nurses (American Association for Public Opinion Research response rate 4). A total of 1,055 PCPs completed the survey. We excluded 8 PCPs who saw no adolescent patients during a typical week, resulting in an analytic sample of 1,047 participants.

Procedures

The survey company emailed an invitation and, if necessary, two reminders to panel members in February and March 2021. Survey participants provided informed consent, completed the survey online, and received up to $80 for survey completion. The online survey allowed participants to participate confidentially, and we stored data anonymously so that responses could not be tied to individual participants. The University of North Carolina Institutional Review Board approved the study protocol.

Measures

Our survey included 18 questions focused on getting adolescent vaccination back on track. The survey began with introductory language defining "adolescents" as patients between the ages of 11 and 17 years, and "clinics" as the practice where the respondent spent the majority of their time providing medical care. To help understand overall clinical practice among respondents, the survey first assessed their awareness of adolescent HPV vaccination rates at their own clinic, asking respondents to report the last time they viewed their clinic's coverage (within 1 month, 2–3 months, 4–6 months, 7–12 months, >12 months, have not seen, or not sure). The survey also assessed which vaccines providers routinely recommended at the respondent's clinic, including HPV vaccine and Tdap booster vaccine.

To measure the extent to which PCPs believed that adolescent vaccination rates had changed, the survey next assessed respondents' perceptions on clinic-level vaccination coverage and frequency of recommendations at the time of the survey compared to before the COVID-19 pandemic. For questions on perceived vaccination uptake, we recategorized responses as lower, same, and higher from a five-point response scale that ranged from "a lot lower" to "a lot higher." A response of "I am not sure" was recoded as "same." For questions on perceived recommendation frequency, we recoded responses as less often, as often, and more often from a 5-point response scale that ranged from "a lot less often" to "a lot more often."

The survey measured PCPs' perceptions of parents' willingness to participate in routine vaccination at clinics and perceptions about the impact of the lack of enforcement of school vaccination requirements on routine vaccine uptake. Two items focused on the role of parents in vaccination during the pandemic. One asked respondents to estimate the percentage of parents willing to bring adolescents to the clinic for routine vaccination during the COVID-19 pandemic, and another asked about parents' perceived lack of safety in the clinic and how these factors might act as a potential limitation to adolescent vaccine uptake. Two additional items assessed lack of enforcement of school vaccination requirements for adolescent vaccination and the lack of enforcement around sports physicals as a potential reason for limited adolescent vaccination at the respondent's clinic. The 4-point response scale for these items ranged from "not at all" (coded as 1) to "a lot" (coded as 4).

Lastly, the survey assessed PCPs' perceptions of their clinics' prior and anticipated efforts to encourage adolescent vaccination during the COVID-19 pandemic. One item was about the ways in which the respondent's clinic had encouraged vaccination in the last three months. Regarding COVID-19 safety precautions, two items assessed the extent to which PCPs agreed with the belief that sharing COVID-19 safety precautions with families led to more vaccination appointment scheduling and attendance, with a 5-point response scale that ranged from "strongly disagree" (coded as 1) to "strongly agree" (coded as 5). Another item assessed the regularity with which PCPs believed their clinic shared COVID-19 safety precautions with patients. For respondents who reported their clinic having ever shared COVID-19 safety precautions, two items focused on the type of information and type of messaging used. These items were excluded for respondents who reported that their clinics did not share any COVID-19 safety precautions (see Appendix 1 for the full survey items and response scales). A final item assessed the likelihood of

taking additional action to increase adolescent vaccination delivery in the three months following the administration of the survey, with a 5-point response scale ranging from "not at all" (coded as 1) to "extremely" (coded as 5).

Using measures adapted from Gilkey et al. (2015) [14], the survey included items on PCPs' demographic and professional characteristics, including their training, gender, race, number of years in practice, and number of adolescent patients seen in a typical week. The survey also assessed characteristics of the clinics where PCPs worked. These measures included clinic specialty (family medicine or pediatrics), practice type (solo/group vs. other), whether the clinic was part of a health care system or network, the rurality of the area the clinic served, the US Census region in which the clinic was located, the extent to which the clinic experienced financial strain due to the COVID-19 pandemic, and the proportion of doses provided through the Vaccines for Children program at the clinic.

