

## Pharmacies versus doctors' offices for adolescent vaccination

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### ABSTRACT

**Purpose:** We sought to understand the relative advantage of pharmacies compared to doctors' offices for delivering HPV vaccination to adolescents.

**Methods:** Participants were a national sample of 1500 U.S. parents of adolescents ages 11–17 recruited in 2014–15. In an online survey, items informed by Diffusion of Innovation Theory assessed parents' perceptions of the relative advantages of HPV vaccine delivery in pharmacies and doctors' offices.

**Principle findings:** Many parents believed doctor's offices offered a better health care environment than pharmacies, with more privacy (77%) and a safer place for vaccination (70%). However, many parents also believed pharmacies were more accessible than doctors' offices, requiring less time for vaccinations (71%) and offering more convenient hours (59%). Parents were more willing to get their children HPV vaccine from pharmacists if they indicated more relative advantages in vaccine delivery in pharmacies ( $\beta = .29$ ;  $p < .001$ ) and believed patient accessibility more important than health care environment ( $\beta = .20$ ;  $p < .001$ ).

**Conclusions:** To be more appealing to parents as HPV vaccine providers, pharmacy providers within community and hospital settings should build on their relative advantage with respect to accessibility and enhance their appeal of their healthcare environment.

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## 1. Introduction

Human papillomavirus (HPV) vaccine coverage in the US has lagged behind two other adolescent vaccines introduced around the same time: tetanus, diphtheria, and acellular pertussis (Tdap) and meningococcal vaccines. To improve HPV vaccine uptake among adolescents, the President's Cancer Panel and the National Vaccine Advisory Committee recommended expanding HPV vaccine provision in pharmacies [1,2]. Pharmacy-located vaccination presents advantages for adolescents over vaccination in traditional medical settings given their convenient locations within communities [3–5], longer operating hours [3], and ability to administer vaccines with no appointment and short wait times

[4]. Past studies have identified why pharmacies may be acceptable to parents as vaccination settings for their children [6–10]. However, no studies have directly compared how parents view important features of vaccine delivery in pharmacies versus doctors' offices.

According to the Diffusion of Innovation (DOI) Theory, widespread adoption of an innovation like pharmacy-located adolescent vaccination depends on five traits: relative advantage, compatibility, complexity, trialability, and observability [11,12]. Among these, relative advantage, “the degree to which an innovation is perceived as better than the idea it supersedes,” is the most important predictor of adoption [11]. Parents may perceive pharmacies or doctors' offices as having relative advantage for vaccine delivery based on important delivery features like safety [6,10] and convenient hours [8,9]. In turn, these relative advantages in vaccine delivery could be viewed as meeting parents' expectations of either patient accessibility or acceptable health care environment.

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The objectives of our study were to characterize how parents perceive relative advantages of vaccine delivery between pharmacies and doctors' offices, and how these perceptions relate to parents' willingness to get HPV vaccine for their children from pharmacists. We proposed three hypotheses based on pharmacies' relative advantages. Parents with positive attitudes about vaccinating their children in pharmacies like the convenience and easy access to vaccination services [8,9]. We hypothesized that, compared to doctors' offices, parents believe pharmacies are superior vaccination settings when considering vaccine delivery features related to patient accessibility (*Hypothesis 1a*). However, parents and adolescents who prefer going to traditional medical settings to get vaccines [6–10] have expressed safety and privacy concerns about alternative vaccination settings like pharmacies [6,10]. Therefore, we hypothesized that compared to doctor's offices, parents believe pharmacies are inferior vaccination settings when considering vaccine delivery features related to the health care environment (*Hypothesis 1b*). Additionally, since parents must account for the strengths or benefits of vaccination in either setting in order to determine if one setting has relative advantage over another, we also hypothesize that parents are more willing to get their children HPV vaccine from a pharmacist if they identify more relative advantages at pharmacies (*Hypothesis 2*). Finally, a parent's preference to vaccinate their child in either a pharmacy or doctor's offices also depends on the utility parents derive from the vaccination features. As such, we hypothesize that parents who place more importance on vaccine delivery features related to patient accessibility are more willing to get HPV vaccine from pharmacists compared to parents who place more importance on features related to the health care environment (*Hypothesis 3*).

