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Correlates of comfort with alternative settings for HPV vaccine delivery

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Abbreviations: HPV, human papillomavirus

Low uptake of human papillomavirus (HPV) vaccine calls for innovative approaches. Offering the vaccine in settings outside the traditional medical home, such as schools and pharmacies, could increase use. We sought to characterize the acceptability of HPV vaccine delivery in these alternative settings using a national (US) sample of parents of adolescent males ages 11–17 y (n = 506) and their sons (n = 391) who completed our online surveys in Fall 2010. We used multivariable regression to identify correlates of parents' and sons' comfort with (i.e., acceptability of) alternative settings. Half of parents (50%) and over one-third of sons (37%) reported that they were comfortable with schools or pharmacies as locations for the sons to receive HPV vaccine. Parents and sons were more comfortable with HPV vaccination in alternative settings if the sons had not recently visited their health care providers or had previously received vaccines at school, or if parents and sons were comfortable talking with each other about new vaccines. Parents who perceived greater barriers to HPV vaccination were more comfortable with alternative settings, as were sons who perceived that their peers were more accepting of HPV vaccine (all $p < 0.05$). Offering HPV vaccine in alternative settings may increase vaccination, especially among hard-to-reach adolescents. For example, our results suggest that offering the vaccine in alternative settings to boys who had not had recent health care visits could increase uptake by more than 10%. Study findings also highlight factors that should be addressed to maximize the potential success of HPV vaccination programs.

Introduction

Since 2006, US guidelines have recommended routine administration of human papillomavirus (HPV) vaccine to 11 or 12 y old females with catch-up vaccination through age 26.[1] In 2011, guidelines expanded to recommend routine administration to males ages 11 or 12 with catch-up vaccination through age 21.[2,3] Despite professional recommendations and moderately high acceptability of HPV vaccine among parents,[4,5] as of 2010, only 49% of 13–17 y old females and just 2% of males have received at least one dose of HPV vaccine.[6,7] The recommendation for routine administration to males may decrease this marked gender disparity in uptake. However the continued modest uptake among girls, even after 6 y of recommendations for routine vaccination, suggests that innovative approaches to increasing use are warranted. This may be particularly important for older boys who have lower rates of preventive services use than girls.[8]

HPV vaccine administration in settings beyond the traditional medical home, such as schools and pharmacies, has the potential to effectively augment vaccine delivered in more traditional settings.[9] Schools may be an effective way of reaching low-income youth and others who may have limited access to care.[10] School-located vaccination has been successful in generating broad HPV vaccination coverage in other countries.[11,12] Although most school-based health centers in the US offer some form of vaccination, including HPV vaccine,[13] school-based health care is not widely implemented and varies by state. Pharmacies may also help improve HPV vaccination rates as they have for some other vaccines.[9,14] All 50 states allow pharmacists to vaccinate adults, and about half allow some form of adolescent vaccination.[15]

Although alternative settings hold promise, little research has examined parent attitudes about adolescent immunizations in settings outside the medical home, with few of these studies focusing specifically on HPV vaccine.[16,17] Further, little research on HPV vaccine delivery in alternative settings has included adolescent perceptions despite evidence that adolescents are involved in decisions about whether to get vaccinated against HPV.[18] We previously reported that parents and their adolescent sons most preferred for sons to receive HPV vaccine in a doctor's office, although many were comfortable with school- and pharmacy-located vaccination.[19] However, information on correlates of acceptability is currently lacking, yet sorely needed, if we are to maximize vaccination in these alternative settings. The present study used data from a national sample to identify correlates of

