



Parents' willingness to get human papillomavirus vaccination for their adolescent children at a pharmacy



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ABSTRACT

Pharmacies are promising alternative settings for human papillomavirus (HPV) vaccination because of their accessibility and existing infrastructure for vaccine delivery. We sought to examine parents' willingness to get HPV vaccination for their children at pharmacies. In 2014, we conducted a national, online survey of 1255 parents of 11- to 17-year-old adolescents in the United States. We used multivariable logistic regression to model parents' willingness for getting HPV vaccinations in pharmacies. Overall, 29% of parents would be willing to get HPV vaccine for their children at a pharmacy. Parental willingness was associated with believing that pharmacists are skilled at administering vaccines (OR = 2.05, 95% CI:1.68–2.51), HPV vaccine was at least as important as other adolescent vaccines (OR = 1.48, 95% CI:1.10–1.98), and getting vaccines in pharmacies would give children more opportunities to get health care (OR = 2.17, 95% CI:1.63–2.89). Parental willingness was also more common among parents of adolescents ages 13–17 or who had already initiated the HPV vaccine series. Parents most often indicated that they would like to learn about HPV vaccination in pharmacies from their children's doctor (37%). Offering HPV vaccine in pharmacies may increase uptake as a meaningful number of parents would get the vaccine for their children in these settings. Physician referrals for completing the HPV vaccine series may serve as an important source for increasing awareness of and demand for adolescent vaccination services in pharmacies.

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1. Introduction

An estimated 14 million people are newly infected with human papillomavirus (HPV) in the United States each year (Satterwhite et al., 2013). Persistent infection with oncogenic HPV types results in nearly 30,000 new cases of HPV-associated cancers in men and women annually (Viens et al., 2016). To prevent HPV-associated cancers, the Advisory Committee on Immunization Practices (ACIP) has recommended routine HPV vaccination of children ages 11–12, for girls since 2006 and for boys since 2011 (Markowitz et al., 2014). Despite ACIP's recommendations, among 13- to 17-year-olds, only 42% of girls and 28% of

boys had completed the 3-dose series by 2015 (Reagan-Steiner et al., 2016). These rates are considerably below the national Healthy People 2020 goal of 80% for ages 13–15 (U.S. Department of Health and Human Services, 2014).

Pharmacies are promising alternative settings for HPV vaccination (Shah et al., 2014) because they are highly accessible to U.S. families (Murphy et al., 2012). Americans make about 250 million visits weekly to nearly 60,000 pharmacies nationwide, and these pharmacies are usually closer to their homes than their primary care providers' offices (Bach and Goad, 2015). Other advantages include extended hours of operation and the availability of vaccination services without an appointment (Bach and Goad, 2015). Millions are already taking advantage of this increased access and convenience by getting their vaccinations at pharmacies. In 2011–2012, for example, one major pharmacy chain reported having administered over 6 million vaccinations, of which 30% were provided during off-clinic hours (Goad et al., 2013). Pharmacists administered about 34% of HPV vaccine doses they delivered during off-clinic hours, with patients under age 18 using off-clinic hours for

Abbreviations: HPV, human papillomavirus; ACIP, Advisory Committee on Immunization Practices; NVAC, National Vaccine Advisory Committee; Tdap, tetanus, diphtheria and pertussis; OR, odds ratio; CI, confidence interval; SD, standard deviation.

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vaccination more often than any other age-group. These findings suggest that pharmacies may offer a way of extending our vaccine delivery system so as to address persistently low HPV vaccination rates.

State laws that regulate the scope of practice for pharmacists to administer HPV vaccines are usually one of four types: independent authority, by collaborative practice protocol, by prescription, or not permitted (Brewer et al., 2014). In states where pharmacists have independent authority, pharmacists may administer the vaccine without prior approval from an accredited prescriber (typically a physician). In states with collaborative practice protocol laws, pharmacists may administer the vaccine to patients of a prescriber upon the signing of a supervision agreement with that prescriber. In prescription-only states, pharmacists may administer the vaccine only to adolescents who present a prescription. In some states, pharmacists may not administer the vaccine under any condition. Such a patchwork of state laws greatly restrict pharmacist authority to administer HPV vaccine to age-eligible adolescents.