Statistical analysis

To identify activities associated with increased adolescent vaccine uptake, we used bivariate logistic regression. The respective outcomes were whether their clinic experienced an increase in HPV vaccine uptake and an increase in Tdap booster vaccine uptake since the start of the pandemic. The candidate correlates were activities undertaken at the clinic level to promote adolescent vaccination, including COVID-19 safety precautions and promotion of visits. To identify correlates of intention for engaging in future activities to increase adolescent vaccine uptake, we conducted a multivariable regression analysis. The analysis used a model that included demographic variables that were statistically significant in bivariate correlates with the likelihood to engage in increasing adolescent vaccination activities. The outcome was the likelihood of engaging in activities to promote adolescent vaccination, and the candidate correlates were clinic- and respondent-level demographic factors. We conducted analyses using IBM SPSS, Version 26 (Chicago, IL), two-tailed tests, and a critical alpha of .05.

Results

Participant characteristics

Our sample consisted of physicians (71%; Table 1), physician assistants and nurse practitioners (17%), and nurses (12%). The majority had 10 or more years of experience in practice (76%) and saw 10 or more adolescent patients during a typical week (73%). PCPs worked primarily in clinics focusing on family medicine (64%) or pediatrics (29%). Most served areas that were urban (35%) or suburban (50%), with a smaller portion serving rural populations (15%). More than half worked in clinics that were part of a health care system (56%), and two-thirds (66%) of PCPs reported that their clinics had experienced moderate to high financial strain due to the COVID-19 pandemic. Demographically, nearly half of respondents were women (49%) and most were white (68%); PCPs from all four US census regions were represented in the sample.

Adolescent vaccination coverage

About half of PCPs (46%) reported having seen their clinic's HPV vaccination rates in the past 3 months, and nearly one-third (31%) reported that they had not seen their clinic's HPV vaccination rates in the past year. For HPV vaccination, 43% of PCPs reported that uptake declined, while for Tdap booster vaccination, 41% reported a decline. For both vaccines, only 7% of respondents reported an increase in vaccine uptake since before the COVID-19 pandemic. About half of the respondents reported that uptake remained the same for both HPV vaccination (50%) and Tdap booster vaccination (52%). Common reasons for lower adolescent vaccine uptake included the lack of requirement for school sports physicals (48%) and parents not feeling safe in the clinic (37%). Thirty-nine percent of PCPs said they believed that fewer than half of families in their practice would be willing to bring their children to the clinic for vaccination appointments.

Table 1
Sample characteristics (n = 1,047)

Characteristics	n (%)
Clinic	
Vaccine doses provided through VFC program	
0% of doses	177 (17)
1%–49% of doses	613 (59)
50% + of doses	257 (25)
In a health care system	
No	457 (44)
Yes	590 (56)
Financial strain due to pandemic	
None	36 (3)
A little	324 (31)
A moderate amount	489 (47)
A lot	198 (19)
Rurality	
Urban	363 (35)
Suburban	525 (50)
Rural	159 (15)
Region	
Midwest	247 (24)
Northeast	265 (25)
South	333 (32)
West	202 (19)
Respondent	
Training	
Physician	747 (71)
Physician assistant	46 (4)
Nurse practitioner	131 (13)
Nurse	123 (12)
Specialty	
Pediatrics	299 (29)
Family medicine	669 (64)
Others	119 (11)
Adolescent patients seen per week	
1–9 adolescents	283 (27)
10–24 adolescents	431 (41)
25 + adolescents	333 (32)
Years in practice	
0–9 years	252 (24)
10–19 years	395 (38)
20 + years	400 (38)
Gender	
Female	515 (49)
Male	492 (47)
Non-binary	8 (1)
Prefer not to say	32 (3)
Race	
Asian	170 (16)
Black	41 (4)
White	717 (68)
Other	119 (11)

VFC = Vaccines for Children.

