

Quality of Physician Communication about Human Papillomavirus Vaccine: Findings from a National Survey

Melissa B. Gilkey¹, Teri L. Malo^{2,3}, Parth D. Shah³, Megan E. Hall³, and Noel T. Brewer^{2,3}

Abstract

Background: Improving the quality of physicians' recommendations for human papillomavirus (HPV) vaccination is critical to addressing low coverage. Thus, we sought to describe HPV vaccine communication practices among primary care physicians.

Methods: Pediatricians and family physicians ($n = 776$) completed our national online survey in 2014. We assessed the quality of their HPV vaccine recommendations on strength of endorsement (i.e., saying the vaccine is important), timeliness (recommending it by ages 11–12), consistency (recommending it routinely vs. using a risk-based approach), and urgency (recommending same-day vaccination).

Results: A sizeable minority of physicians reported that they do not strongly endorse HPV vaccine (27%) or deliver timely recommendations for girls (26%) or boys (39%). Many physicians (59%) used a risk-based approach to recommending HPV vaccine, and only half (51%) usually recommended same-day vaccination.

Overall recommendation quality was lower among physicians who were uncomfortable talking about HPV vaccine or who believed parents did not value it. Quality was higher among physicians who began discussions by saying the child was due for HPV vaccine versus giving information or eliciting questions.

Conclusion: Many physicians in our national sample reported recommending HPV vaccine inconsistently, behind schedule, or without urgency. These practices likely contribute to under-immunization among adolescents, and may convey ambivalence to parents.

Impact: As one of the first studies to assess multiple aspects of recommendation quality, these findings can inform the many state and national initiatives that aim to improve communication about HPV vaccine so as to address the persistent underuse of a powerful tool for cancer prevention. *Cancer Epidemiol Biomarkers Prev*; 24(11); 1673–9. ©2015 AACR.

See related commentary by Zimet, p. 1643

Introduction

Low coverage of human papillomavirus (HPV) vaccine is one of the most pressing problems in cancer prevention (1). Despite an excellent safety profile (2), mounting evidence of effectiveness (3, 4), and national guidelines for routine administration (5), only 38% of adolescent girls and 14% of adolescent boys complete the three-dose HPV vaccine series (6). In contrast with our success in delivering other adolescent vaccines, HPV vaccination continues to fall far short of the Healthy People 2020 goal of 80% coverage (6). This shortfall carries serious consequences, translating into 53,000 future cervical cancer cases over the lifetimes of girls ages 12 years and younger (1). Persistent racial, economic, and geographic disparities in cervical cancer mortality in the

United States make this missed opportunity for cancer prevention all the more regrettable (7).

Public health leaders, including the Centers for Disease Control and Prevention (CDC) and the President's Cancer Panel, have identified improving healthcare providers' communication as a key strategy for raising HPV vaccine coverage (1, 2). A provider's recommendation is one of the strongest and most consistent predictors of HPV vaccination, yet providers often miss opportunities to deliver effective recommendations (2, 8–13). Parental reports suggest that over one third of adolescent girls (36%) and half of adolescent boys (58%) do not receive a recommendation (2). Furthermore, recommendations parents and adolescents do receive may be weak, with some providers expressing limited support for HPV vaccine or suggesting delayed vaccination when faced with parental hesitancy (14, 15).

The promise of modifying provider communication to improve HPV vaccination has inspired the mobilization of considerable resources for intervention development. The CDC, for example, has launched "You Are the Key," a national campaign for improving provider communication, while also funding state and regional health departments to develop their own provider-focused quality improvement programs (16). Research on provider communication about HPV vaccination is urgently needed to inform these efforts. Although existing communication campaigns advise providers in general terms about the importance of "strong" HPV vaccine recommendations delivered "the way you recommend other vaccines," little evidence exists for giving

¹Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, Massachusetts. ²Lineberger Comprehensive Cancer Center, University of North Carolina, Chapel Hill, North Carolina. ³Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina, Chapel Hill, North Carolina.

Corresponding Author: Melissa B. Gilkey, Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, 133 Brookline Avenue, Boston, MA 02215. Phone: 617-991-8240; Fax: 617-509-9845; E-mail: gilkey@email.unc.edu

doi: 10.1158/1055-9965.EPI-15-0326

©2015 American Association for Cancer Research.

providers more specific guidance about how to improve their recommendations (17).

To address this need, we used data from a national survey of primary care physicians to: (i) assess the prevalence of five communication practices for recommending HPV vaccine according to national guidelines and (ii) identify correlates of overall recommendation quality. As one of the first surveys to investigate multiple aspects of HPV vaccine recommendation quality, our study aims to inform efforts to target interventions to the specific communication practices and provider populations that could benefit most.