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Table 1. Characteristics of parents (n = 506) and their adolescent sons (n = 391)

	n	(%)
Parent Characteristics		
Sex		
Female	271	(53.6)
Male	235	(46.4)
Age		
< 45 y	309	(61.1)
≥ 45 y	197	(38.9)
Race / Ethnicity		
Non-Hispanic White	340	(67.2)
Non-Hispanic Black	62	(12.3)
Hispanic	78	(15.4)
Other race/ethnicity	26	(5.1)
Education		
High school degree or less	223	(44.1)
Some college or more	283	(55.9)
Marital status		
Divorced, widowed, separated, never married	91	(18.0)
Married or living with a partner	415	(82.0)
Son Characteristics[a]		
Age		
11–12 y	119	(30.4)
13–15 y	149	(38.1)
16–17 y	123	(31.5)
Race / Ethnicity		
Non-Hispanic White	240	(61.4)
Non-Hispanic Black	48	(12.3)
Hispanic	63	(16.1)
Other race/ethnicity	40	(10.2)
Saw a health care provider in past year		
No	105	(20.8)
Yes	401	(79.3)
Household characteristics		
Annual household income		
< $60,000	253	(50.0)
≥ $60,000	253	(50.0)
Urbanicity		
Rural	85	(16.8)
Urban	421	(83.2)
Region of residence		
West	107	(21.2)
Midwest	122	(24.1)
Northeast	108	(21.3)
South	169	(33.4)

[a]Data collected during parent survey, but we report data only for those sons who completed their own surveys. Sons who completed surveys were similar to non-completers on these characteristics (all p > 0.05).

parents' and sons' comfort with sons receiving HPV vaccination in alternative settings.

Results

Most parents were younger than 45 y old (61%), non-Hispanic white (67%) and married (82%; **Table 1**). About half of parents were female (54%) and had at least some college education (56%). Around one-third each of participating sons were ages 11–12 (30%), 13–15 (38%) and 16–17 (32%), and 21% of sons had not seen a health care provider for a preventive visit in the previous year.

Sons perceived moderate levels of peer acceptance of HPV vaccine (mean = 3.03, SD = 0.60) but also moderate levels of potential embarrassment if they got vaccinated against HPV and their friends found out (mean = 3.00, SD = 1.00). In general, parents and sons had moderate to high levels of comfort talking with each other about new vaccines (parents: mean = 4.35, SD = 0.79; sons: mean = 3.60, SD = 1.06), and about 1 out of 6 sons (14%) had previously received vaccines at school.

Half of parents (50%, 254/506) and over one-third of sons (37%, 143/391) reported that they were comfortable or very comfortable with either school or pharmacy-located HPV vaccination. Both parents and sons were moderately comfortable with sons receiving HPV vaccine in alternative settings (parents: mean = 2.89, SD = 1.14; sons: mean = 2.59, SD = 1.08). Sons' comfort was positively correlated with their parents' comfort ($r = 0.50$, $p < 0.001$), though parents were on average slightly more comfortable with alternative settings than sons (mean difference = 0.30, $t(390) = 5.34$, $p < 0.001$).

Correlates of parents' comfort. In multivariable analyses, parents were more comfortable with vaccination in alternative settings if they lived in the southern region of the US (compared with the western region, β = 0.13), if their sons had not seen a health care provider in the past year (β = 0.09), or if their sons had previously received vaccines at school (β = 0.17; **Table 2**). Parents were also more comfortable with alternative vaccination settings if they reported greater comfort talking with their sons about new vaccines (β = 0.08) or perceived greater barriers to getting their sons vaccinated against HPV (β = 0.10). Parents were less comfortable with their sons receiving HPV vaccination in alternative settings if they had higher levels of either uncertainty about HPV vaccine (β = -0.17) or anticipated regret if their sons got vaccinated and fainted (β = -0.16).