## 2. Methods

### 2.1. Data source and procedures

The Adolescent Vaccinations in Pharmacies (AVIP) Study was an online, cross-sectional survey of U.S. parents of adolescents conducted from November 2014 to January 2015. The Institutional Review Board at the University of North Carolina at Chapel Hill approved the study protocol. Informed consent was obtained from all individual participants included in the study. Study participants were members of an existing, national panel of non-institutionalized adults maintained by a survey company [13]. The national panel was created through probability-based sampling of U.S. households using a combination of random-digit dialing and address-based sampling frames. Eligible respondents were parents of at least one child ages 11 to 17 who lived with them at least half of the time. Parents answered survey items about their children who they identified at the beginning of the survey.

The survey company randomly contacted 2845 parents from a panel comprised of members from all 50 states and the District of Columbia. About 14% ( $n = 391$ ) of invited panelists were not eligible to complete the survey based on a screener that verified they had at least one child aged 11 to 17. Of the 2454 eligible parents, 1518 completed some portion of the survey. After we excluded 14 panelists who did not complete at least two-thirds of the survey and four panelists who did not complete our study's variables of interest, our final analytic sample contained 1500 parents. The response rate was 61% (1,500/2454) based on American Association for Public Research Response Rate Five [14,15]. Participants' sociodemographic characteristics appear in Table 1.

### 2.2. Measures

*Survey item development.* We developed survey items based on previous research among parents, adolescents, and health care pro-

viders [16–20], or adapted items from other sources [21–23]. We cognitively tested the AVIP survey with a convenience sample of 18 local parents of adolescents ages 11 to 17 to ensure the clarity of survey items. We pre-tested the instrument with 26 parents from the national panel (not included in the final sample) to ensure proper survey functionality. The full AVIP survey instrument is available online at [www.unc.edu/~ntbrewer/hpv.htm](http://www.unc.edu/~ntbrewer/hpv.htm).

*Outcome variable.* The outcome of interest for this study is willingness to get HPV vaccine from an immunizing pharmacist. Parents were first prompted with the statement “Imagine you and [child's name] decided to get the HPV vaccine for [him/her].” Parents were then asked “How willing would you be to have [child's name] receive it from an immunizing pharmacist?” Parents indicated the extent of their willingness with a four-point scale ranging from “definitely not willing” [1] to “definitely willing” [4].

*Relative advantages of vaccine delivery by setting.* The survey told parents to “imagine [child's name] needed a vaccine such as tetanus booster, meningitis vaccine, or HPV vaccine. Also imagine these vaccines are available at pharmacies and doctors' offices.” Parents then answered seven questions about whether a pharmacy or doctor's office would be better at a particular vaccine delivery feature. Parents could respond by selecting “pharmacy”, “doctor's office”, or “they're the same”. The seven features were: (1) providing privacy during vaccination, (2) being a safer place for vaccinations, (3) having more welcoming staff, (4) more likely to get vaccinated without an appointment, (5) taking less time for vaccinations, (6) more convenient hours for vaccinations, and (7) telling the cost of vaccines before delivery. The seven items were conceptualized into two broad categories during analysis: “health care environment” consisting of the first three features, and “patient accessibility” consisting of the last four features. Finally, parents were asked “which of these is most important when choosing between a pharmacy and a doctor's office as a place to get [child's name] vaccinated?” Parents responded by selecting the vaccine delivery feature they believed was most important.

We conducted confirmatory factor analysis to evaluate how well the seven delivery feature items loaded onto the two dimensions of “health care environment” and “patient accessibility.” The hypothesized measurement model demonstrated adequate fit (Comparative Fit Index: .94; Tucker-Lewis Index: .91; root mean squared error of approximation: .089) and good internal consistency reliability (health care environment coefficient- $\omega = .76$ ; patient accessibility coefficient- $\omega = .85$ ). We created a relative advantage composite score to get parents' overall ratings of vaccine delivery between pharmacies and doctors' offices. We coded the seven vaccine delivery feature items so that indicating a doctor's office was better was “-1,” a pharmacy and doctor's office were the same was “0,” and a pharmacy was better was “1.” We then summed the seven contrast-coded items and scaled it so that the relative advantage composite score ranged from “-1” to “1.”