Materials and Methods

Participants and procedures

The Physician Communication about HPV Vaccination Study was an online survey of U.S. pediatricians and family physicians conducted from April to June 2014. We contracted with a survey research company to administer the survey, which we developed, to an existing national panel of physicians (18). Panel members, who were recruited from American Medical Association lists, included 2,368 primary care physicians (51% family medicine, 49% pediatricians) practicing across the United States (22% Northeast, 23% Midwest, 37% South, 18% West); about two thirds (68%) were male. For this study, eligible respondents were pediatricians and family medicine physicians who indicated providing preventive care, including vaccinations, to adolescent patients ages 11 to 12 years. We focused on pediatricians and family physicians because in the United States, most doses of HPV vaccine are delivered in the context of these specialties (19). Our survey gave special consideration to patients ages 11 to 12 years because national guidelines specify this group for routine HPV vaccination (5).

The survey company emailed invitations to all 2,368 panel members with pediatric or family medicine specialties, and 1,022 physicians (43%) used the link provided in the invitation to access the survey site. Of these, 776 (76%) met eligibility criteria and completed the survey. Data on the percentage of ineligible respondents are not available, but overall, 33% of physicians in the panel completed the survey. Respondents provided informed consent and received \$25 to \$45 for their participation, with higher incentives used to maximize participation later in the fielding process. The University of North Carolina (Chapel Hill, NC) Institutional Review Board approved the study protocol.

Measures

Our survey assessed indicators of HPV vaccine recommendation quality based on a framework that we developed using national practice guidelines and the research literature. Because guidelines specify a target age range for routine vaccine administration (5), two items assessed recommendation timeliness, or whether physicians start recommending HPV vaccine for male and female patients by ages 11 to 12 versus older or not at all. Because guidelines are for routine HPV vaccination by age versus selective vaccination by risk (5), one item assessed recommendation consistency, or the avoidance of risk-based approaches to recommending HPV vaccine. Because some physicians suggest delaying HPV vaccination (14, 15), our survey assessed urgency, or recommending same-day vaccination versus otherwise. Finally, because some physicians frame HPV vaccine as an optional vaccine (14, 15), we assessed strength of endorsement, or saying that the vaccine is "very" or "extremely" important versus less so.

We combined these five items into an index of overall recommendation quality by awarding one point for each indicator of quality and calculating the sum (20). For our primary analysis, we next created two index categories: low quality (scores of 0–3) and high quality (scores of 4–5). For subsequent sensitivity analyses, we redefined these categories using cutoffs of 3 and 5 (versus 4) for high recommendation quality.

To better understand the communication context surrounding HPV vaccine recommendations, our survey included five items that assessed physicians' perceptions of their discussions with parents. Respondents indicated how important parents feel HPV vaccine is for their 11- to 12-year-old children. Two items assessed whether respondents anticipate uncomfortable conversations when recommending HPV vaccine for 11- to 12-year-olds and whether having to talk about a sexually transmitted infection makes conversations about HPV vaccine uncomfortable. Respondents indicated the conversational tone that they feel parents are most receptive to and how important tone is in relation to the content of what physicians say.

Three survey items assessed additional communication practices. Respondents indicated which of the following they do first in discussions about HPV vaccine: say the child is due, give information, suggest giving HPV vaccine to the child, elicit questions, or say they will give HPV vaccine at the end of the visit. Respondents also indicated whether they say HPV vaccine can prevent cervical cancer, other cancers, genital warts, or none of these. For those respondents who had indicated using a risk-based approach to recommending HPV vaccine, one item assessed which groups of adolescents they perceive to be at higher risk for HPV infection.

On demographic and professional characteristics, our survey assessed respondents' sex, medical specialty, and years in practice since residency. Respondents also indicated the number of adolescent patients they see in a typical week, as well as the percentage of vaccine doses they deliver through the Vaccines for Children (VFC) program. VFC is a federally funded program that provides free vaccines to vulnerable populations (21). On clinical practice characteristics, respondents indicated their practice type (private practice vs. other), the total number of physicians in the clinic, whether the clinic regularly stocks HPV vaccine, and the state in which the clinic is located. We categorized locations into national regions using U.S. Census classifications (22). The full survey instrument is available online at www.unc.edu/~ntbrewer/hpv.htm.

Statistical analysis

We used simple logistic regression to identify bivariate correlates of high HPV vaccine recommendation quality. We then entered statistically significant correlates into a multivariable model. To probe the robustness of our findings, we reran our analyses to assess all correlates when we defined the cutoff for high recommendation quality as composite scores of 3 or 5 (vs. 4). We conducted analyses using Stata Version 12.0. Statistical tests were two-tailed with a critical α of 0.05.