Correlates of sons' comfort. In multivariable analyses, sons were more comfortable with vaccination in alternative settings if they were Hispanic (as compared with non-Hispanic white; β = 0.14), lived in an urban area (β = 0.17), or had not seen a health care provider in the past year (β = 0.11; **Table 3**). Compared with sons who had never received vaccines at school, sons who had either previously received vaccines at school or didn't know if they had were more comfortable with alternative vaccination setting (β = 0.13 and β = 0.12, respectively). Sons were also more comfortable with alternative vaccination settings if they were more comfortable talking with their parents about new vaccines (β = 0.13) or perceived that their peers were more accepting of

Table 2. Parents' comfort with getting their sons HPV vaccine in alternative settings (n = 506)

	Comfort		Bivariate		Multivariable	
	Mean	(SD)	β	(95% CI)	β	(95% CI)
Parent characteristics						
Sex						
Female	2.93	(1.18)	ref		-	
Male	2.85	(1.09)	-0.03	(-0.12, 0.15)	-	
Age						
< 45 y	2.91	(1.18)	ref		-	
≥ 45 y	2.86	(1.11)	-0.02	(-0.11, 0.07)	-	
Race/Ethnicity						
Non-Hispanic White	2.87	(1.17)	ref		-	
Non-Hispanic Black	2.96	(0.98)	0.03	(-0.06, 0.12)	-	
Hispanic	2.87	(1.10)	0.00	(-0.09, 0.09)	-	
Other race/ethnicity	3.10	(1.20)	0.04	(-0.04, 0.13)	-	
Education						
High school degree or less	2.95	(1.16)	ref		-	
Some college or more	2.85	(1.12)	-0.04	(-0.13, 0.04)	-	
Marital status						
Divorced, widowed, separated, never married	2.89	(1.08)	ref		-	
Married or living with a partner	2.89	(1.15)	0.00	(-0.09, 0.09)	-	
Son characteristics						
Age						
11–12 y	2.73	(1.15)	ref		ref	
13–15 y	2.91	(1.17)	0.08	(-0.03, 0.22)	0.02	(-0.07, 0.12)
16–17 y	3.02	(1.08)	0.12	(0.02, 0.23)*	0.05	(-0.05, 0.15)
Saw a health care provider in past year						
No	3.10	(1.09)	0.09	(0.01–0.18)*	0.09	(0.01, 0.18)*
Yes	2.84	(1.14)	ref		ref	
Ever received any vaccines at school						
No	2.79	(1.12)	ref		ref	
Yes	3.45	(1.09)	0.20	(0.11, 0.29)**	0.17	(0.09, 0.26)**
Don't know	3.00	(1.16)	0.03	(-0.06, 0.12)	0.01	(-0.08, 0.09)
Household characteristics						
Annual household income						
< $60,000	2.98	(1.14)	ref		-	
≥ $60,000	2.81	(1.13)	-0.07	(-0.16, 0.1)	-	
Urbanicity						
Rural	2.96	(1.10)	ref		-	
Urban	2.88	(1.15)	-0.03	(-0.12, 0.06)	-	
Region of residence						
West	2.64	(1.14)	ref		ref	
Midwest	2.98	(1.12)	0.12	(0.01, 0.24)*	0.09	(-0.01, 0.20)

Note: Table presents standardized regression coefficients (β) from linear regression models. Dashes (–) indicate that the model did not include the item. HPV, human papillomavirus; SD, standard deviation; ref, referent category. [a]No (38%), Yes (14%), Did not have a daughter (48%); [b]No (10%), Yes (21%), Don't know (69%); [c]No (98%), Yes (2%); [d]Continuous variable with overall mean (SD) reported. [e]4-point response scale ranging from "not at all" to "a lot" (coded 1–4). [f]4-point response scale ranging from "no chance" to "high chance" (coded 1–4). [g]2 item scale; each item had a 5-point response scale ranging from "very uncomfortable" to "very comfortable" (coded 1–5). [h]3 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). [fi]5 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). [j]2 item scale; each item had a 3-point response scale ranging from "not hard at all" to "very hard" (coded 1–3). *p < 0.05, **p < 0.001.