To address this barrier, the President's Cancer Panel and the National Vaccine Advisory Committee (NVAC) recommended promoting and facilitating HPV vaccination in pharmacies (President's Cancer Panel, 2014; National Vaccine Advisory Committee, 2016). Understanding parents' perspectives on HPV vaccination in pharmacies is an important component of this agenda. Previous studies, limited to parents of boys and conducted prior to ACIP recommendations that boys routinely receive HPV vaccine, indicate that many parents would be comfortable with HPV vaccination in pharmacies (McRee et al., 2013; Reiter et al., 2012). To examine this issue in more depth, we used data from a national survey of parents of vaccine-eligible boys and girls to assess willingness to get HPV vaccinations at a pharmacy. We also sought to identify variables associated with parental willingness and to assess contextual factors such as types of pharmacy preferred.

2. Materials and methods

2.1. Participants and procedures

We conducted an online survey of parents of adolescents between November 2014 and January 2015. Respondents were members of a standing, national panel of U.S. adults maintained by a survey research company (GfK, 2015). The company constructed the panel using list-assisted, random-digit dialing supplemented by address-based sampling. This approach captured households with landline phones, cell phone-only households, and households without telephones. Eligible respondents were parents of an 11–17-year-old child living primarily in their households. Respondents with more than one age-eligible child were instructed to respond with regard to the child with the most recent birthday.

The survey company emailed invitations to a random sample of 2845 panel members. A total of 1760 panel members responded by visiting the survey website, answering an eligibility screener, and providing informed consent. Of these, 1504 parents were eligible and went on to complete the online survey. After accounting for ineligible respondents ($n = 335$) and excluding those who did not complete at least two-thirds of the survey ($n = 14$), the overall response rate was 61%, calculated using the American Association for Public Opinion guidelines for Research Response Rate 5 (American Association for Public Opinion Research, 2008). We excluded respondents who reported on a child who had completed the 3-dose series ($n = 249$) as we sought to estimate willingness among parents of vaccine-eligible children. Our final sample consisted of the remaining 1255 parents.

Prior to fielding, we cognitively tested our survey with 18 parents of adolescents to assess respondent comprehension. We then pretested the survey online with 26 panel members to ensure proper functioning. The survey instrument is available online at http://www.unc.edu/~ntbrewer/surveys/HPV_2014_pharmacy.pdf. The University of North Carolina Institutional Review Board approved the study protocol.

2.2. Measures

Our survey assessed parents' willingness to get vaccines for their adolescent children at a pharmacy with one item: "Imagine that [NAME] needed to get tetanus booster, meningitis, HPV, and flu vaccines. Which of these vaccines would you be willing to get [NAME] at a pharmacy?" Respondents were asked about each of the above mentioned vaccines. For the present study, the outcome was willingness to get HPV vaccine. Respondents also indicated which of the following types of pharmacy they would be willing to use for HPV vaccination: chain pharmacy, pharmacy in a grocery store, pharmacy in a big box store, pharmacy in a clinic or hospital where their child receives medical care, independent pharmacy, or any type of pharmacy.

The survey assessed HPV vaccine doses received with one item: "How many shots of the HPV vaccine has [NAME] had?" We dichotomized responses as none or 1–2 doses. Our survey also assessed receipt of provider recommendation with one item: "Has a doctor or other healthcare provider ever told you [NAME] should get the HPV vaccine?" The survey assessed history of receiving adolescent vaccination in pharmacies with the following item: "Has [NAME] ever received a vaccine at a pharmacy?" For parents who indicated yes, the survey assessed the type of vaccine received.

To assess respondents' belief about who can get vaccination services in pharmacies, the survey asked parents if adults and children as young as age 11 can get vaccinated at the pharmacy where they usually go to get prescription medications for their children. The survey also asked parents how they would like to find out about HPV vaccination services, if their child's regular pharmacy were to offer the vaccine.

The survey assessed parents' perceptions of pharmacist vaccination skills with seven items: whether pharmacists "can advise parents about the health benefits and risks of getting adolescents vaccinated", "can give vaccines to adolescents as safely as doctors", "can give vaccines to adolescents as safely as nurses", "know what to do if vaccinations cause adolescents to have a minor health problem, like arm soreness", "know what to do if vaccinations cause adolescents to have a major health problem, like an allergic reaction", "have enough time to address questions and concerns about vaccines for adolescents", and "routinely report this information to adolescents' doctors or health care providers". These items had 5-point response scales that ranged from "strongly disagree" to "strongly agree". We averaged the 7 items to create a scale of perceived pharmacist vaccination skills ($\alpha = 0.89$). This decision was supported by the findings of an exploratory factor analysis, which identified a single factor. The analysis used principal component analysis with Promax rotation, followed by examination of the scree plot.