Results

Respondents were pediatricians (53%) and family physicians (47%; Table 1). About two thirds (68%) were male, and over half (55%) had 20 or more years of experience in practice. Most physicians (83%) saw 10 or more adolescent patients per week, and over half (55%) reported that VFC provided at least one tenth

Table 1. Sample characteristics ($n = 776$)

	<i>n</i> (%)
Physician characteristics	
Medical specialty	
Pediatrics	410 (53)
Family practice	366 (47)
Sex	
Male	526 (68)
Female	250 (32)
Years in practice	
≤ 19	352 (45)
≥ 20	424 (55)
Adolescent patients seen in typical wk	
≤ 9	129 (17)
10–24	351 (45)
≥ 25	296 (38)
Vaccine doses through VFC program	
$\leq 9\%$	290 (37)
10%–49%	274 (35)
$\geq 50\%$	152 (20)
Not sure	60 (8)
Clinic or practice characteristics	
Type	
Private practice (solo, group, HMO)	660 (85)
Other ^a	116 (15)
Total physicians	
1–4	398 (51)
5–9	217 (28)
≥ 10	161 (21)
Stock HPV vaccine	
Yes	703 (91)
No	73 (9)
Region	
Northeast	184 (24)
Midwest	165 (21)
South	275 (35)
West	152 (20)

NOTE: Percentages may not total 100% due to rounding.

Abbreviation: HMO, health maintenance organization.

^aIncludes hospital- and university-based clinics, Federally Qualified Health Centers, and community, rural, migrant, Indian, military, public health, and school health clinics.

of the vaccine doses they deliver. Most respondents worked in private practices (85%). We did not find statistically significant differences between respondents and those invited to participate on specialty, sex, or national region (all $P > 0.05$).

HPV vaccine recommendation quality

Across our quality indicators, physicians' HPV vaccine recommendation practices were most often weak in the areas of consistency and urgency (Table 2). A majority of physicians (59%) used a risk-based approach to recommending HPV vaccine, and about half (49%) did not usually recommend same-day vaccination. A substantial minority also reported weaker recommendation practices in the areas of timeliness for males (39%), timeliness for females (26%), and strength of endorsement (27%). Composite quality scores spanned the range of the index with 10% of physicians scoring a zero and 22% scoring a five; about half of physicians (51%) fell into the category for low recommendation quality (Fig. 1).

Communication context and practices

Overall, almost half of the physicians (47%) believed that parents feel HPV vaccine is not or only slightly important for

Table 2. HPV vaccine recommendation quality indicators

	<i>n</i> (%)
Timeliness	
For males: start routinely recommending HPV vaccine...	
Early/on time (≤ 12 y)	472 (61)
Late/never (≥ 13 y)	304 (39)
For females: start routinely recommending HPV vaccine...	
Early/on time (≤ 12 y)	573 (74)
Late/never (≥ 13 y)	203 (26)
Consistency	
Use a risk-based approach to recommending HPV vaccine	
Strongly/somewhat disagree	316 (41)
Strongly/somewhat agree/neither agree nor disagree	460 (59)
Urgency	
Usually recommend 11- to 12-year-olds get HPV vaccine...	
At current visit	399 (51)
At later visit/give a choice/other	377 (49)
Strength of endorsement	
Say HPV vaccine for 11- to 12-year-olds is...	
Very/extremely important	568 (73)
Not/slightly/moderately important	208 (27)

NOTE: For each variable the higher quality response is listed first.

their 11- to 12-year-old children. About one third of respondents somewhat or strongly agreed that they anticipate uncomfortable conversations about HPV vaccine (34%) and that having to talk about a sexually transmitted infection makes conversations about HPV vaccine uncomfortable (32%). Most physicians (84%) perceived the tone of HPV vaccine conversations to be as or more important than what is said. Respondents more often indicated that parents are receptive to a tone that is informative (76%) or nonjudgmental (44%) versus concerned (23%), warm (22%), or upbeat (13%).

In terms of strategies for introducing HPV vaccine, similar numbers of physicians reported that they begin discussions by giving information (34%), saying the child is due (30%), or suggesting the child get HPV vaccine (29%); very few physicians (1%) indicated starting discussions by saying they will give HPV

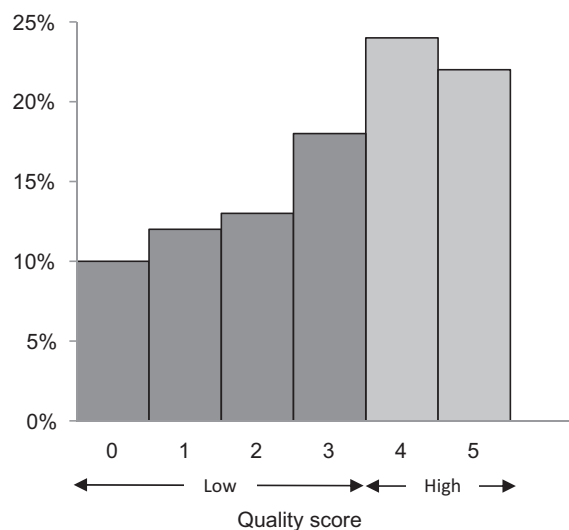


Figure 1. Distribution of composite scores for HPV vaccine recommendation quality ($n = 776$).