*Sociodemographic characteristics.* The survey company provided parent and household demographic characteristics including parent sex, age, race and ethnicity, education, household income, urbancity (“non-metropolitan statistical area” or “metropolitan statistical area”), and U.S. region of residence. The survey included five items about parents' HPV vaccine confidence from the Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) [17]. The survey also assessed what kind of pharmacy parents typically use for their child's prescription medications (“chain pharmacy,” “independent pharmacy,” or “pharmacy in clinic or hospital”), and how many minutes it takes parents to get to that pharmacy. Additionally, the survey assessed how well parents knew the pharmacists at the pharmacy they used (i.e., familiarity). The three-point response scale ranged from “not well at all” (coded as 1) to “very well” (3). For demographic and health characteristics for the parent's index child (reported by the parent), the survey assessed

**Table 1**  
Sample demographic characteristics ( $n = 1500$ ).

	$n$ (%) or mean (SD)
<b>Parent Characteristics</b>	
Sex	
Male	665 (44)
Female	835 (56)
Age	43.9 (7.84)
Race/Ethnicity	
Non-Hispanic White	1058 (70)
Non-Hispanic Black	134 (9)
Hispanic	212 (14)
Other/multiracial	98 (7)
Education	
High school diploma or less	573 (38)
Some college or more	927 (62)
HPV vaccine confidence	3.31 (.72)
Pharmacy type used for child's prescriptions	
Chain pharmacy	1213 (81)
Independent pharmacy	155 (10)
Pharmacy in clinic or hospital	124 (8)
Familiarity (how well parent knew pharmacist)	
Not well at all	905 (61)
Moderately well	478 (32)
Very well	108 (7)
<b>Child Characteristics</b>	
Sex	
Male	761 (51)
Female	739 (49)
Age	14.0 (2.01)
Race	
White	1172 (79)
Black	159 (11)
Other	140 (10)
Ethnicity	
Non-Hispanic	1232 (83)
Hispanic	258 (17)
HPV vaccination status	
0 doses	805 (54)
≥1 dose	694 (46)
Child vaccinated in alternative settings	
No	991 (66)
Yes	509 (34)
<b>Household Characteristics</b>	
Household income	
\$0–\$34,499	328 (22)
\$35,000–\$74,999	468 (31)
\$75,000 or more	704 (47)
Urbanicity	
Non-metropolitan statistical area	234 (16)
Metropolitan statistical area	1266 (84)
Region	
Northeast	261 (17)
Midwest	393 (26)
South	496 (33)
West	350 (23)
Distance lived from pharmacy used for child's prescriptions (minutes in travel time)	11.7 (11.7)
Distance lived from child's doctor's office (minutes in travel time)	17.7 (12.9)

Note. Frequencies for specific characteristics may not total to 1500 participants due to missing responses.

sex, age, race and ethnicity, HPV vaccinations status (“0 doses” or “≥1 dose”), and previous use of an alternative vaccination setting (defined as the child previously vaccinated at a pharmacy, school, or health department).

### 2.3. Statistical analyses

**Analyses.** First, we tested the equality of proportions [24] to identify if the percentage of parents who believed a pharmacy was better at one of the seven vaccine delivery features was different from the percentage of parents who believed a doctor's office was better (*Hypotheses 1a & 1b*). Percentages of parents' responses endorsing a doctor's office or a pharmacy were different if they

deviated from .5 (or 50%) based on the test statistic. Next, we evaluated how parents' willingness to get HPV vaccine from pharmacists varied by the importance parents placed on the seven vaccine delivery features when deciding to get their children vaccinated at either a pharmacy or doctor's office (*Hypothesis 3*). We used a *t*-test to discern if mean willingness differed between the two categories of vaccine delivery features (predictor: “health care environment” versus “patient accessibility”). We then conducted two analyses of variance (ANOVA) to ascertain if mean willingness to get HPV vaccine from pharmacists varied within each category's vaccine delivery features.

Lastly, we evaluated how parents' beliefs about the relative advantages of pharmacies and doctors' offices in adolescent vac-

cine delivery were associated with willingness to get HPV vaccine from pharmacists (*Hypothesis 2*). We examined bivariate associations between parents' willingness to get HPV vaccine with the relative advantage composite score and several other sociodemographic characteristics. All statistically significant correlates were combined in a multiple regression model. In a supplementary exploratory analysis, we evaluated how sociodemographic characteristics of parents and adolescents correlated with the relative advantage composite variable (*Supplemental Table 1*).