Table 2. Parents' comfort with getting their sons HPV vaccine in alternative settings (n = 506) (continued)

Northeast	2.88	(1.13)	0.07	(-0.04, 0.18)	0.06	(-0.04, 0.16)
South	3.02	(1.14)	0.15	(0.04, 0.27)*	0.13	(0.02, 0.24)*
HPV and HPV vaccine						
Daughter has received HPV Vaccine[a]						
No	2.83	(1.16)	ref		ref	
Yes	3.15	(1.13)	0.10	(0.01, 0.19)*	0.01	(-0.09, 0.10)
Does not have a daughter	2.87	(1.12)	0.02	(-0.08, 0.11)	-0.01	(-0.10, 0.08)
Thinks son's insurance covers HPV vaccine[b]						
No	3.03	(1.15)	ref		-	
Yes	2.81	(1.14)	-0.08	(-0.21, 0.06)	-	
Don't know	2.89	(1.14)	-0.05	(-0.19, 0.08)	-	
Son's doctor said son should get HPV vaccine[c]						
No	2.90	(1.14)	ref		-	
Yes	2.71	(0.96)	-0.03	(-0.11, 0.06)	-	
Worry about son getting HPV-related disease[d,e]	1.45	(0.76)	0.10	(0.02, 0.19)*	0.01	(-0.08, 0.10)
Perceived likelihood of son getting HPV-related disease[d,f]	2.20	(0.63)	0.14	(0.06, 0.23)**	0.06	(-0.03, 0.15)
Comfort talking with son about new vaccines[d,g]	4.35	(0.79)	0.12	(0.04, 0.21)*	0.08	(0.01, 0.16)*
Amount talked with son about HPV vaccine[d,e]	1.18	(0.49)	0.08	(-0.01, 0.17)	-	
Perceived effectiveness of HPV vaccine[d,e]	2.41	(0.92)	0.18	(0.09–0.26)**	0.02	(-0.07, 0.11)
Perceived uncertainty of HPV vaccine[d,h]	3.57	(0.67)	-0.23	(-0.31, -0.14)**	-0.17	(-0.26, -0.09)**
Perceived harms of HPV vaccine[d,i]	3.03	(0.53)	-0.23	(-0.31, -0.14)**	-0.08	(-0.18, 0.01)
Perceived barriers to getting son HPV vaccine[d,j]	1.36	(0.47)	0.09	(0.01, 0.18)*	0.10	(0.02, 0.18)*
Anticipated regret if son got HPV vaccine and fainted[d,e]	2.70	(1.07)	-0.25	(-0.33, -0.16)**	-0.16	(-0.25, -0.07)**
Anticipated regret if son didn't get HPV vaccine and later got HPV infection[d,e]	3.17	(0.94)	0.10	(0.02, 0.19)*	0.03	(-0.06, 0.12)

Note: Table presents standardized regression coefficients (β) from linear regression models. Dashes (–) indicate that the model did not include the item. HPV, human papillomavirus; SD, standard deviation; ref, referent category. [a]No (38%), Yes (14%), Did not have a daughter (48%); [b]No (10%), Yes (21%), Don't know (69%); [c]No (98%), Yes (2%); [d]Continuous variable with overall mean (SD) reported. [e]4-point response scale ranging from "not at all" to "a lot" (coded 1–4). [f]4-point response scale ranging from "no chance" to "high chance" (coded 1–4). [g]2 item scale; each item had a 5-point response scale ranging from "very uncomfortable" to "very comfortable" (coded 1–5). [h]3 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). [fi]5 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). [j]2 item scale; each item had a 3-point response scale ranging from "not hard at all" to "very hard" (coded 1–3). *p < 0.05, **p < 0.001.

HPV vaccine (β = 0.18). Sons were less comfortable with receiving HPV vaccine in alternative settings if they had higher levels of potential embarrassment if they got vaccinated and their friends found out (β = -0.20) or anticipated regret if they got vaccinated and fainted (β = -0.19).