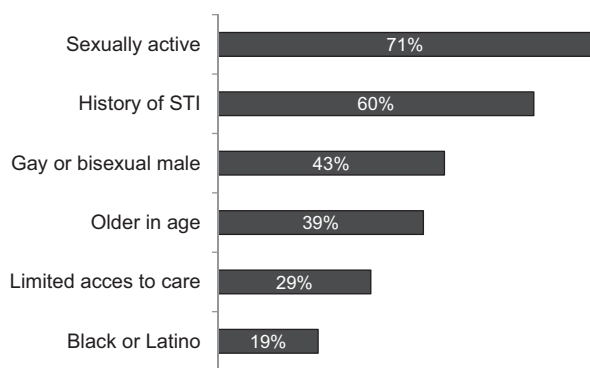


Figure 2. Risk groups physicians target for HPV vaccination, among those using a risk-based recommendation approach ($n = 460$).

vaccine at the end of the visit. Almost all physicians reported saying that HPV vaccine prevents cervical cancer (99%), and a majority also said genital warts (84%) or other cancers (55%). Physicians using a risk-based approach to recommending HPV vaccine most often identified sexually active adolescents (71%) and adolescents who have had a sexually transmitted infection (60%) as being at higher risk for HPV infection (Fig. 2). Fewer than half correctly identified gay and bisexual males (43%) and older adolescents (39%) as being at increased risk for HPV infection.

Correlates of high-quality HPV vaccine recommendations

Table 3 shows the proportion of physicians with high recommendation quality scores for each level of the candidate correlates. On communication context, high-quality scores were less common among physicians who believed parents felt HPV vaccine was of low versus higher importance (multivariable OR, 0.60; 95% confidence interval; CI, 0.43–0.84) or perceived having to talk about a sexually transmitted infection as making conversations about HPV vaccine uncomfortable (OR, 0.45; 95% CI, 0.31–0.65). Although bivariate analyses indicated that anticipating uncomfortable conversations also correlated with lower recommendation quality, this variable did not retain statistical significance in the multivariable model.

On communication practices, high recommendation quality scores correlated with beginning discussions about HPV vaccine by saying the child is due compared with giving information (OR, 0.12; 95% CI, 0.08–0.18), suggesting the vaccine (OR, 0.26; 95% CI, 0.17–0.40), or eliciting questions (OR, 0.13; 95% CI, 0.06–0.29). Recommendation quality also correlated with saying HPV vaccine prevents three disease types (cervical cancer, other cancers, and genital warts) compared with cervical cancer and genital warts (OR, 0.56; 95% CI, 0.38–0.82) or cervical cancer alone (OR, 0.36; 95% CI, 0.20–0.64).

We did not find statistically significant differences in HPV vaccine recommendation quality by physician or clinical practice characteristics in the multivariable analysis. However, bivariate analyses indicated that high-quality scores were less common among family physicians versus pediatricians, males versus females, those reporting low versus high participation in the VFC program, and those who did not regularly stock HPV vaccine versus those who did. Our sensitivity analyses yielded the same

pattern of findings in terms of the identified correlates of high recommendation quality; for this reason, we do not report further on these data.

Discussion

Many pediatricians and family physicians in our national sample reported recommending HPV vaccine inconsistently, behind schedule, or without urgency. Of the quality indicators we assessed, consistency was most often lacking, with fewer than half of physicians avoiding a risk-based approach to recommending HPV vaccine. Although targeting health services according to need holds intuitive appeal, the strategy is poorly suited to preventing HPV infections, which are so highly prevalent that one third of older adolescent girls carry the virus at any given time (1). When asked in our survey, many physicians in our study did not indicate that factors such as being sexually active or older in age put adolescents at higher risk for HPV infection. In the absence of such knowledge, a risk-based recommendation approach will exclude many adolescents who could benefit from vaccination. The difficulties inherent in accurately assessing risk related to sexual activity make a risk-based recommendation approach all the more problematic (23, 24). Informing physicians and other vaccine providers about the need for and rationale behind routine versus risk-based delivery of HPV vaccine may be one way to improve recommendations and, in turn, raise coverage (24). Specifically, physician educators should emphasize that a "just in time" approach to recommending HPV vaccine will fail to protect many adolescents before HPV exposure, thereby decreasing the potential benefits of vaccination.