The survey also assessed importance of HPV vaccination with the statement: "I feel that the HPV vaccine for [child's name] is...", accompanied by a 5-point response scale that ranged from "not important" to "extremely important". The survey repeated the same statement for meningococcal and tetanus, diphtheria, and pertussis (Tdap) vaccines. We used these data to evaluate perceived importance of HPV vaccine relative to other recommended adolescent vaccines (Calo et al., 2016). We gave a score of 1 if parents rated HPV vaccine as important as, or more important than, the average score for meningococcal and Tdap vaccines and 0 otherwise. The survey also assessed parents' perceptions regarding care coordination with one item: "Getting [NAME] a vaccine from an immunizing pharmacist would give [HIM/HER] more opportunities to get health care, in addition to the care [NAME]'s doctor gives". This item used a 5-point response scale ranged from "strongly disagree" to "strongly agree".

On demographic characteristics, our survey assessed the sex and age of the child. The survey company provided data on parents' sex, race/ethnicity, and educational attainment. For each household, the company also provided data on annual income and U.S. state of residence. We used the latter data to assess whether respondents live in a state that authorizes pharmacists to administer HPV vaccine to adolescents.

Some states authorize pharmacists to administer HPV vaccine to adolescents but the age eligibility varies and extends from ages 9 to 17. States granting pharmacists' authority to administer HPV vaccine were defined as those where an adolescent could get the vaccine from a pharmacist under a collaborative practice protocol, with a prescription, or without prior approval from a physician.

2.3. Statistical analysis

We used bivariate logistic regression to identify variables associated with parental willingness to get HPV vaccination to their children at a pharmacy. We then entered statistically significant covariates into a multivariable logistic regression model. Statistical tests were two-tailed with a critical α of 0.05. We calculated odds ratios (OR) and 95% confidence intervals (CI). We conducted analyses using Stata Version 13.1 (College Station, TX).

3. Results

3.1. Participant characteristics

About half of parents (52%) were female and the majority were non-Hispanic White (71%) or Hispanic (13%). Forty-six percent of parents answered the survey about a daughter (Table 1). The mean age of children was 14 years. About half of parents (55%) did not report having received a provider recommendation to get their children HPV vaccine, and around two-thirds (64%) had children who had not initiated HPV vaccination. Few children (8%) had ever received a vaccine at a pharmacy. Among the 98 children who had received a vaccine at a pharmacy, 84 received flu vaccine, 5 Tdap booster, 3 HPV vaccine, 1 meningitis vaccine, and 10 another vaccine. A majority of families (61%) lived in states that authorizes pharmacists to administer HPV vaccine to adolescents of a certain age.

Table 1
Sample characteristics ($n = 1255$).

	N	(%)
<i>Child characteristics</i>		
Female	583	(46)
Age, years		
11–12	395	(31)
13–17	860	(69)
Received provider recommendation for HPV vaccine	569	(45)
HPV vaccine doses received		
0 doses	801	(64)
1–2 doses	454	(36)
Ever received a vaccine at a pharmacy	98	(8)
<i>Parent characteristics</i>		
Female	655	(52)
Race/ethnicity		
Non-Hispanic White	888	(71)
Non-Hispanic Black	113	(9)
Hispanic	169	(13)
Other	85	(7)
Education		
High school degree or less	471	(38)
Some college or more	784	(62)
<i>Household characteristics</i>		
Income		
\$0–\$34,999	263	(21)
\$35,000–\$74,999	397	(32)
\geq \$75,000	595	(47)
Region		
Northeast	209	(17)
Midwest	329	(26)
South	430	(34)
West	287	(23)
Resident of state that authorizes pharmacists to administer HPV vaccine to adolescents	767	(61)

3.2. Vaccination skills, perceived access, and preferred information sources

Respondents leaned somewhat towards endorsing pharmacists as skilled at adolescent vaccination (scale mean = 3.40, standard deviation [SD] = 0.76, Table 2). Parents' perceptions that pharmacists know what to do if vaccinations cause a minor problem scored highest (3.62, SD = 0.94), while confidence in proper vaccine dose documentation scored lowest (3.05, SD = 0.90).