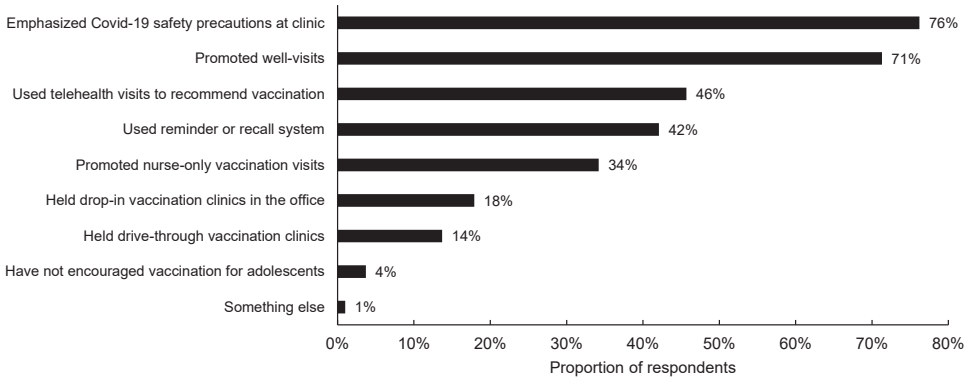

Figure 1. Clinics' previous activities to encourage adolescent vaccine uptake (n = 1,047).

Outreach during the COVID-19 pandemic

Nearly all PCPs (92%) reported that their clinics had engaged in some activity to increase adolescent vaccine uptake during the COVID-19 pandemic, with a median of three activities. The most common activities included emphasizing COVID-19 safety precautions at the clinic (76%), the promotion of well-visits (71%), the use of telehealth visits to recommend vaccination (46%), and the use of reminder or recall systems (42%) (Figure 1). PCPs whose clinics perceived higher vaccine uptake reported more activities compared to those that experienced a drop in uptake or remained the same, for both HPV vaccination (mean [standard deviation] = 2.46 [1.49] vs. 3.03 [1.52], $p < .05$) and Tdap booster vaccination (mean [standard deviation] = 2.45 [1.49] vs. 3.03 [1.53], $p < .05$).

Among PCPs who reported having emphasized COVID-19 safety precautions at their clinic, the majority used both passive (78%) and active (69%) outreach (Figure 2). Safety information available on the clinic's website (58%) and patient portal (52%) were the most common forms of passive outreach reported by respondents, while emails (37%) and phone/video calls (35%) were the most common forms of active outreach.

PCPs who engaged in activities promoting adolescent vaccination were more likely to believe that HPV and Tdap booster vaccine uptake had increased. For both HPV vaccination and Tdap booster vaccination, promotional activities associated with higher uptake were the promotion of nurse-only vaccination visits, use of drop-in vaccination clinics, use of drive-through vaccination clinics (all $p < .05$; Table 2), and use of telehealth visits to recommend vaccination ($p < .01$). For HPV vaccination only, use of reminder systems was associated with perceiving increased uptake as well ($p < .05$).

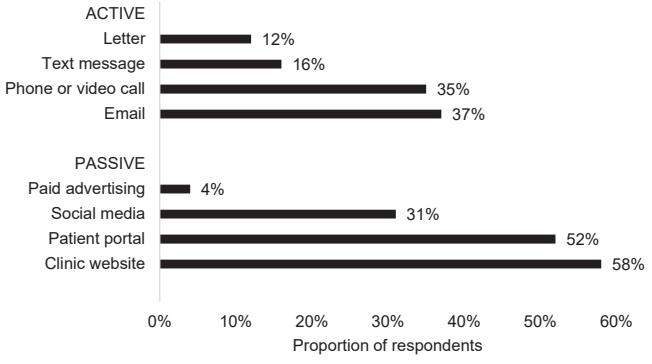

Figure 2. Clinic's outreach to emphasize COVID-19 safety precautions.