In addition to being inconsistent, our findings suggest that HPV vaccine recommendations often lack timeliness and urgency. In keeping with prior research on timeliness (15), about one quarter of physicians in our study reported that they did not routinely recommend HPV vaccine for 11- to 12-year-old girls. Over one third of physicians did not do so for boys of the same age, which suggests improvement over prior years (15, 25), but still represents a concerning departure from practice guidelines. On urgency, about half of physicians reported recommending HPV vaccination for a later visit or giving a choice about when to vaccinate, rather than recommending same-day vaccination for patients in the target age range. These deficiencies in recommendation timeliness and urgency likely lead to avoidable delays in vaccination, thereby contributing to underimmunization among younger adolescents (24). More indirectly, some parents may interpret weak recommendations as signaling physician ambivalence and decide to forgo HPV vaccination for their children altogether (26). Physician educators should emphasize the importance of recommending same-day HPV vaccination for patients, ages 11 and 12, and a special emphasis on boys is warranted to improve the timeliness of HPV vaccine recommendations for this group.

Our finding that one quarter of physicians did not strongly endorse HPV vaccine for younger adolescents further raises the possibility that physicians' communication contributes to parental hesitancy. This finding adds to a growing literature suggesting that many healthcare providers recommend HPV vaccine less strongly than other vaccines, preferring instead to frame it as an "optional" vaccine (14, 15). Convincing physicians of the value of HPV vaccine is likely important for improving their communication, and the recent FDA approval of a new, nine-valent vaccine for protection against more HPV types provides one opportunity

Table 3. Correlates of HPV vaccine recommendation quality

	Physicians with high recommendation quality scores/total physicians in category (%)	Bivariate OR (95% CI)	Multivariable OR (95% CI)
Physician characteristics			
Medical specialty			
Pediatrics	220/410 (54)	1	1
Family practice	137/366 (37)	0.52 (0.39-0.69) ^a	0.72 (0.50-1.04)
Sex			
Male	221/526 (42)	1	1
Female	136/250 (54)	1.65 (1.22-2.23) ^a	1.39 (0.97-2.00)
Years in practice			
≤19	168/352 (48)	1	—
≥20	189/424 (45)	0.88 (0.66-1.17)	—
Adolescent patients seen in typical wk			
≤9	58/129 (45)	1	—
10-24	156/351 (44)	0.98 (0.65-1.47)	—
≥25	143/296 (48)	1.14 (0.76-1.73)	—
Vaccine doses through VFC program			
≤9%	117/290 (40)	1	1
10%-49%	131/274 (48)	1.35 (0.97-1.89)	1.13 (0.76-1.69)
≥50%	85/152 (56)	1.88 (1.26-2.79) ^a	1.50 (0.94-2.39)
Not sure	24/60 (40)	0.99 (0.56-1.74)	1.32 (0.68-2.56)
Clinic or practice characteristics			
Type			
Private practice (solo, group, HMO)	301/660 (46)	1	—
Other	56/116 (48)	1.11 (0.75-1.65)	—
Total physicians			
1-4	174/398 (44)	1	—
5-9	103/217 (47)	1.16 (0.83-1.62)	—
≥10	80/161 (50)	1.27 (0.88-1.84)	—
Stock HPV vaccine			
Yes	335/703 (48)	1	1
No	22/73 (30)	0.47 (0.28-0.80) ^a	0.97 (0.53-1.78)
Region			
Northeast	78/184 (42)	1	—
Midwest	82/165 (50)	1.34 (0.88-2.05)	—
South	121/275 (44)	1.07 (0.73-1.56)	—
West	76/152 (50)	1.36 (0.88-2.09)	—
HPV vaccine communication context			
Believe parents feel HPV vaccine is			
Moderately/very/extremely important	208/409 (51)	1	1
Not/slightly important	149/367 (41)	0.66 (0.50-0.88) ^a	0.60 (0.43-0.84) ^a
Anticipate uncomfortable conversations			
Strongly/somewhat disagree	161/307 (52)	1	1
Strongly/somewhat agree/neither	196/469 (42)	0.65 (0.49-0.87) ^a	0.89 (0.60-1.30)
Perceive STI discussion as uncomfortable			
Strongly/somewhat disagree	222/390 (57)	1	1
Strongly/somewhat agree/neither	135/386 (35)	0.41 (0.30-0.54) ^a	0.45 (0.31-0.65) ^a
Perceive tone of discussions to be			
Less important than what is said	53/127 (42)	1	—
As important as what is said	278/577 (48)	1.30 (0.88-1.91)	—
More important than what is said	26/72 (36)	0.79 (0.43-1.43)	—
Communication practices			
Begin discussions by ^b			
Saying child is due	178/236 (75)	1	1
Giving information	68/261 (26)	0.11 (0.08-0.17) ^a	0.12 (0.08-0.18) ^a
Suggesting HPV vaccine	95/227 (42)	0.23 (0.16-0.35) ^a	0.26 (0.17-0.40) ^a
Eliciting questions	10/41 (24)	0.11 (0.05-0.23) ^a	0.13 (0.06-0.29) ^a
Say HPV vaccine prevents cervical cancer and ^c			
Other cancers and genital warts	220/400 (55)	1	1
Other cancers	11/24 (46)	0.69 (0.30-1.58)	0.70 (0.27-1.81)
Genital warts	93/248 (38)	0.49 (0.36-0.68) ^a	0.56 (0.38-0.82) ^a
Nothing else	26/93 (28)	0.32 (0.19-0.52) ^a	0.36 (0.20-0.64) ^a

NOTE: Dashes (—) indicate the variable was not included in the multivariable model because it was not statistically significant in bivariate analyses.