In terms of perceived access, more than half of parents (60%) believed that adults can get vaccines at the pharmacy where they usually get prescription medications for their children (Fig. 1). One-third (34%) said that they do not know if an adult can be vaccinated at these pharmacies. On the other hand, less than one-fifth (18%) of parents believed that children as young as 11 can get vaccinated at these pharmacies and nearly three-fourths (70%) did not know. Living in a state that authorizes pharmacists to administer HPV vaccine to adolescents was not associated with respondents' belief that children can get vaccines at the pharmacy.

Regarding information sources preferred by parents, more than one-third (37%) said that they would like to find out about pharmacy provision of HPV vaccine through a conversation with their child's doctor. Respondents less often endorsed other sources, such as a sign in the pharmacy (25%), a letter home from the pharmacy (23%), or a conversation with a pharmacist (22%).

3.3. Willingness to vaccinate at a pharmacy

Parents were most willing to get flu vaccine (62%) for their children at a pharmacy. Less than half of parents indicated willingness to get their children Tdap booster (41%) or meningococcal vaccine (33%). Twenty-nine percent of parents would be willing to get HPV vaccine for their adolescent children at a pharmacy. Among willing parents, almost one-third (30%) would be willing to have their children receive all three HPV vaccine doses at a pharmacy.

Parents more often reported that they would be willing to get HPV vaccine at a pharmacy for an older child (ages 13–17 versus 11–12: OR = 1.61, 95% CI:1.19–2.18) or a child who had initiated HPV vaccination (OR = 1.45, 95% CI:1.07–1.95) in multivariable analyses (Table 3). Willingness was also higher among parents who thought pharmacists were more skilled at providing vaccines (OR = 2.05, 95% CI:1.68–2.51), that HPV vaccine was at least as important as other adolescent vaccines (OR = 1.48, 95% CI:1.10–1.98), or that getting vaccines in pharmacies would give children more opportunities to get health care (OR = 2.17, 95% CI:1.63–2.89). In bivariate but not multivariate analyses, parents' willingness was associated with their child having received a vaccine in a pharmacy (OR = 1.64, 95% CI:1.07–2.52).

Among the 360 parents who would be willing to get their children HPV vaccine at a pharmacy, most (80%) indicated that they would go to a chain pharmacy (Fig. 2). Smaller proportions of these parents reported that they would take their children to a pharmacy located in a

Table 2
Parents' beliefs about pharmacist vaccination skills ($n = 1255$).

	Mean (SD)	Factor loading
Give advice about the health benefits and risks of adolescent vaccination	3.57 (0.94)	0.78
Give vaccines to adolescents as safely as doctors	3.49 (1.01)	0.88
Give vaccines to adolescents as safely as nurses	3.53 (1.00)	0.86
Know what to do if vaccinations cause a minor problem	3.62 (0.94)	0.82
Know what to do if vaccinations cause a major problem	3.30 (1.04)	0.82
Have enough time to address questions and concerns about vaccines	3.22 (1.04)	0.78
Report vaccine dose administration to adolescents' doctors or health care providers	3.05 (0.90)	0.43

NOTE. Items had 5-point response scales that ranged from "strongly disagree" to "strongly agree". Seven-item scale mean = 3.40 (SD = 0.76); Cronbach's alpha = 0.89.

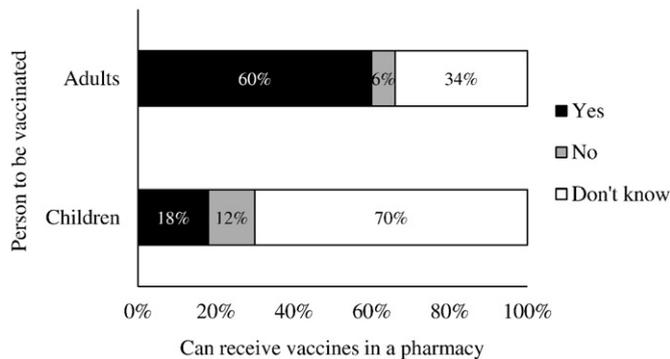


Fig. 1. Parents' belief about who can receive vaccines in a pharmacy ($n = 1255$).

clinic or hospital (43%), an independent pharmacy (40%), big box store (39%), or grocery store (36%) for HPV vaccination. One-fourth (25%) of these parents would take their children to any type of pharmacy.