Discussion

Recognizing that current systems of care are not meeting the complex needs of adolescents, the Institute of Medicine issued a report in 2009 calling for the development of innovative programs to improve health and health care, particularly for young people who are most vulnerable to poor health outcomes.[20] Similarly, low uptake of HPV vaccine and significant disparities in vaccination rates[7] point to the need for innovative approaches to increasing use. In this national sample, parents who perceived greater barriers to vaccination, as well as both parents and sons who reported that the son did not have recent health care visit, had greater comfort with HPV vaccination in alternative settings. Consistent with previous research,[21] these findings suggest that offering HPV vaccination in alternative settings may be a way to reach young people at most risk of not getting the vaccine through more traditional venues. This could result in a substantial increase in HPV vaccine uptake. For example, while we found that about 1 in 5 sons had not had a recent visit with a health care provider, in over half of these cases, parents were comfortable with adolescent vaccination in an alternative setting. This suggests that even by reaching only these sons, offering the vaccine in alternative settings could translate into an additional 12% of all sons in this sample getting vaccinated against HPV.

While previous research has examined potential benefits and concerns about alternative settings for adolescent vaccination descriptively, to our knowledge, the present study is among the first to identify modifiable correlates that can guide efforts to promote HPV vaccination in alternative settings. For example, parents' and sons' comfort communicating with each other about new vaccines was a significant and novel correlate of comfort with HPV vaccination in alterative settings which, to our knowledge, has not been reported in the literature on general HPV

Table 3. Sons' comfort getting HPV vaccine in alternative settings (n = 391)

	Comfort		Bivariate		Multivariable	
	Mean	(SD)	β	(95% CI)	β	(95% CI)
Son characteristics						
Age[a]						
11–12 y	2.39	(1.15)	ref		ref	
13–15 y	2.61	(1.00)	0.10	(-0.02, 0.22)	0.07	(-0.03, 0.17)
16–17 y	2.76	(1.09)	0.16	(0.04, 0.28)*	0.07	(-0.03, 0.18)
Race / Ethnicity[a]						
Non-Hispanic White	2.48	(1.07)	ref		ref	
Non-Hispanic Black	2.66	(1.03)	0.05	(-0.05, 0.16)	0.08	(-0.01, 0.16)
Hispanic	2.96	(1.17)	0.16	(0.06, 0.27)*	0.14	(0.05, 0.23)*
Other race/ethnicity	2.63	(1.01)	0.04	(-0.06, 0.14)	0.05	(-0.03, 0.15)
Saw a health care provider in past year[a]						
No	2.86	(1.05)	0.13	(0.03, 0.23)*	0.11	(0.02, 0.19)*
Yes	2.52	(1.08)	ref		ref	
Ever received any vaccines at school[a]						
No	2.51	(1.05)	ref		ref	
Yes	2.90	(1.20)	0.12	(0.03, 0.22)*	0.13	(0.05, 0.22)*
Don't know	3.55	(0.72)	0.15	(0.05, 0.25)**	0.12	(0.03, 0.20)*
Household characteristics						
Annual household income						
< $60,000	2.26	(1.03)	ref		–	
≥ $60,000	2.66	(1.08)	0.01	(-0.08, 0.11)	–	
Urbanicity						
Rural	2.26	(1.03)	ref		ref	
Urban	2.66	(1.08)	0.14	(0.04, 0.24)*	0.17	(0.08, 0.26)**
Region of residence						
West	2.51	(1.1)	ref		–	
Midwest	2.44	(1.00)	-0.03	(-0.15, 0.10)	–	
Northeast	2.67	(1.10)	0.06	(-0.07, 0.18)	–	
South	2.70	(1.11)	0.08	(-0.05, 0.21)		
HPV and HPV vaccine						
HPV knowledge[b]						
Never heard of HPV prior to survey	2.54	(1.07)	ref		–	
Heard of HPV, low knowledge	2.75	(1.00)	0.06	(-0.04, 0.16)	–	
Heard of HPV, high knowledge	2.75	(1.17)	0.07	(-0.03, 0.17)	–	
Sister had received HPV vaccine[a]						
No	2.58	(1.09)	ref		–	
Yes	2.86	(1.03)	0.09	(-0.02, 0.20)	–	
Did not have a sister	2.53	(1.09)	-0.02	(-0.13, 0.08)	–	
Perceived likelihood of getting HPV-related disease[c,d]	2.04	(0.67)	0.12	(-0.02, 0.22)*	-0.02	(-0.11, 0.07)