Abbreviations: HMO, health maintenance organization; STI, sexually transmitted infection.

^a*P* < 0.01.^bExcludes respondents (*n* = 11) who indicated "say we'll give it at the end of the visit."^cExcludes respondents (*n* = 11) who indicated "none of these."

for doing so (27). For this and other occasions for continuing education, recommendation consistency, timeliness, urgency, and strength of endorsement offer specific targets for better aligning physician communication with the goal of routine administration of HPV vaccine.

Our findings suggest that many physicians view HPV vaccine-related discussions negatively, and understanding these perceptions may help to contextualize suboptimal recommendation practices. Most strikingly, almost half of the physicians in our sample perceived parents' endorsement of HPV vaccine as being very low for adolescents in the target age range. Furthermore, about one third of physicians reported that having to talk about a sexually transmitted infection made conversations about HPV vaccine uncomfortable. In both instances, having a negative perception of HPV vaccine discussions correlated with lower recommendation quality. This study's cross-sectional design precludes analysis of whether recommendation practices cause or are caused by negative perceptions. In either case, however, physicians may benefit from learning that healthcare providers tend to overestimate HPV vaccine hesitancy and that many parents are willing to vaccinate their children (2, 28). Training physicians in communication strategies for foregrounding cancer prevention and better navigating the topic of sex in relation to HPV vaccination is another avenue for alleviating the interpersonal discomfort that may discourage recommendations (24, 29). Research is needed to evaluate interventions for helping physicians communicate about HPV vaccine with greater confidence and to assess how physicians' perceptions of the social environment and other factors, such as vaccine cost, influence their recommendation practices (30, 31).

We found that two communication practices correlated with higher recommendation quality scores. First, quality was higher among physicians who began conversations about HPV vaccine by saying that the child was due versus giving information or eliciting questions. This approach may correspond with a more directive, or "presumptive," communication style that research in early childhood vaccination suggests is associated with higher vaccine acceptance when compared with an open-ended, "participatory" style (32, 33). Second, we found that higher recommendation quality correlated with telling parents that HPV vaccine protects against three disease types (i.e., cervical cancer, other cancers, and genital warts) versus cervical cancer and genital warts or cervical cancer alone. Interestingly, our prior research with patients generally lends support to the idea that prevention messages about HPV vaccination are more compelling when they mention more disease types (34). Given that in our sample of physicians the strongest proponents of HPV vaccine favored a directive communication style and comprehensive prevention messaging, these communication practices are especially promising and should be tested further in terms of their short- and long-term effectiveness and acceptability.

Strengths of our study include data from a large, national sample of primary care physicians. Although improving recommendation practices is a primary goal in the national campaign to raise HPV vaccination coverage, relatively few studies to date have explored physicians' experiences of HPV vaccine recommendation and delivery in any depth. Although gaining physicians' perspectives is a study strength, the self-reported nature of our measures also constitutes a limitation. Most notably, physicians in our sample may have overestimated the quality of their recommendation practices because of a tendency among survey

respondents to report socially desirable behavior. Limitations also include a modest response rate, which is a common challenge for physician surveys (35). Although surveys of physicians appear to be less vulnerable to nonresponse bias than surveys of the general population (35), our findings should be replicated with other national samples; additional research could be especially helpful in describing subgroup differences in physician communication by factors such as geographic region or patient population served. Finally, because we restricted our sample to physicians, further research is needed to characterize HPV vaccine recommendation practices of other important vaccine providers, including nurse practitioners and pharmacists (36, 37).

Conclusion

Half of the primary care physicians in our national sample reported at least two communication practices that likely compromise their ability to meet guidelines for the routine delivery of HPV vaccine. Interventions are urgently needed to help physicians improve their HPV vaccine recommendations, and the quality indicators of timeliness, consistency, urgency, and strength of endorsement offer one framework for guiding these efforts. Given evidence that many physicians are uncomfortable discussing HPV vaccine and view parents of younger adolescents as unreceptive, interventionists should be sensitive to the interpersonal dynamics of the clinical encounter, and helping physicians better navigate the topic of sex may be an especially important goal. Testing the effectiveness and acceptability of communication strategies, such as the use of a presumptive recommendation style, should also be a priority. By improving how physicians recommend HPV vaccine, we can raise national coverage, thereby ensuring that today's youth enjoy the full benefit of a potent tool for cancer prevention.