Plans to increase adolescent vaccination

Nearly two-thirds of PCPs (62%) were likely to engage in activities to promote adolescent vaccine uptake within the next three months. With respect to clinical characteristics, PCPs who reported an increase in HPV vaccine uptake during the pandemic were more likely to plan future activities to increase vaccine uptake than those whose clinics reported no change in vaccine uptake (81% vs. 58%; adjusted odds ratio [aOR] = 2.19, 95% confidence interval [CI]: 1.16–4.13) (Table 3). Moreover, PCPs who reported having ever viewed their clinics' vaccination rates were also more likely to plan future activities to increase vaccine uptake compared to those who had not viewed the rates (68% vs. 44%; aOR = 2.07, 95% CI: 1.51–2.83).

Regarding respondent characteristics, PCPs who reported seeing 10 or more adolescent patients per week compared to those who saw fewer were more likely to plan future promotional activities to increase vaccine uptake (67% vs. 49%; aOR = 1.41, 95% CI: 1.03–1.92). Nurses were more likely than those with other training to plan future promotional activities for adolescent vaccination ($p < .05$).

Discussion

In our national survey of US PCPs, many reported that their clinic had a decrease in HPV vaccine provision during the COVID-19 pandemic. In contrast, a select few reported an increase in vaccine provision, which was especially common among those that engaged in quality improvement activities. A worrisome finding is that a third of clinics did not plan any HPV promotional activities in the coming months. For the United States to get HPV vaccination back on track, a more concerted effort will be needed nationally.

Table 2
Association of activities to promote adolescent vaccination and perception of higher HPV and Tdap vaccine uptake

Activity	n	Higher HPV vaccine uptake %	Bivariate OR (95% CI)	Higher Tdap booster uptake %	Bivariate OR (95% CI)
Emphasized COVID-19 safety precautions at clinic					
No	249	8	1	9	1
Yes	798	7	.98 (.45–1.69)	7	.85 (.50–1.45)
Promoted well-visits					
No	301	6	1	7	1
Yes	746	7	1.24 (.60–2.20)	7	.88 (.52–1.49)
Promoted nurse-only vaccination visits					
No	689	6	1	6	1
Yes	358	9	1.65 (.99–2.72)*	9	1.74 (1.07–2.85)*
Held drop-in vaccination clinics in the office					
No	860	6	1	6	1
Yes	187	12	2.03 (1.17–3.52)*	12	1.96 (1.14–3.38)*
Held drive-through vaccination clinics					
No	904	6	1	7	1
Yes	143	12	1.81 (.99–3.28)*	12	2.03 (1.12–3.69)*
Used telehealth visits to recommend vaccination					
No	569	5	1	5	1
Yes	478	9	2.23 (1.35–3.68)**	10	2.61 (1.59–4.28)**
Used reminder/recall system					
No	606	5	1	7	1
Yes	441	9	2.03 (1.23–3.34)*	8	1.18 (.73–1.91)

CI = confidence interval; HPV = human papillomavirus; OR = odds ratio.
* $p < .05$.
** $p < .001$.

Most respondents in our survey reported that both HPV and Tdap booster vaccination had either decreased or remained the same in the early months of the COVID-19 pandemic. These findings on PCPs' perceptions about vaccination coverage are consistent with previously published research documenting the decline in vaccine ordering and administration during the early months of the COVID-19 pandemic in the United States [15,16] and decline in coverage among children aged 11–12 years (some national survey data, based on a low response rate, do not show a drop [17]). Any decrease may be explained by the huge impacts the pandemic has had on practices around vaccination, despite the efforts of primary care clinics [18]. Although more than three quarters of PCPs included in the study reported that their clinic emphasized COVID-19 safety precautions through multiple channels, more than one-third also cited parents' perceived unease coming into the clinic as a reason behind lower adolescent vaccine uptake. This is consistent with findings from other studies and reporting [16,19,20] calling for additional efforts to increase vaccination coverage. Nearly half of PCPs also cited the belief that an easing of school requirements of physicals for sports participation played a role in declining vaccination coverage, given that children commonly receive vaccinations at these physicals. This finding highlights the importance of school mandates in supporting pediatric vaccination coverage in United States [21]. Therefore, programs and interventions could focus on renewing enforcement of existing school entry requirements, and potentially increasing immunization requirements in school settings. Currently, only four states and one US territory require HPV vaccination for school entry [22]. While the impact has been mixed [23–26], school entry requirements may be a promising way to increase HPV vaccine uptake when implemented strictly and appropriately [27].