*Missing data procedure.* Missing cases for each variable ranged from zero to two percent. We used multiple imputation by chained equations to estimate plausible values for missing data [25], and augmented regression procedures to avoid perfect prediction for incomplete categorical variables [26]. Twenty imputed datasets were generated and merged. We compared regression coefficients using complete case analysis ( $n = 1404$ ) with the imputed dataset ( $n = 1500$ ) as a sensitivity analysis to check for biases (*Supplemental Table 2*). The regression results reported are from the imputed dataset.

All analyses were conducted in Stata 13.1 (College Station, TX). All statistical tests used a two-tailed critical  $\alpha = .05$ . We used Huber-White sandwich estimators to account for possible non-normality in the distribution of the errors in the regression models [27], and report standardized  $\beta$ -coefficients for the multiple regression models.

### 3. Results

#### 3.1. Parents' evaluation of vaccine delivery features

The majority of parents believed doctors' offices offered a better health care environment for adolescent vaccinations, while at the same time believed pharmacies offered better patient access to adolescent vaccinations (*Fig. 1*). Most parents believed doctors' offices were better at providing privacy during vaccination (77%), being a safer place for vaccination (70%), and having more welcom-

ing staff (50%), while very few parents believed pharmacies were better at these features (providing privacy: 3%; safer place: 1%; more welcoming staff: 4%). By comparison, the majority of parents believed pharmacies were better for getting children vaccinated without an appointment (70%), having more convenient hours for vaccination (59%), taking less time for vaccination (50%), and telling the cost of vaccinations before administration (47%), while fewer parents believed doctors' offices were better at these features (no appointment: 17%; more convenient hours 19%; taking less time: 30%; telling the vaccination cost: 18%). All proportion tests showed significant differences between the proportion of parents who selected a doctor's office and the proportion who selected a pharmacy for all seven vaccine delivery features ( $p < .001$ ).

#### 3.2. Importance placed on vaccine delivery features

Seventy-one percent of parents identified vaccine delivery features related to the health care environment as being the most important consideration when choosing between a doctor's office or pharmacy to get their child an adolescent vaccine (*Table 2*). The majority of parents indicated the most important consideration was the safety of the setting (58%), privacy (10%), getting vaccinations without an appointment (10%), and convenient hours (9%). Few parents said the most important considerations were taking less time to get their children vaccinated (6%), explaining vaccination cost before administration (4%), and having welcoming staff (3%).

Forty-four percent of parents were either probably or definitely willing to get HPV vaccine from an immunizing pharmacist (mean = 2.31, SD = .93). Parents who placed the greatest importance on a vaccine delivery feature related to the health care environment had lower willingness to get HPV vaccine for their children from pharmacists (mean = 2.14, SD = .89) compared to parents who placed the greatest importance on a vaccine delivery feature related to patient accessibility (mean = 2.72, SD = .91;  $p < .001$ ). No differences in willingness appeared among parents who selected vaccine delivery features within the health care environment category as