4. Discussion

In our national survey, a meaningful proportion (29%) of parents of vaccine-eligible adolescents reported that they would get HPV vaccine for their children at a pharmacy. In this way, our findings support the recommendations of the *President's Cancer Panel* (2014) and the *National Vaccine Advisory Committee* (2016), which have endorsed expanding HPV vaccine provision in pharmacies. Extending HPV vaccine delivery to alternative settings is needed because fewer adolescents, compared to younger children, access the medical system for getting preventive care services (*National Vaccine Advisory Committee*, 2008). Furthermore, given the suboptimal use of HPV vaccine by adolescents in the United States, venues outside of, but in coordination with, primary care practices must be considered to reach national HPV vaccination goals (*President's Cancer Panel*, 2014).

The role of parents' belief that getting vaccines in pharmacies would give their children more opportunities to get health care was a novel finding. As many adolescents do not get HPV vaccine through regular medical visits (*Brewer et al.*, 2011; *Viens et al.*, 2016), pharmacies can become ideal destinations for parents seeking solutions for their children vaccination needs. We also found that parents of adolescents who already received the first or second dose were more willing to get HPV vaccinations at a pharmacy. Given that vaccination recommendations in the United States at the time of the study called for three doses (*Meites et al.*, 2016), making the vaccine available at pharmacies may increase the likelihood that adolescents complete the series (*Brewer et al.*, 2014). Our finding that parents who believed HPV vaccine was as or more important than other adolescent vaccines were more willing to get the vaccine for their children at a pharmacy suggests that normalizing HPV vaccine may increase demand for this vaccine in pharmacies. Furthermore, because routine concomitant vaccination has been associated with increased HPV vaccine uptake (*Moss et al.*, 2016), pharmacies that offer the adolescent vaccine platform may improve vaccination coverage. Parents of older adolescents, ages 13–17, were also more willing to get HPV vaccine for their children at a pharmacy, an important finding because this population is overdue for HPV vaccination. It was also encouraging to find no evidence of disparities in who would get HPV vaccination for their children at a pharmacy, such that no differences in willingness were noted by socioeconomic status, race/ethnicity, and child's sex. In this way, pharmacies may be well positioned to reach diverse populations, thereby maximizing coverage among high priority populations.

We found that parents' willingness to get HPV vaccination for their children at a pharmacy was associated with perceiving pharmacists to be skilled at administering vaccines. Our finding is in line with prior research exploring patients' perceptions of pharmacist vaccination skills

providing routine and travel vaccines to adults (*Bounthavong et al.*, 2010) and flu vaccines to children (*Deshpande et al.*, 2013). Although the literature reports that parents have generally positive attitudes towards pharmacists as providers of vaccines to children (*Deshpande et al.*, 2013), many are not aware of the vaccination practice competencies of pharmacists (*Shah et al.*, 2016). *Reiter et al.* (2012), for example, reported that one of parents' major concerns about HPV vaccination in pharmacies is the training of staff administering the vaccine. This concern is not supported by current pharmacy practice as many pharmacies in the United States are staffed with pharmacists who are well trained to administer vaccines (*Rothholz and Tan*, 2016). The American Pharmacist Association's Pharmacy-Based Immunization Certificate Training Program has trained more than 280,000 pharmacists to administer vaccines across the lifespan, including adolescent vaccines (*Bach and Goad*, 2015). With regard to specific skills, we found that confidence in proper documentation was especially low among respondents. Our finding is consistent with a previous study that reported that many parents were concerned about getting HPV vaccination outside of primary care practices because they do not know if their children's doctors would keep track of these vaccines (*Reiter et al.*, 2012). Addressing this concern would require that vaccine providers use their state's immunization information systems or registries to assess their patients' vaccination history and to ensure tracking of series completion, possibly leading for better continuity of preventive care and reducing over- or under-vaccination (*Rothholz and Tan*, 2016). If adolescent vaccination services in pharmacies are to become more common, pharmacies and pharmacist associations may need to educate parents about the vaccination practice skills of pharmacists, including their capacity to retrieve, document, and exchange children's immunization information.