Disclosure of Potential Conflicts of Interest

N.T. Brewer reports receiving commercial research grants from Merck, Pfizer, and GSK, received speaker honoraria from Merck, and is a consultant/advisory board member for Merck. No potential conflicts of interest were disclosed by the other authors.

Authors' Contributions

Conception and design: M.B. Gilkey, P.D. Shah, M.E. Hall, N.T. Brewer
Development of methodology: M.B. Gilkey, N.T. Brewer
Acquisition of data (provided animals, acquired and managed patients, provided facilities, etc.): M.B. Gilkey, N.T. Brewer
Analysis and interpretation of data (e.g., statistical analysis, biostatistics, computational analysis): M.B. Gilkey, T.L. Malo, P.D. Shah, M.E. Hall, N.T. Brewer
Writing, review, and/or revision of the manuscript: M.B. Gilkey, T.L. Malo, P.D. Shah, M.E. Hall, N.T. Brewer
Administrative, technical, or material support (i.e., reporting or organizing data, constructing databases): M.E. Hall
Study supervision: N.T. Brewer

Grant Support

This work was funded via an unrestricted educational grant from Pfizer (to N.T. Brewer). M. B. Gilkey and T.L. Malo were supported by the Cancer Control Education Program at UNC Lineberger Comprehensive Cancer Center (R25 CA57726). M.B. Gilkey was also supported by a career development award from the National Cancer Institute (K22 CA186979).

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked *advertisement* in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

Received March 26, 2015; revised May 27, 2015; accepted June 23, 2015; published OnlineFirst October 22, 2015.