Note: Table presents standardized regression coefficients (β) from linear regression models. Dashes (–) indicate that the model did not include the item. HPV, human papillomavirus; SD, standard deviation; ref, referent category. [a]Data collected during parent survey. [b]Most sons (75%) had never heard of HPV prior to the survey. Among those who were aware of HPV, 9% had low knowledge and 16% had high knowledge about the virus. [c]Continuous variable with overall mean (SD) reported. [d]4-point response scale ranging from "no chance" to "high chance" (coded 1–4). [e]2 item scale; each item had a 5-point response scale ranging from "very uncomfortable" to "very comfortable" (coded 1–5). [f]4-point response scale ranging from "not at all" to "a lot" (coded 1–4). [g]4 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). [h]2 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). *p < 0.05, **p < 0.001.

Table 3. Sons' comfort getting HPV vaccine in alternative settings (n = 391) (continued)

Comfort talking with parents about new vaccines[c,e]	3.60	(1.06)	0.22	(0.12, 0.32)**	0.13	(0.04, 0.22)*
Amount talked with parents about HPV vaccine[c,f]	1.12	(0.42)	0.01	(-0.09, 0.11)	–	
Perceived peer acceptance of HPV vaccine[c,g]	3.03	(0.60)	0.32	(0.23, 0.41)**	0.18	(0.08, 0.27)**
Potential embarrassment of getting HPV vaccine[c,h]	3.00	(1.06)	-0.34	(-0.43, -0.25)**	-0.20	(-0.29, -0.11)**
Anticipated regret if got HPV vaccine and fainted[c,f]	2.79	(1.11)	-0.30	(-0.39, -0.20)**	-0.19	(-0.28, -0.10)**
Anticipated regret if didn't get HPV vaccine and later got HPV infection[c,f]	3.13	(1.00)	0.07	(-0.03, 0.17)	–	

Note: Table presents standardized regression coefficients (β) from linear regression models. Dashes (–) indicate that the model did not include the item. HPV, human papillomavirus; SD, standard deviation; ref, referent category. [a]Data collected during parent survey. [b]Most sons (75%) had never heard of HPV prior to the survey. Among those who were aware of HPV, 9% had low knowledge and 16% had high knowledge about the virus. [c]Continuous variable with overall mean (SD) reported. [d]4-point response scale ranging from "no chance" to "high chance" (coded 1–4). [e]2 item scale; each item had a 5-point response scale ranging from "very uncomfortable" to "very comfortable" (coded 1–5). [f]4-point response scale ranging from "not at all" to "a lot" (coded 1–4). [g]4 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). [h]2 item scale; each item had a 5-point response scale ranging from "strongly disagree" to "strongly agree" (coded 1–5). *p < 0.05, **p < 0.001.

vaccine acceptability. It may be that communication is particularly important for vaccination in settings where the parent may not be present (such as school), as wanting parents to be present during vaccination has been reported as a concern about vaccine delivery in alternative settings.[19,21] Promoting parent-child communication about health care and vaccination could help allay some concerns, though research is needed on the best way to do so.