We found that 80% of willing parents would go to a chain pharmacy for HPV vaccinations, twice the number of parents who said they would go to any other type of pharmacy. This finding may reflect greater familiarity with these venues, as chain drug stores share 32% of the market in terms of prescriptions dispensed in the country (*Statista*, 2016). Fewer parents endorsed other types of pharmacies for HPV vaccination, suggesting that outreach might be needed to support HPV vaccine delivery in these settings. Similarly, our finding that 70% of respondents did not know if children as young as 11 can get vaccinated at the pharmacy where they usually get prescriptions further suggests the need to increase awareness of the vaccination services available in these venues. Along those lines, many parents in our study said that they would like to get information about HPV vaccinations in pharmacies through their children's doctors, suggesting that physician referrals may be key to increasing awareness and use of pharmacies for vaccination. Although physician organizations have recommended that patients receive all immunizations in primary care (*American Academy of Pediatrics*, 2002; *American Academy of Family Physicians*, 2013), many pediatricians support collaborative vaccine delivery with alternative settings for school-aged children (*Kempe et al.*, 2012). Collaboration and coordination between pharmacies and primary care, coupled with a strong provider recommendation for HPV vaccination (*Gilkey et al.*, 2016), may increase the likelihood that adolescents complete HPV vaccination within the "medical neighborhood" (*President's Cancer Panel*, 2014; *Rothholz and Tan*, 2016).

In terms of opportunities for future work, researchers should seek to better understand the practical issues surrounding pharmacist provision of HPV vaccinations in actual pharmacies and within the many legal contexts of pharmacist practice authority. For example, research is needed to assess the impact of new or expanded HPV vaccination services on pharmacy workflow, ease of vaccine dose recording and reporting to the state immunization information system, and processes to ensure care coordination with the patient's primary care provider.

4.1. Strengths and limitations

Study strengths include using a large, national sample of parents and having a good response rate. Our study also filled an important gap in

Table 3
Parents' willingness to get HPV vaccination to their adolescent children at a pharmacy ($n = 1255$).

	# of parents who would be willing to get HPV vaccine at a pharmacy/total in category (%)	Bivariate OR (95% CI)	Multivariable OR (95% CI)
Overall	360/1255 (29)		
<i>Child characteristics</i>			
<i>Sex</i>			
Male	199/672 (30)	Ref	–
Female	161/583 (28)	0.91 (0.71, 1.16)	–
<i>Age, years</i>			
11–12	83/395 (21)	Ref	Ref
13–17	277/860 (32)	1.79 (1.35, 2.37)	1.61 (1.19, 2.18)
<i>Provider recommended HPV vaccine</i>			
No	187/686 (27)	Ref	–
Yes	173/569 (30)	1.17 (0.91, 1.49)	–
<i>HPV vaccine doses received</i>			
0 doses	196/801 (24)	Ref	Ref
1–2 doses	164/454 (36)	1.75 (1.36, 2.24)	1.45 (1.07, 1.95)
<i>Ever received a vaccine at a pharmacy</i>			
No	322/1157 (28)	Ref	Ref
Yes	38/98 (39)	1.64 (1.07, 2.52)	1.15 (0.72, 1.84)
<i>Parent characteristics</i>			
<i>Sex</i>			
Male	180/600 (30)	Ref	–
Female	180/655 (27)	0.88 (0.69, 1.13)	–
<i>Race/ethnicity</i>			
Non-Hispanic White	263/888 (30)	Ref	–
Non-Hispanic Black	25/113 (22)	0.68 (0.42, 1.08)	–
Hispanic	44/169 (26)	0.84 (0.58, 1.21)	–
Other	28/85 (33)	1.17 (0.73, 1.88)	–
<i>Education</i>			
High school degree or less	150/471 (32)	Ref	–
Some college or more	210/784 (27)	0.78 (0.61, 1.01)	–
<i>Household characteristics</i>			
<i>Income</i>			
\$0–\$34,999	76/263 (29)	Ref	–
\$35,000–\$74,999	122/397 (31)	1.09 (0.78, 1.54)	–
≥\$75,000	162/595 (27)	0.92 (0.67, 1.27)	–
<i>Region</i>			
Northeast	55/209 (26)	Ref	–
Midwest	86/329 (26)	0.99 (0.67, 1.47)	–
South	136/430 (32)	1.30 (0.90, 1.87)	–
West	83/287 (29)	1.14 (0.76, 1.70)	–
<i>Resident of state that authorizes pharmacists to administer HPV vaccine to adolescents</i>			
No	136/488 (28)	Ref	–
Yes	224/767 (29)	1.07 (0.83, 1.37)	–
<i>Attitudes towards HPV vaccine and vaccination in pharmacies</i>			
<i>Relative importance of HPV vaccine^a</i>			
Less important	171/694 (25)	Ref	Ref
As or more important	189/561 (34)	1.55 (1.22, 1.99)	1.48 (1.10, 1.98)
Pharmacist vaccination skills, scale mean ^b	3.40 (SD = 0.76)	2.43 (2.02, 2.93)	2.05 (1.68, 2.51)
<i>Pharmacist-provided HPV vaccination gives children more opportunities to get health care</i>			
Disagree/neither	179/859 (21)	Ref	–
Agree	181/396 (46)	3.20 (2.47, 4.14)	2.17 (1.63, 2.89)