References

1. President's Cancer Panel Annual Report. Accelerating HPV vaccine uptake: urgency for action to prevent cancer. A report to the President of the United States from the President's Cancer Panel. Bethesda, MD: National Cancer Institute; 2014.
2. Stokley S, Jeyarajah J, Yankey D, Cano M, Gee J, Roark J, et al. Human papillomavirus vaccination coverage among adolescents, 2007–2013, and postlicensure vaccine safety monitoring, 2006–2014—United States. *MMWR Morb Mortal Wkly Rep* 2014;63:620–4.
3. Crowe E, Pandeya N, Brotherton JM, Dobson AJ, Kisely S, Lambert SB, et al. Effectiveness of quadrivalent human papillomavirus vaccine for the prevention of cervical abnormalities: case-control study nested within a population based screening programme in Australia. *BMJ* 2014;348:g1458.
4. Ali H, Donovan B, Wand H, Read TR, Regan DG, Grulich AE, et al. Genital warts in young Australians five years into national human papillomavirus vaccination programme: national surveillance data. *BMJ* 2013;346:f2032.
5. Markowitz LE, Dunne EF, Saraiya M, Chesson HW, Curtis CR, Gee J, et al. Human papillomavirus vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep* 2014;63:1–30.
6. Elam-Evans LD, Yankey D, Jeyarajah J, Singleton JA, Curtis RC, MacNeil J, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2013. *MMWR Morb Mortal Wkly Rep* 2014;63:625–33.
7. Simard EP, Fedewa S, Ma J, Siegel R, Jemal A. Widening socioeconomic disparities in cervical cancer mortality among women in 26 states, 1993–2007. *Cancer* 2012;118:5110–6.
8. Brewer NT, Gottlieb SL, Reiter PL, McRee AL, Liddon N, Markowitz L, et al. Longitudinal predictors of human papillomavirus vaccine initiation among adolescent girls in a high-risk geographic area. *Sex Transm Dis* 2011;38:197–204.
9. Gerend MA, Weibley E, Bland H. Parental response to human papillomavirus vaccine availability: uptake and intentions. *J Adolesc Health* 2009;45:528–31.
10. Reiter PL, Brewer NT, Gottlieb SL, McRee AL, Smith JS. Parents' health beliefs and HPV vaccination of their adolescent daughters. *Soc Sci Med* 2009;69:475–80.
11. Allen JD, Othus MK, Shelton RC, Li Y, Norman N, Tom L, et al. Parental decision making about the HPV vaccine. *Cancer Epidemiol Biomarkers Prev* 2010;19:2187–98.
12. Vadaparampil ST, Malo TL, Kahn JA, Salmon DA, Lee JH, Quinn GP, et al. Physicians' human papillomavirus vaccine recommendations, 2009 and 2011. *Am J Prev Med* 2014;46:80–4.
13. Lau M, Lin H, Flores G. Factors associated with human papillomavirus vaccine-series initiation and healthcare provider recommendation in US adolescent females: 2007 National Survey of Children's Health. *Vaccine* 2012;30:3112–8.
14. Hughes CC, Jones AL, Feemster KA, Fiks AG. HPV vaccine decision making in pediatric primary care: A semi-structured interview study. *BMC Pediatr* 2011;11:74.
15. McRee AL, Gilkey MB, Dempsey AF. HPV vaccine hesitancy: findings from a statewide survey of health care providers. *J Pediatr Health Care* 2014; 28:541–9.
16. Centers for Disease Control and Prevention. HPV. You are the key to cancer prevention. 2015 [cited 2015 Mar 15]. Available from: <http://www.cdc.gov/vaccines/who/teens/for-hcp-tipsheet-hpv.html>.
17. Centers for Disease Control and Prevention. Tips and time-savers for talking with parents about HPV vaccine. 2015 [cited 2015 Mar 15]. Available from: <http://www.cdc.gov/vaccines/who/teens/for-hcp-tipsheet-hpv.html>.
18. GfK. Physicians Consulting Network. 2015 [cited 2015 Mar 15]. Available from: <http://www.knowledgenetworks.com/resources/pcn.html>.
19. Dorell CG, Yankey D, Santibanez TA, Markowitz LE. Human papillomavirus vaccination series initiation and completion, 2008–2009. *Pediatrics* 2011;128:830–9.
20. Singleton RA, Straits BC. Approaches to social research. 3rd ed. New York: Oxford University Press; 1999.
21. Centers for Disease Control and Prevention. Vaccines for children. 2015 [cited 2015 Mar 15]. Available from: <http://www.cdc.gov/vaccines/programs/vfc/index.html>.
22. U.S. Census Bureau. Geographic terms and concepts—census divisions and census regions. 2015 [cited 2015 Mar 15]. Available from: https://www.census.gov/geo/maps-data/maps/docs/reg_div.txt.
23. Schroder KE, Carey MP, Venable PA. Methodological challenges in research on sexual risk behavior: II. Accuracy of self-reports. *Ann Behav Med* 2003;26:104–23.
24. Perkins RB, Clark JA, Apte G, Vercruyse JL, Sumner JJ, Wall-Haas CL, et al. Missed opportunities for HPV vaccination in adolescent girls: a qualitative study. *Pediatrics* 2014;134:e666–74.
25. Malo TL, Giuliano AR, Kahn JA, Zimet GD, Lee JH, Zhao X, et al. Physicians' human papillomavirus vaccine recommendations in the context of permissive guidelines for male patients: a national study. *Cancer Epidemiol Biomarkers Prev* 2014;23:2126–35.
26. Hamlish T, Clarke L, Alexander KA. Barriers to HPV immunization for African American adolescent females. *Vaccine* 2012;30:6472–6.
27. U.S. Food and Drug Administration. Approved products. Gardasil 9. 2014 [cited 2015 Mar 15]. Available from <http://www.fda.gov/BiologicsBlood-Vaccines/Vaccines/ApprovedProducts/ucm426520.htm>.
28. Healy CM, Montesinos DP, Middleman AB. Parent and provider perspectives on immunization: are providers overestimating parental concerns? *Vaccine* 2014;32:579–84.
29. Bynum SA, Staras SA, Malo TL, Giuliano AR, Shinkman E, Vadaparampil ST. Factors associated with Medicaid providers' recommendation of the HPV vaccine to low-income adolescent girls. *J Adolesc Health* 2014; 54:190–6.
30. Kahn JA, Rosenthal SL, Tissot AM, Bernstein DI, Wetzel C, Zimet GD. Factors influencing pediatricians' intention to recommend human papillomavirus vaccines. *Ambul Pediatr* 2007;7:367–73.
31. Keating KM, Brewer NT, Gottlieb SL, Liddon N, Ludema C, Smith JS. Potential barriers to HPV vaccine provision among medical practices in an area with high rates of cervical cancer. *J Adolesc Health* 2008;43:S61–7.
32. Opel DJ, Heritage J, Taylor JA, Mangione-Smith R, Salas HS, Devere V, et al. The architecture of provider-parent vaccine discussions at health supervision visits. *Pediatrics* 2013;132:1037–46.
33. Opel DJ, Mangione-Smith R, Robinson JD, Heritage J, Devere V, Salas HS, et al. The Influence of provider communication behaviors on parental vaccine acceptance and visit experience. *Am J Public Health* 2015:e1–e7.
34. McRee AL, Reiter PL, Chantala K, Brewer NT. Does framing human papillomavirus vaccine as preventing cancer in men increase vaccine acceptability? *Cancer Epidemiol Biomarkers Prev* 2010;19:1937–44.
35. Flanigan TS, McFarlane E, Cook S. Conducting survey research among physicians and other medical professionals: a review of current literature. *ASA Proc Sect Surv Res Methods* 2008:4136–47.
36. Shah PD, Gilkey MB, Pepper JK, Gottlieb SL, Brewer NT. Promising alternative settings for HPV vaccination of US adolescents. *Expert Rev Vaccines* 2014;13:235–46.
37. Brewer NT, Chung JK, Baker HM, Rothholz MC, Smith JS. Pharmacist authority to provide HPV vaccine: novel partners in cervical cancer prevention. *Gynecol Oncol* 2014;132:S3–8.