Our national survey identified important opportunities to get adolescent HPV vaccination back on track. With respect to previous activities, those associated with higher HPV and Tdap vaccine uptake in our study—nurse-only visits, drop-in clinics, drive-through clinics, and telehealth visits to recommend vaccination—aimed to increase visit convenience for patients and their families, making it easier for parents to vaccinate their children. Our findings on activities used to promote adolescent vaccination can inform clinic policies and practices in their efforts to reinvigorate adolescent vaccine uptake. Several of these activities can be carried out by nonprovider clinical staff, such as nurses, creating efficiencies on the clinic side as well. As the COVID-19 pandemic has changed the landscape of health care, continued support for and utilization of services such as telehealth is likely to continue beyond the pandemic [28]. Novel approaches in telehealth are promising areas for studies and programs that aim to increase vaccination. Reminder/recall systems were associated with increased HPV vaccine uptake in our study, and are an established cost-effective mechanism to help improve vaccine uptake [29]. While several of these strategies may not be novel, they reinforce the need to continue utilizing proven tactics to promote adolescent vaccination, strategies that may also be applicable in ongoing efforts to vaccinate adolescents against COVID-19 in tandem with other routine vaccines [30].

With regard to future planned activities to promote adolescent vaccination, several individual and clinic-level traits were associated with future intentions. At the clinic level, reviewing vaccination rates frequently was associated with a greater likelihood of engaging in future promotional activities for adolescent vaccine uptake. These results underscore the need for and success of strong investment in routine vaccination services that existed before the pandemic. Thus, practices such as regularly reviewing vaccination rates and using new or more consistent procedures for updating records in the state immunization registry can help increase adolescent vaccine uptake [31]. Our results also highlight the association between the role of nurses with future intention to promote vaccination, indicating an opportunity for nursing professionals to take on a more significant

Table 3
Correlates of being likely to engage in activities to increase adolescent vaccine uptake in the next 3 months (n = 1,047)

	Likely to engage in activities/total respondents in category (%)[a]	Bivariate OR (95% CI)	Multivariable aOR (95% CI)
Clinic			
Change in HPV vaccine coverage during pandemic			
Lower	281/447 (63)	1.21 (.93-1.57)	1.13 (.86-1.49)
No change	308/528 (58)	1	1
Higher	58/72 (81)	2.96 (1.61–5.44)**	2.19 (1.16–4.13)*
Ever reviewed vaccination rates			
No	113/259 (44)	1	1
Yes	534/788 (68)	2.72 (2.04–3.62)**	2.07 (1.51–2.83)**
Number of activities conducted to promote adolescent vaccination during the pandemic	–	1.47 (1.34–1.62)**	1.34 (1.22–1.49)**
Vaccine doses provided through VFC program			
0% of doses	85/177 (48)	1	1
1%–49% of doses	390/613 (64)	1.89 (1.35–2.65)**	1.35 (.94–1.95)
50% + of doses	172/257 (67)	2.19 (1.48–3.25)**	1.52 (.99–2.32)
In a health care system			
No	279/457 (61)	1	
Yes	368/590 (62)	1.06 (.82–1.36)	
Financial strain due to pandemic			
None, or a little	220/360 (61)	1	
A moderate amount	291/489 (60)	.94 (.71–1.24)	
A lot	136/198 (69)	1.40 (.97–2.02)	
Rurality			
Urban	227/363 (63)	1	
Suburban	333/525 (63)	1.04 (.79–1.37)	
Rural	87/159 (55)	.72 (.50–1.06)	
Region			
Northeast	160/265 (60)	1	
Midwest	154/247 (62)	1.09 (.76–1.55)	
South	210/333 (63)	1.12 (.80–1.56)	
West	123/202 (61)	1.02 (.70–1.49)	
Respondent			
Training			
Nurse	98/123 (80)	1	1
Physician assistant or nurse practitioner	108/177 (61)	.40 (.23–.68)**	.48 (.27–.85)*
Physician	441/747 (59)	.37 (.23–.58)*	.52 (.32–.85)*
Specialty			
Family medicine	400/669 (60)	1	1
Pediatrics	199/299 (67)	1.34 (1.01–1.78)*	1.19 (.87–1.62)
Others	48/79 (61)	1.04 (.65–1.68)	1.29 (.76–2.19)
Adolescent patients seen per week			
1–9 adolescents	139/283 (49)	1	1
10 + adolescents	508/764 (67)	2.06 (1.56–2.71)**	1.41 (1.03–1.92)*
Years in practice			
0–9 years	160/252 (64)	1	
10 + years	487/795 (61)	.91 (.68–1.22)	
Gender			
Female	311/515 (60)	1	
Male	308/492 (63)	1.10 (.85–1.42)	
Other	28/40 (70)	1.53 (.76–3.08)	
Race			
White	429/717 (60)	1	
Asian	112/170 (66)	1.30 (.91–1.84)	
Other	106/160 (66)	1.32 (.92–1.89)	