Consistent with previous research on general HPV vaccine acceptability among both males[6] and females,[22] we found that sons' perceived peer acceptance of HPV vaccination is an important correlate of comfort with vaccination in alternative settings. We also found that sons' potential embarrassment from getting vaccinated could be a barrier that may be heightened in alternative settings. Efforts to normalize HPV vaccination among adolescents and provide assurances of privacy and confidentiality in alternative settings may help increase comfort among sons.

In contrast to our previous research showing that anticipated regret of *not* vaccinating and later getting an HPV-related infection was an important longitudinal predictor of HPV vaccine uptake among parents of adolescent girls,[23] inaction regret was not a correlate of comfort in this study. Instead, we found that anticipated *action* regret (i.e., anticipated regret if sons received the vaccine and fainted) was a strong and consistent correlate of comfort with alternative settings for both groups. This type of anticipated regret may be more salient when considering the concrete consequences of vaccine receipt in situations where parents may not be present for vaccination or sons might feel embarrassed or concerned that other people might find out.[19,21] In addition to educating parents and sons about the level of provider training and privacy of vaccination settings, providers may be able further able to address concerns about fainting and other adverse events, as data from females' vaccination experiences suggest that these events are relatively rare and no greater for HPV vaccine than other adolescent vaccines.[24]

We found that previous experience with school-located vaccination was a consistent correlate of comfort with HPV vaccination in alternative settings for both parents and sons. This may reflect greater exposure to, or even positive experiences with, health care venues outside of the medical home. Research on attitudes toward school-based health centers shows a similar pattern—students with the greatest exposure to school-based health care have the most favorable attitudes, and students who utilize services express high levels of satisfaction.[25] Further, in other research, 40% of parents consenting to school-located vaccination for their children had previously indicated that schools were not a preferred setting, suggesting that hypothetical preferences may not reflect actual use when given the opportunity to vaccinate in an alternative setting.[26]

Although the coefficients we report for some correlates may be relatively small, if addressed at a population level,[27] the factors identified in this study could increase acceptability of HPV vaccine delivery in alternative settings and, potentially, vaccine uptake. However, previous research also identifies other salient factors for utilization of these settings. Efforts to maximize HPV vaccine delivery in alternative settings will also need to address multiple policy and logistical concerns that are beyond the scope of the current study, such as coordinating medical/vaccination records with the medical home, billing insurance and obtaining parental consent where necessary.[13,14,16,19,21,28] Additional research is needed to identify strategies to increase acceptability, evaluate the feasibility of wide-scale implementation of vaccination located in alternative settings, and explore ways to ensure continuity of care with the medical home.

Study strengths include the use of a population-based sample and the inclusion of novel survey items about alternative vaccination settings. Our study is further strengthened by the inclusion of adolescent perspectives which can help to ensure the relevance of interventions to this population. However, our study also has several limitations. At the time we conducted the survey, many parents and sons were unaware that HPV vaccine could be given to males;[6] while the survey provided information about HPV vaccine for males to all participants, responses may nonetheless reflect a lack of knowledge and familiarity with the vaccine itself. Further, survey questions were about a hypothetical situation (i.e., one that posited they had decided for sons to receive the vaccine), which may not reflect actual comfort or utilization when faced with actual opportunities. Comfort levels measured in advance of the widespread promotion of HPV vaccination in alternative settings may not accurately reflect ultimate utilization. Although the online panel is comparable to the US population on many sociodemographic characteristics,[29] most participants were

non-Hispanic white and of fairly high socioeconomic status. Our study focused on vaccination of adolescent males; generalizability to other populations, including adolescent girls, needs to be established.

Taken together with other research on acceptability of delivering adolescent vaccines outside the medical home,[16,17,21,28] the moderate levels of comfort among parents and sons in our study are promising for expanding vaccine coverage in the US and hopefully increasing coverage rates to match those of other countries (e.g., Australia and the UK) that already offer the vaccine non-traditional settings. Indeed, comfort with these settings may be higher as such programs become more common.