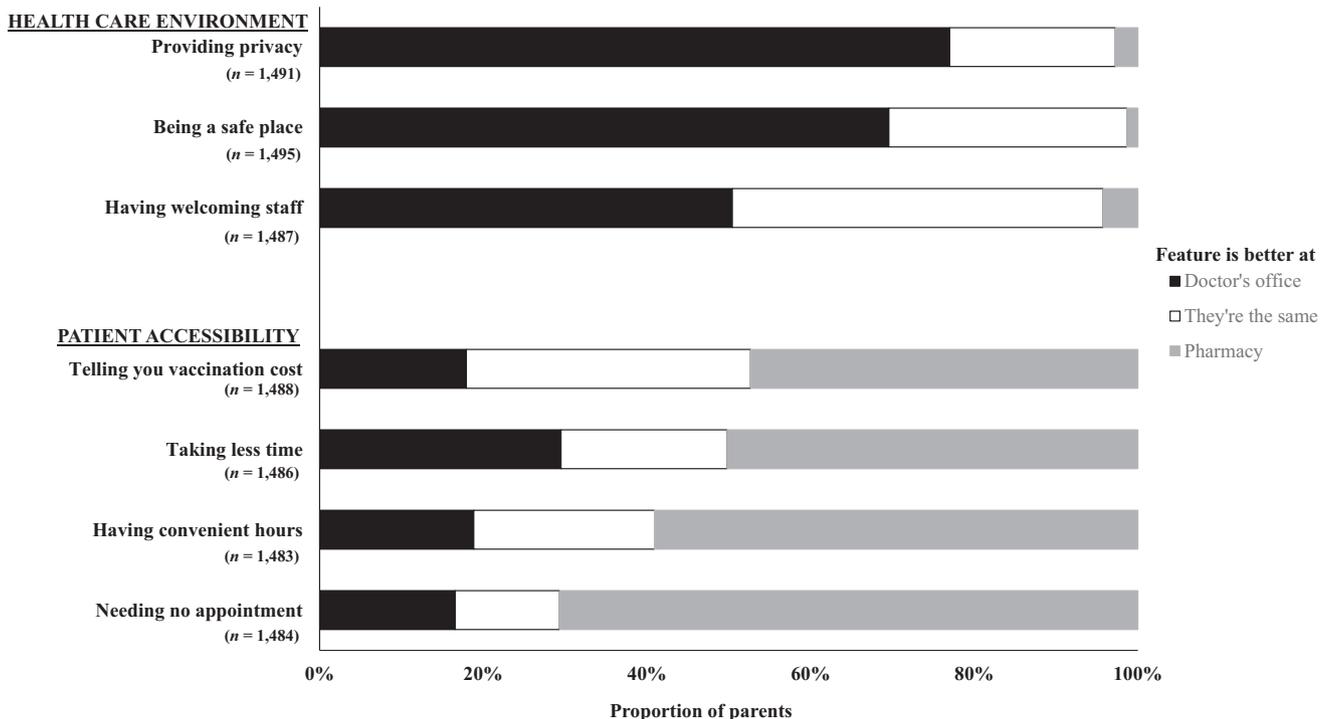


Fig. 1. Parents' evaluation of adolescent vaccine delivery features.

**Table 2**  
Most important vaccine delivery features and willingness to get HPV vaccine from immunizing pharmacists.

Vaccine delivery feature	Said feature was most important, n (%)	Willingness to get HPV vaccine from an immunizing pharmacist, means (SD)
<i>Health care environment<sup>a</sup></i>	<b>1050 (71)</b>	<b>2.14 (.89)</b>
Provide privacy <sup>b</sup>	146 (10)	1.99 (.83)
Safe place <sup>b</sup>	856 (58)	2.17 (.90)
Welcoming staff <sup>b</sup>	48 (3)	2.10 (.81)
<i>Patient accessibility<sup>a</sup></i>	<b>424 (29)</b>	<b>2.72 (.91)</b>
No appointment <sup>c</sup>	143 (10)	2.76 (.99)
Convenient hours <sup>c</sup>	136 (9)	2.69 (.90)
Tells you vaccination cost <sup>c</sup>	59 (4)	2.73 (.81)
Takes less time <sup>c</sup>	86 (6)	2.69 (.88)

Note. Total sample is 1474 parents.

<sup>a</sup> *t*-test was statistically significant ( $p < .001$ ).

<sup>b</sup> One-way ANOVA was not statistically significant ( $p = .08$ ).

<sup>c</sup> One-way ANOVA was not statistically significant ( $p = .90$ ).

their most important considerations ( $F = 2.52$ ;  $p = .08$ ). Similarly, no differences in willingness appeared among parents who selected vaccine delivery features within the patient accessibility category as their most important considerations ( $F = .19$ ;  $p = .90$ ).

### 3.3. Correlates of willingness to get HPV vaccine from pharmacists

Willingness was higher among parents who believed that pharmacies offered more advantages relative to doctor's offices ( $\beta = .29$ ;  $p < .001$ ) or placed greater importance on patient accessibility than the healthcare environment ( $\beta = .20$ ;  $p < .001$ ; Table 3). Willingness

was also higher among parents who were more familiar with their pharmacists ( $\beta = .13$ ;  $p < .001$ ), and had their children previously vaccinated in an alternative setting ( $\beta = .13$ ;  $p < .001$ ). Similarly, willingness was also higher among parents who reported higher HPV vaccine confidence ( $\beta = .09$ ;  $p < .001$ ), had children who had at least one dose of HPV vaccine ( $\beta = .10$ ;  $p < .001$ ), and had children whose race was categorized as other or multiracial ( $\beta = .09$ ;  $p < .001$ ). Finally, willingness was lower among parents who usually went to independent pharmacies for their children's prescription medications ( $\beta = -.06$ ;  $p = .013$ ).