aOR = adjusted odds ratio; CI = confidence interval; HPV = human papillomavirus; OR = odds ratio; VFC = Vaccines for Children.
* $p < .05$.
** $p < .001$.
[a] Outcome is reporting being moderately, very, or extremely likely to engage in activities to increase adolescent vaccine uptake in the next 3 months. Survey conducted March 2021.

role in adolescent vaccination education, communication, and delivery, and for quality improvement initiatives to support them more explicitly. For HPV vaccination in particular, existing research on the role of nurses is relatively limited, though team approaches involving multiple primary care team members in HPV vaccine communication have been shown to be effective [32]. Future research should focus on the role of nurses in this space and their potential to act as vaccine champions.

To our knowledge, our study was among the first to assess the role of PCPs in changes in vaccination coverage during the pandemic and efforts to improve coverage moving forward. Our findings provide valuable insight on the perspectives of PCPs who work in adolescent clinical care on a daily basis. Another strength is the use of data from a large, nationally representative survey that included physicians, advanced practitioners, and nurses. With respect to study limitations, we relied on self-report

when assessing changes in vaccine uptake during the pandemic, engagement in activities to promote vaccine uptake, and plans to continue to engage in promotional activities, all of which are susceptible to recall errors. Estimates for recommendation practices and clinic vaccination coverage may reflect overestimastes or underestimates, though studies show self-report to be reliable for individual PCP estimates of vaccination coverage [33–35]. Moreover, more of our respondents worked in family medicine than in pediatrics. Considering the critical role of pediatric clinics in adolescent vaccination, including HPV vaccination, this perspective may be under-represented in our sample, which included PCPs who served adolescents aged 11–17 as part of a larger project on the shortfall of adolescent vaccines during the pandemic. Our cross-sectional survey does not support causal inference about the influence of providers and clinic characteristics on vaccination. While our survey questions were vetted by a group of experts with relevant expertise, they were not formally evaluated in cognitive interviews due to the rapid nature of survey distribution. Finally, the ability to generalize the findings to later eras in the pandemic remains to be established.

As the COVID-19 pandemic moves into its third year, more sophisticated approaches are needed to ensure that adolescent vaccination gets back on track to avoid a “lost decade” [36]. Considering ways to address vaccination shortcomings experienced during the COVID-19 pandemic—through innovative clinical practice that promotes ease of visits for patients and highlights the strength of nursing and other clinical staff—should be a top priority for getting adolescent health care back on track.

Supplementary Data

Supplementary data related to this article can be found at 10.1016/j.jadohealth.2023.01.004.

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