Materials and Methods

This study uses data from the HPV Immunization in Sons (HIS) study which examined HPV vaccine attitudes and beliefs of parents and their adolescent sons.[6] During August and September 2010, we surveyed a national sample of parents of adolescent males ages 11–17. All parents were members of an existing national panel of US households that a survey company created using a dual frame approach combining list-assisted, random-digit dialing and address-based random sampling of US households.[29] In exchange for completing surveys, panel members accumulated points that they could redeem for small cash payments. Households without pre-existing internet received a laptop computer and internet access. We asked participating parents to also allow their sons to participate. The Institutional Review Board at the University of North Carolina approved the study.

The survey company invited 1,195 parents to complete our online survey, and 752 responded. Of those, 547 (73%) parents were eligible to participate, consented and completed the parent survey. Over half of responding parents (56%, n = 421) had sons who assented and participated by taking the son survey. For the present analysis, we excluded participants when the sons had received at least one dose of HPV vaccine (parent survey, n = 12; son survey, n = 9) or who were home schooled (parents, n = 29; sons, n = 21), resulting in an analytic sample size of 506 parents and 391 sons.

Measures. The parent and son surveys (available online at: www.unc.edu/~ntbrewer/hpv.htm) included established measures in the literature as well as our own previous research with parents of adolescent daughters.[16,23,30] Prior to survey administration, we cognitively tested the survey with 6 parent-son dyads to ensure that survey instructions and items were clear and confirm that participants interpreted items as intended.

We provided all participants with information about HPV and HPV vaccine throughout the survey. Parent and son surveys included equivalent items about vaccine delivery in alternative settings. To focus on acceptability of delivery settings, rather than the vaccine itself, each question began with the stem: "If you and [son's name (parent survey)/your parents (son survey)] decided to get [him (parent survey)/you (son survey)] the HPV vaccine…" Questions asked participants how comfortable they were with the sons getting HPV vaccine at: (1) a local pharmacy or drug store if they offered the vaccine, and (2) the son's school if they offered the vaccine in a nurse's office. Both items had a 5-point response scale ranging from "very uncomfortable" to "very comfortable" (coded 1–5 with higher values indicating greater comfort). To clarify the meaning of "comfortable," surveys indicated that the items were not about whether the shots themselves would be painful. We created a composite measure of comfort with alternative site vaccination based on the mean of the two items (possible range: 1–5). Analyses use a composite that is the average of the two items, as they were highly correlated (r = 0.49 and 0.47 for parent and son surveys, respectively), had similar means ($p > 0.05$ for both groups) and showed similar patterns of correlates.

The survey assessed parents' and sons' HPV knowledge, HPV vaccine attitudes and beliefs,[30] and previous experience with vaccination in alternative settings.[6] We also collected information on various sociodemographic characteristics (age, race/ethnicity, income, urbanicity and region of residence), defining "urban" as living in a metropolitan statistical area (MSA) and "rural" as living outside of an MSA.[31]

Data analysis. We calculated Pearson's correlation coefficient to determine the correlation between parents' and sons' comfort and used a paired t-test to assess the mean difference in their comfort with alternative settings. We used linear regression to identify bivariate correlates of parent and son comfort with receiving HPV vaccine in alternative vaccine delivery settings. Multivariable regression models included all variables associated ($p < 0.05$) in bivariate analyses. We report data from parent and son surveys separately as standardized regression coefficients (βs). We conducted all analyses in Stata SE version 10.0 (Statacorp) using two-tailed tests and a critical α of 0.05.

Potential Conflicts of Interest

A research grant from Merck Sharp and Dohme Corp. funded the study. Merck Sharp and Dohme Corp. played no role in the study design, planning, implementation, analysis or reporting of the findings. The opinions expressed in this paper are those of the authors and do not necessarily represent those of Merck Sharp and Dohme Corp. N.T.B. has also received grants and/or honoraria from Merck Sharp and Dohme and from GlaxoSmithKline.

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