## 4. Discussion

To the best of our knowledge, this is the first study to directly compare parents' beliefs about the vaccine delivery between pharmacies and doctors' offices. Ultimately, the goal in making pharmacy-located adolescent vaccination more appealing to parents is to improve perceptions of pharmacies as a setting that can be trusted in complementing adolescent HPV vaccination. We found evidence that supports our three hypotheses, and that framing the vaccine delivery process in pharmacies in terms of their relative advantages could be a fruitful way to increase parents' interest in pharmacy vaccination services.

Our results illuminate strategies to enhance parents' perception of pharmacies as advantageous places to receive adolescent vaccination. First, pharmacies should stress the range of potential advantages parents currently perceive them to have over doctor's offices to encourage more rapid adoption of pharmacy-located HPV vaccination. These advantages tend to pertain to patient accessibility such as having more convenient hours and vaccinating without appointments. The results track with parents' sentiments about alternative vaccination settings [8,9]. Additionally, parents endorsed these two features the most among those who considered patient accessibility the most important consideration for getting their children vaccines between a pharmacy and doctor's office. Pharmacies that offer adolescent vaccination services should highlight these two aspects of patient accessibility to make the services more appealing to parents.

Second, pharmacies should examine the design of their vaccine provision spaces with an eye toward increasing perceptions of privacy and safety. Our findings showed that parents believed doctor's offices were better at vaccine delivery when considering the health care environment, with safety and privacy as the two most important considerations when choosing between the two locations to get their children vaccinated. Parents' prioritization of these features expand upon their general safety and privacy concerns with alternative settings found in previous studies [6,10]. Pharmacy vaccination in the U.S. is quite varied, with some pharmacies using consultation rooms, exam rooms, and semi-private

**Table 3**  
Correlates of willingness to get HPV vaccine from immunizing pharmacists ( $n = 1500$ ).

	Bivariate analyses $\beta$	Multivariable analysis $\beta$
<b>Care delivery indicators</b>		
<i>Relative advantage composite score</i>	.35***	.29***
<i>Importance placed on vaccine delivery feature related to...</i>		
Health care environment	ref	–
Patient accessibility	.28***	.20***
<i>Familiarity (how well parent knew pharmacist)</i>	.14***	.13***
<i>Child vaccinated in alternative settings</i>		
No	ref	–
Yes	.21***	.13***
<i>Pharmacy type used for child's prescriptions</i>		
Retail chain pharmacy	ref	–
Independent pharmacy	–.05	–.06*
Pharmacy in clinic or hospital	–.05	.01
<b>HPV vaccine indicators</b>		
<i>Parent's HPV vaccine confidence</i>	.16***	.09***
<i>Child's HPV vaccination status</i>		
0 doses	ref	–
$\geq 1$ dose	.12***	.10***
<b>Sociodemographic characteristics</b>		
<i>Parent's age</i>	.06*	.01
<i>Child's age</i>	.09***	.04
<i>Child's race</i>		
White	ref	–
Black	–.04	–.01
Other/multiracial	.09	.09***

Note. Table shows only associations significant in bivariate analyses except for pharmacy type. Variables that were not significant in bivariate analyses: Distance lived from pharmacy, distance lived from doctor's office, primary health care decision maker, parent sex, parent race/ethnicity, parent education, child sex, child's ethnicity, household income, urbanicity, and region of residents.  $\beta$ -coefficients are standardized regression coefficients.

\*  $p < .05$ .

\*\*\*  $p < .001$ .

barriers to provide vaccinations, and other pharmacies offering less privacy. We were unable to illuminate specific details of what parents believe constitutes a safe and private place for vaccinations, but considerations could include a clean space that is well equipped in case of adverse events, or one that accommodates anonymity during vaccination. Investigating these details is a potential avenue for future quality improvement research. Nevertheless, pharmacies that attend to desirable vaccine delivery attributes that are found in doctors' offices, and communicate these attributes to their patients, may improve parents' overall image of pharmacies as a trusted place for broader health care needs.