NOTE. HPV = Human papillomavirus; OR = Odds ratio; CI = confidence interval; Ref = Referent group; NA = Not applicable. Dashes (–) indicate the variable was not included in the multivariable model because it was not statistically significant in bivariate analysis.

^a Relative to Tdap and meningococcal vaccines.

^b Seven-item scale was included in models as a continuous variable; OR is the change in the odds of parental willingness to get HPV vaccine at a pharmacy for every one-unit increase in scale score.

the literature as previous studies on this topic were limited to parents of boys and happened prior to ACIP recommendations that boys routinely receive the vaccine. Study limitations include that the survey asked parents about a hypothetical situation of getting vaccination for their children in a pharmacy, which may not reflect real utilization when offered HPV vaccination services. Although the panel is comparable to the U.S. adult population on many sociodemographic characteristics (e.g., racial/ethnic composition, educational attainment), most survey participants reported somewhat higher household income on average compared to the general population (DeNavas-Walt et al., 2013). Thus, the generalizability of our study findings needs to be established. The survey did not ask about some potentially important issues that

may influence parents' decisions of HPV vaccination in pharmacies, such as out-of-pocket costs if health insurance plans do not recognize pharmacies as medical providers of HPV vaccines, an important area for future research.

5. Conclusions

Almost a third of parents in our national survey said that they would take their children to a pharmacy for HPV vaccination, showing the potential of these venues for increasing HPV vaccine uptake in the United States. Our study is also among the first to identify key variables associated with willingness, and can inform efforts to initiate or expand HPV

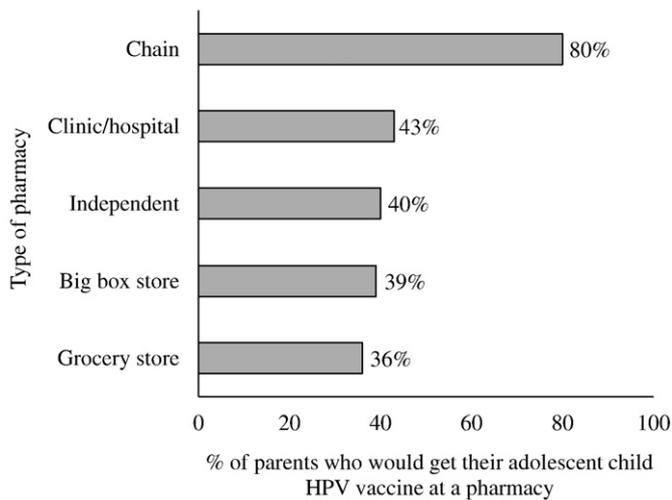


Fig. 2. Parents' willingness to get their adolescent child HPV vaccine at each type of pharmacy ($n = 360$).

vaccination programs in states where pharmacists are allowed to administer the vaccine to adolescents. One of our study's most notable findings is that many parents would like to get information about HPV vaccinations in pharmacies through their children's doctors, highlighting the importance of physician referrals to increasing awareness of and demand for this service. In order to further realize the promise of pharmacies as HPV vaccination settings, pharmacists across the country will need to obtain expanded authority to immunize adolescents, gain in-network status to be reimbursed by private insurance, become Vaccines for Children program providers, and have access to their state immunization registry (President's Cancer Panel, 2014; Brewer et al., 2014; Trogdon et al., 2016).

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Disclosure of potential conflicts of interest

Brewer reports receiving commercial research grants from Merck and Pfizer and is a paid advisory board member for Merck. The other authors of this paper have no financial disclosures or potential conflicts of interest to report.

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