Third, vaccine marketing efforts should include direct engagement of customers by pharmacists about vaccine delivery options and other healthcare needs. Similar to previous studies [8,10,28], we found that parents' familiarity with pharmacists or having children who have been vaccinated in alternative settings had higher willingness to get their children HPV vaccine from pharmacists. This highlights that trust with vaccine providers in addition to the setting itself are important factors for vaccine decision making. Although research documents high levels of trust in pharmacists in general [29], consumer data show that less than half of patients speak with pharmacists about their medications [30]. Effective communication techniques like being attentive to individuals' perspectives and needs and providing information that enables shared-decision making could aid pharmacists in improving parents' trust in them as adolescent vaccinators [31,32].

Our results suggest these strategies will not only improve parents' perception of pharmacies as vaccine providers, but potentially increase use of pharmacies for adolescent vaccination. Care delivery indicators played the most important role in parents' willingness to get HPV vaccine from pharmacist compared to HPV vaccine or sociodemographic indicators. Following DOI theory [11], willingness was strongly associated with how doctors' offices and pharmacies were perceived by their overall relative advantage in vaccine delivery. What was also striking was how willingness varied based on whether parents placed the greatest importance in vaccine delivery on the health care environment or patient accessibility. Together these two associations show that not only may parents be more likely to adopt pharmacy-located adolescent vaccinations if they perceive there are more relative advantages in pharmacy-located adolescent vaccinations over doctor's offices, but parents may also be more prone to adopt this kind of vaccination service if the relative advantages they see are relevant to their vaccine decision making for their children.

Our study had notable strengths, including a large national sample of parents and novel items comparing the vaccine delivery process between pharmacies and doctors' offices informed by DOI theory. This study was limited by the use of a cross-sectional design, which allowed us to infer associations of parents' willingness to get HPV vaccine from pharmacists, but not the direction of these associations. While this study offers strategies for quality improvement for pharmacy-located vaccination, the generalizability beyond the United States remains to be established because vaccination practices in pharmacies may vary greatly in other countries. Measures were self-reported, which can lead to response bias in survey questions. The interpretation of our findings is also limited by the lack of adolescent and health care provider perspective of the vaccine delivery process, which could strengthen the relevance of our findings for improving pharmacy-based vaccinations. We were also limited in our ability to weight the relative advantages of vaccine delivery by the importance parents placed on each feature in our regression analysis based on our study design. Creating weights that prioritized certain vaccine delivery features over others could have provided more information about the value parents placed on different components of the vaccine delivery process. Future studies could employ contingent valuation

or discrete choice analyses to help illuminate how different combinations of vaccine delivery features may improve parents' adoption of pharmacy-located vaccinations. While the study focused on several provider-level characteristics of vaccine delivery, other features of vaccine delivery maybe important to parents' willingness to get HPV vaccine from pharmacists were not tested, such as potentially prohibitive out-of-pocket costs [33]. Other aspects of DOI Theory may be relevant to pharmacy-based adolescent vaccinations such as "observability" [11] that we were unable to assess in our study. For example, some pharmacists who provide HPV vaccine have reported vaccinating all their eligible employees and own children as a means to publicize and normalize the service to clientele [34].

## 5. Conclusion

Pharmacies present a promising complement to primary care clinics in adolescent HPV vaccination efforts due to their substantial reach within communities. An estimated 250 million visits are made to a pharmacy each week in the United States [35], and around 93% of U.S. residents live within five miles of a pharmacy [36]. In our study, many parents were willing to go to pharmacists for their children's HPV vaccinations, demonstrating at the very least an openness to participating in these programs if they were available. However, to achieve high adoption of pharmacy-based vaccinations, pharmacies must capitalize on their perceived advantages over doctors' offices, such as vaccinating without appointments or having convenient operating hours, while also attending to vaccine delivery features parents believe to be superior at doctors' offices such as safety and privacy during vaccination.

## Potential conflicts of interest

Brewer and Trogon have received independent grants from Merck Sharp & Dohme. Brewer has served on paid advisory boards for Merck.

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## Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.vaccine.2018.04.088>.

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